Proceedings of International Workshop on

Governance and Sustainability in Mediterranean Agri-Food Value Chains

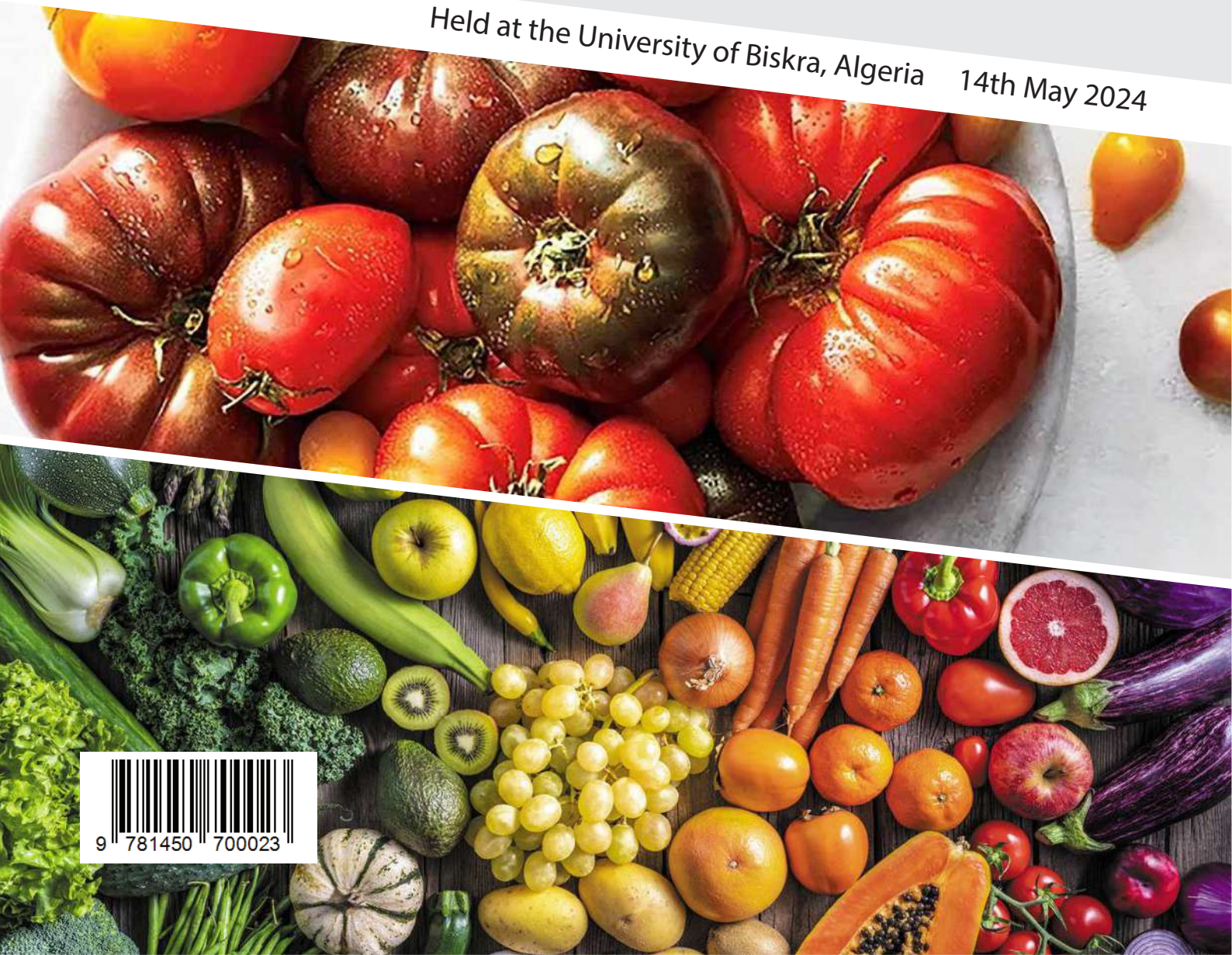
Challenges and Perspectives

UNIVERSITY OF BISKRA

GourMED

DEDSPAZ

Held at the University of Biskra, Algeria 14th May 2024



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Proceedings of
International Workshop on

Governance and Sustainability in Mediterranean Agri-Food Value Chains

Challenges and Perspectives

14th May 2024

Edited by

Amine M. Benmehaia
Georgia Ayfantopolou

University of Biskra, Algeria

SUMMARY

Preface
Rector of University

It is with great pleasure and a profound sense of responsibility that I inaugurate this international workshop on Governance and Sustainability in the Mediterranean Value Chains. The University of Biskra is steadfast in its commitment to fostering economic development and fortifying partnerships across all socioeconomic sectors, both locally and nationally. This workshop is a testament to our ongoing dedication to addressing critical issues that impact our region, aligning with the national policy guidelines aimed at promoting sustainability and effective governance. The focus on Mediterranean value chains is particularly pertinent, given the region's unique challenges and opportunities.

The University of Biskra recognizes the importance of such initiatives in facilitating dialogue and collaboration among diverse stakeholders. By bringing together experts, practitioners, and policymakers, this workshop aims to explore innovative solutions and share best practices that can lead to more sustainable and resilient value chains. The discussions and insights generated here will not only enhance our understanding of the current landscape but also pave the way for actionable strategies that can be implemented across the Mediterranean region. It is our hope that this event will serve as a catalyst for stronger, more collaborative relationships among all participants, ultimately contributing to the sustainability of our shared economic and environmental future.

On behalf of the University of Biskra, I am honored to officially open this workshop. I am personally committed to supporting and promoting the outcomes of this significant scientific event. The valuable contributions and findings that emerge from our discussions will be instrumental in shaping policies and practices that benefit our communities. Let us seize this opportunity to work together towards a more sustainable and prosperous Mediterranean region. I extend my heartfelt gratitude to all the organizers, speakers, and participants for their dedication and efforts in making this workshop a success.

Pr. Mahmoud Debabeche
Rector of the University of Biskra

Preface

The Mediterranean region is renowned for its rich agricultural heritage and its significant contribution to global food production. However, it faces a range of complex challenges, including environmental sustainability, food security, economic viability, and social equity. Addressing these issues requires a thorough examination of governance and sustainability within agri-food value chains (AVCs). By exploring the complexities of the entire chain—from production and processing to distribution and consumption—we can design effective strategies to overcome challenges and seize potential opportunities.

This international workshop of the GourMed Project distinguished itself with a multidisciplinary approach, encompassing a wide range of topics that contribute to a comprehensive understanding of governance and sustainability in Mediterranean AVCs. Experts and academics from fields such as agronomy, economics, environmental sciences, and political science converged to offer diverse perspectives. This approach acknowledges the multifaceted and interdependent nature of the challenges and opportunities within agri-food value chains, highlighting the importance of collaborative insights in generating holistic solutions.

Key themes addressed during the workshop included:

-Environmental Sustainability: Exploring strategies to reduce the ecological footprint of AVCs, promote sustainable agricultural practices, and address the impact of climate change.

-Economic Viability: Analyzing the economic aspects of AVCs, including market dynamics, trade policies, and the financial viability of stakeholders.

-Social Fairness: Discussing issues related to working conditions, fair trade, and social responsibility within AVCs.

-Policy and Governance: Examining the role of government policies and regulations in shaping the sustainability and governance of AVCs.

-Technology and Innovation: Studying the impact of technological advancements, innovation, and digitalization on the optimization of AVCs.

The primary aim of the workshop was to facilitate meaningful discussions, knowledge exchange, and collaboration among participants. The insights gained from these interactions have enhanced our understanding of the challenges and potential solutions for governing and ensuring the sustainability of Mediterranean agri-food value chains. The outcomes of this workshop, as expected, benefited not only academic research but also policy development and industrial practices, contributing to a more sustainable and equitable food system in the region.

The workshop is titled "Governance and Sustainability in Mediterranean Agri-Food Value Chains: Challenges and Perspectives," and was held on May 14, 2024, at the University of Biskra, Algeria. The event took place in the Audio-Visual Conference Room of the Central Bibliotheca. It brought together 73 participants from various sectors, including academia, industry, government, and civil associations.

The workshop inaugurated at 9:00 AM with an opening ceremony that included welcome addresses from university officials and key organizers. This was followed by a series of expert presentations divided into three main conference sessions. Each session focused on very specific themes, with speakers sharing their research findings and practical experiences.

The afternoon session featured poster presentations by PhD students and young researchers, providing a platform for emerging scholars to showcase their work and engage with established experts in the field. The poster session fostered dynamic interactions and offered valuable feedback to the young researchers.

The workshop concluded at 4:00 PM with a closing ceremony that summarized the key takeaways and outlined future directions for research and collaboration. Participants left with a renewed commitment to advancing the governance and sustainability of Mediterranean agri-food value chains, inspired by the knowledge shared and the connections made during the event. Through this gathering, the workshop successfully fostered an environment of intellectual exchange and practical discussion, paving the way for future advancements in the governance and sustainability of Mediterranean agri-food value chains.

Amine M. Benmehaia
Georgia Ayfantoupolou

Institutional Partners of the Workshop

Organizing Institutions

جامعة بسكرة
UNIVERSITY OF BISKRA

GourMED

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PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA
The PRIMA programme is supported and funded under horizon 2020 , the framework European Union's Programme for research and innovation

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ICARDA
Science for resilient livelihoods in dry areas

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مركز البحث في الاقتصاد المطبق من أجل التنمية
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Chairs of the Workshop

Pr. Mahmoud Debabeche
Rector of the University of Biskra
Honorary President

Dr. Georgia Aifandopoulou
CERTH-HIT, Greece
Honorary Vice-President

Pr. Abdallah Attaf
Dean of Faculty SESNV, University of Biskra
Honorary Vice-President

Dr. Amine M. Benmehaia
University of Biskra
President

Scientific Committee

Chair of the Scientific Committee of the workshop
Pr. Salah Eddine Benziouche
University of Biskra, Algeria

Members of the Scientific Committee

Amine M. Benmehaia	University of Biskra, Algeria
Georgia Aifandopoulou	CERTH-HIT, Greece
Anagnostis Argiriou	University of Aegean, Greece
Andrea Gianotti	University of Bologna, Italy
Andreas Detzel	IFEU, Germany
Lotfi Achour	ISBM, Tunisia
Boubaker Dhehibi	ICARDA, Tunisia
Ali Chebil	INRGREF, Tunisia
Kamel Guimeur	University of Biskra, Algeria
Hakim Drouai	University of Biskra, Algeria
Naima Mebrek	University of Biskra, Algeria
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Belkacem Boumaraf	University of Biskra, Algeria
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Kamilia Farhi	University of Biskra, Algeria
Ahmed Messai	University of Biskra, Algeria
Radhouane Benmehaia	University of Msila, Algeria
Ahmed Benmihoub	CREAD, Algeria

Organizing Committee

Chair of the Workshop Organizing Committee
Dr. Kamel Guimeur
University of Biskra, Algeria

Members of the Organizing Committee

Amine M. Benmehaia	University of Biskra, Algeria
Salah Eddine Benziouche	University of Biskra, Algeria
Marianna Giannaki	CERTH-HIT, Greece
Hakim Drouai	University of Biskra, Algeria
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Ahmed Simozrag	University of Biskra, Algeria
Khadoudj Benaissa	University of Biskra, Algeria
Radhouane Benmehaia	University of Msila, Algeria
Haoua Amrouni	INRA, Algeria
Ilham Guettafi	INRA, Algeria

Openings

The international workshop on "Governance and Sustainability in Mediterranean Agri-Food Value Chains: Challenges and Perspectives" commenced promptly at 9:00 AM on May 14, 2024. The present responsible staff included:

- Amine M. Benmehaia, Chair of the Workshop
- Salah E. Benziouche, Chair of the Scientific Committee
- Andrea Gianotti, Partner of the GourMed Project
- Georgia Ayfoutanpolou, International Coordinator of the GourMed Project (online)
- Abdellah Attaf, Dean of the Faculty SESNV

The workshop was moderated by Dr. Amine M. Benmehaia and Pr. Salah Eddine Benziouche from the Department of Agricultural Sciences at the University of Biskra. The event was launched by Pr. Benziouche, who then handed over to Dr. Benmehaia for the official welcome address.

Dr. Benmehaia expressed his gratitude to the Rector of the University of Biskra, Professor Mahmoud Debabeche, and extended special thanks to Ms. Georgia Ayfoutanpolou, the International Coordinator of the GourMed Project. He highlighted the significance of the workshop in addressing critical issues in agri-food value chains within the Mediterranean region.

Following Dr. Benmehaia's remarks, Dr. Andrea Gianotti, an esteemed guest from the University of Bologna, Italy, and a partner in the GourMed Project, delivered a welcoming speech. Dr. Gianotti expressed his appreciation to the organizing committee and emphasized the importance of collaborative efforts in advancing the goals of the workshop.

Next, Ms. Georgia Ayfoutanpolou joined the session online and delivered a brief speech. She thanked the Workshop Chair and provided an overview of the GourMed Project, highlighting the contributions and involvement of European partners who were participating remotely via Teams© software. Her remarks underscored the project's aim to enhance sustainability and governance in Mediterranean agri-food value chains through international cooperation.

The official opening of the workshop was then announced by Pr. Abdallah Attaf, the Dean of the Faculty of Exact Sciences and Nature and Life Sciences at the University of Biskra. Speaking on behalf of the Rector, Professor Attaf welcomed all participants and formally inaugurated the workshop, setting the stage for a day of insightful discussions and knowledge exchange.

Following the opening ceremony, the workshop sessions began at 9:30 AM. Moderators Dr. Benmehaia, Benziouche and Marianna Giannaki (from Greece, handling online interventions) ensured a smooth transition into the scheduled presentations and discussions, fostering an environment conducive to learning and collaboration among the diverse group of attendees.

Briefings

The workshop comprised three conference sessions and one poster session, providing a comprehensive exploration of governance and sustainability in Mediterranean agri-food value chains. The conference sessions began at 9:30 AM, each focusing on distinct themes relevant to the workshop's objectives. First Conference Session was on the Insights from the GourMed Project. The initial session highlighted key insights from the GourMed Project, featuring four oral presentations by project partners:

- "GourMed Project: How to reach fair agri-food supply chains in the Mediterranean" by Georgia Ayfantopoulou from CERTH, Greece, which discussed insightful strategies to achieve equitable agri-food supply chains.
- "Empowering consumers through data-driven technologies in the food market" by Anagnostis Argiriou from CERTH, Greece, which explored the role of technology in enhancing consumer engagement and transparency.
- "Assessing fair contract farming implementation in Algeria" by Ioannis Mallidis from CERTH, Greece, which evaluated quantitatively and mathematically the effectiveness of contract farming practices in Algeria.
- " Bioactivity potential of Mediterranean tomato paste: An aspect to be further valorized for fair pricing " by Andrea Gianotti and Maria Teresa Rodriguez Estrada from UNIBO, Italy, which analyzed meticulously the attributes that make Algerian tomatoes competitive in the market.

The session concluded with a discussion on the main findings and implications of the GourMed Project. Second Conference Session was on the Insights from Agriculture in Algeria. The session started at 10:30 AM, and focused on agricultural development in Algeria and featured the following presentations:

- "Evolution of public agricultural policies and their impact on food security in Algeria: From 1962 to 2024" by Soumeya Bekkis from the Ministry of Agriculture, Algeria, which examined the historical and current impacts of agricultural policies on food security.
- "Development of food value chains in Saharan Agriculture: Elements for analysis of the Algerian case" by Salah Eddine Benziouchen from the University of Biskra, Algeria, which provided an in-depth analysis of Saharan agricultural value chains.

The session concluded with a lively discussion, with notable comments from Georgia Ayfantopoulou, who emphasized the richness and utility of the presentations. Third conference session on tomato sector and its challenges—Italy and Algeria experiences. This session began at 11:30 AM and focused on the challenges and innovations within the tomato sector, featuring three presentations and a round table discussion:

- "Governance of Italian processed tomato value chain" by Antonella Samoggia from UNIBO, Italy, which detailed the governance structures of Italy's processed tomato sector.
- "Some consequences of unfair prices in the industrial tomato sector in Algeria" by Amine M. Benmehaia from the University of Biskra, Algeria, which explored the impacts of pricing policies on the Algerian tomato industry.
- "Challenges and innovations in pest management for the Algerian tomato farming sector" by Farida Bettiche from CRSTRA, Algeria, which discussed pest management strategies and their importance for the sector.

The session included a round table moderated by Amine M. Benmehaia and Haoua Amrouni (from INRAA, Algeria) featuring five socioeconomic actors from the Biskra region. The discussion provided practical insights into the real-world challenges faced by the tomato sector.

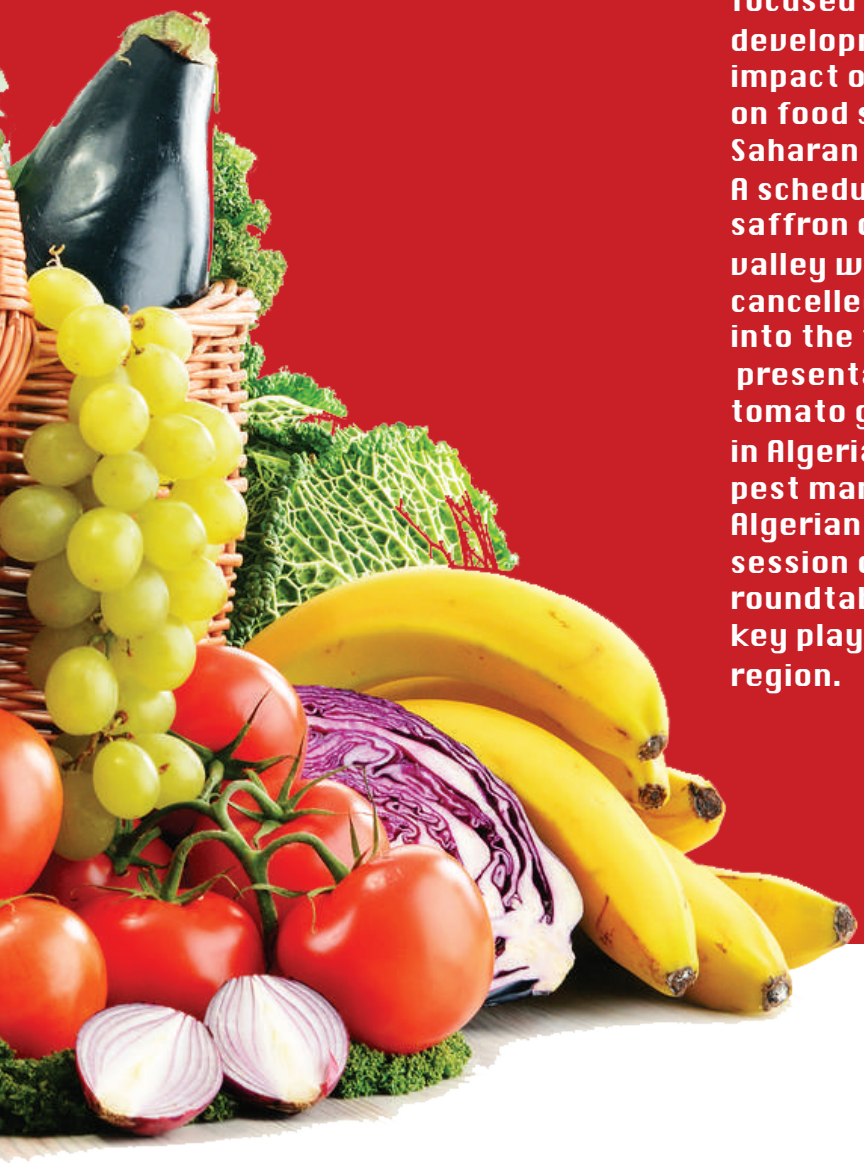
The final part of the workshop was the poster session, which began at 2:00 PM and was moderated by the scientific subcommittee. A total of 28 posters were presented, showcasing a variety of research topics and innovations. Each poster was evaluated, fostering an engaging and interactive environment for knowledge exchange.

The workshop concluded at 4:30 PM by Dr. Naima Mebrek, the Head of the Department of Agricultural Sciences, leaving participants with a deeper understanding of the governance and sustainability challenges within Mediterranean agri-food value chains and a renewed commitment to advancing solutions in this critical area.

Oral Communication Sessions for Debates on **Governance of Mediterranean**

Agrifood Supply Chains

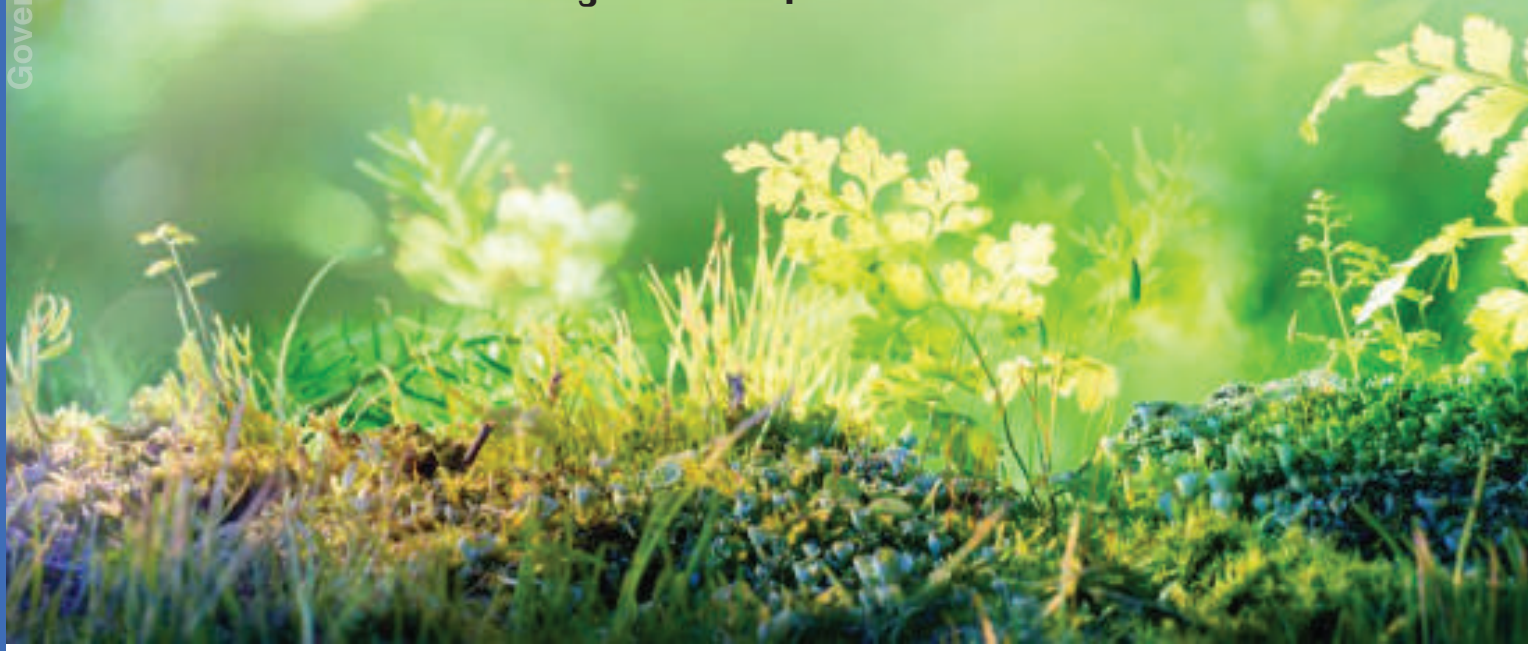
The first conference session on the GourMed Project explored strategies for fair food supply chains, consumer empowerment through technology, contract farming in Algeria, and the competitive edge of Algerian tomatoes. The second session focused on Algeria's agricultural developments, examining the impact of past and present policies on food security and analyzing Saharan agricultural value chains. A scheduled presentation on saffron cultivation in the M'zab valley was unfortunately cancelled. The third session delved into the tomato sector, with presentations on Italy's processed tomato governance, unfair pricing in Algerian tomato production, and pest management challenges for Algerian tomato farmers. This session concluded with a roundtable discussion featuring key players from Algeria's Biskra region.



GourMED

Session 1
Insights from

The first conference session delved into the profound insights and findings from the GourMed Project, an initiative dedicated to fostering fair and sustainable agri-food supply chains in the Mediterranean region. This session was pivotal in setting the stage for the workshop, as it showcased the collaborative efforts and research outputs of the project's partners. Through a series of four oral presentations, experts from various institutions shared their knowledge and strategies aimed at enhancing the sustainability and fairness of agri-food value chains, addressing critical issues such as consumer empowerment, contract farming, and competitive advantages in agricultural products.



GourMed project

GourMed Project: How to Reach Fair Agrifood Supply Chains in the Mediterranean

Georgia Ayfantopoulou

Research Director, Deputy Director at Hellenic Institute of Transport – Centre for Research and Technology Hellas, Thessaloniki, Greece
email: *gea@certh.gr*

"By providing a comprehensive overview of the GourMed project, this presentation highlighted the significance of fostering knowledge exchange between the Open Innovation Community and the local Algerian community, encouraged dialogue on innovation, fairness, and sustainability in agri-food supply chains, stressing that such interactions are crucial for driving forward the project's objectives"

Introduction and Aim of the Project

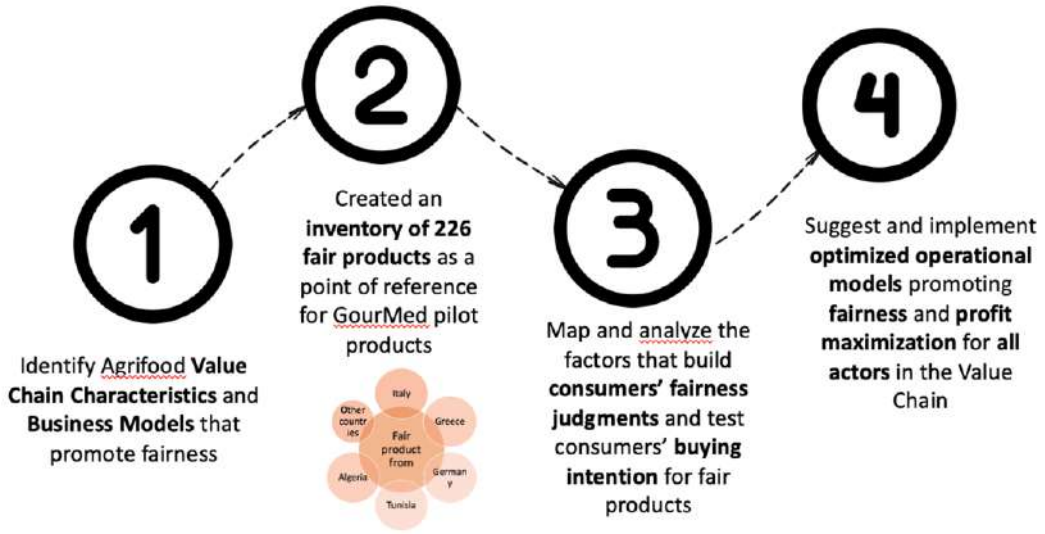
In her presentation, Dr. Georgia Ayfantopoulou, the Project Coordinator, provided a comprehensive overview of the GourMed project. This initiative, funded under the PRIMA 2020-05 framework, commenced on June 1, 2021, and is slated to conclude on November 30, 2024. Dr. Ayfantopoulou highlighted the collaborative nature of the project, showcasing its international consortium, which includes a diverse array of partners from various countries and disciplines. She also outlined the project's pilot programs, which are designed to test and implement the innovative models being developed. These pilots serve as practical case studies for the project's broader objectives, demonstrating real world applications and impacts.

The main aim of GourMed is to develop innovative, optimized governance and operational models for agri-food supply chains that ensure food quality, profitability, and sustainability. Dr. Ayfantopoulou emphasized the project's goal to enhance value creation within Mediterranean agri-food value chains, distinguishing them from cheaper imports that often undermine local economies. The project seeks to achieve a more balanced power dynamic and equitable value appropriation among actors within these value chains. By fostering collaboration and integrating advanced technological solutions, GourMed aims to improve both the efficiency and the fairness of these supply chains, ultimately contributing to the resilience and sustainability of the Mediterranean agri-food sector.

Highlights

To achieve this goal, the project approaches the concept of fairness in agri-food systems in a multidimensional way. The project defines a fair agri-food supply chain as one that promotes mutual benefits, shared value creation, sustainability, fair profit distribution and fair compensation for all actors, including farmers, processors, retailers and consumers. GourMed addresses fairness in the agri-food chain through several strategies, including the identification of value chain characteristics and business models, the creation of an inventory of fair products, broad consumer analysis and the implementation of optimized operational models, as shown in Dr. Ayfantopoulou's presentation.

Moving on, Dr. Ayfantopoulou presented an overview of the GourMed tools and methodologies, including the mapping of supply chains and stakeholders, business models related to fairness, molecular tools promoting fairness, digital tools and sustainability assessments (LCA and socioeconomic). A highlight for the day was the presentation of contract farming as the business model for the Algerian pilot.



GourMed approach to Assess Fairness multidimensionally

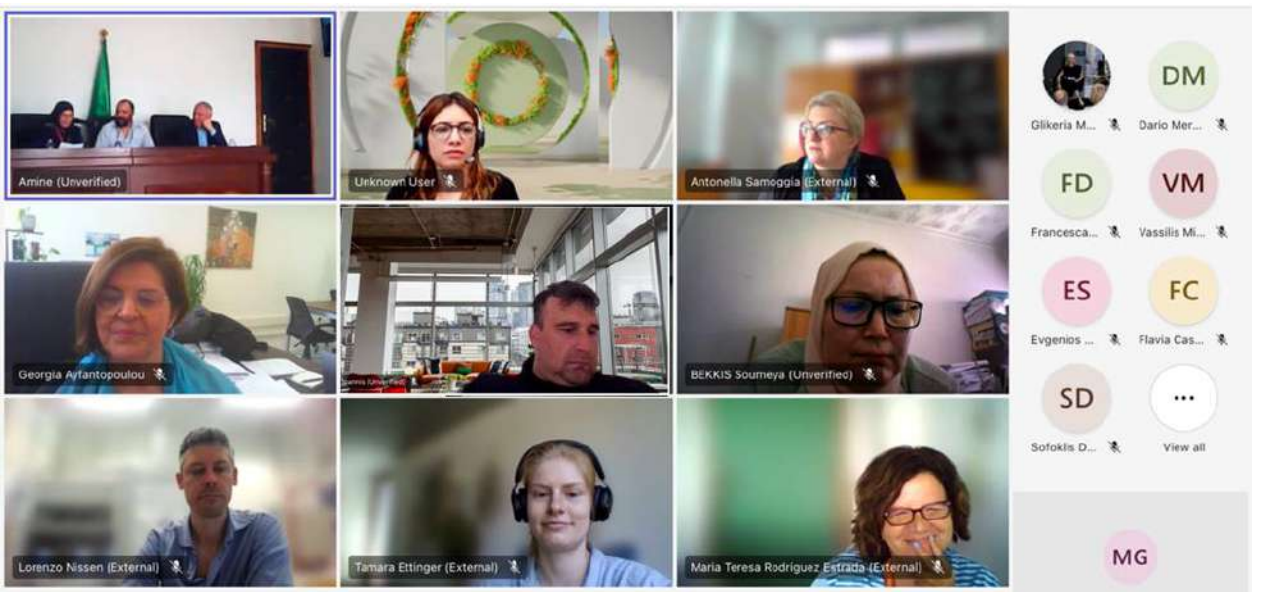
Dr. Ayfantopoulou presented the key questions explored in the project. One of the project's key questions is "*What Makes a Product Fair?*". To answer this question, GourMed examined the agri-food supply chains through distributive, procedural and interactional fairness assessments and created an inventory of 226 fair products across the Mediterranean region. To address "*How to Make an Agri Food Supply Chain Fair?*", the project defined fair business models for agri food, identified competitive advantages for fair products, applied technology for added value creation, and conducted sustainability assessments of supply chains.

Another important question for the project was regarding "*Consumer Willingness to Pay for Fair Products*". For this, the project conducted a survey with 1,250 consumers to assess their willingness to pay more for fair products. Survey findings indicated that fairness is relevant but not clearly understood by consumers, there is limited awareness of innovative technologies supporting product quality, price is a significant factor especially for younger consumers and there is perceived unfairness in value chains, particularly towards farmers. Lastly, GourMed responded to the challenge of "*Defining Price Functions for Fair Products*" by conducting stakeholder surveys on fairness definitions and value redistribution and establishing price functions by stakeholder category and product type.

Concluding Remarks

Dr. Ayfantopoulou's presentation concluded with a call to action, aiming to foster productive discussions and interactions regarding the project's results. She emphasized the importance of engaging workshop participants in evaluating the feasibility of the strategies proposed by the GourMed project. Dr. Ayfantopoulou urged attendees to delve deeply into assessing the competitive advantages of local agri-food products, considering factors such as production identity, taste, packaging, and pricing. By examining these elements, participants could better understand what makes a fair product attractive in the marketplace and how these attributes can be leveraged to enhance the competitiveness of Mediterranean agri food products.

Furthermore, Dr. Ayfantopoulou highlighted the significance of fostering knowledge exchange between the GourMed *Open Innovation Community* and the local Algerian community. She encouraged dialogue on innovation, fairness, and sustainability in agri-food supply chains, stressing that such interactions are crucial for driving forward the project's objectives. By sharing insights and best practices, stakeholders can collaboratively develop and refine approaches that promote fair and sustainable agri-food systems. This collaborative spirit, she noted, is essential for realizing the full potential of the GourMed project, ensuring that its benefits extend beyond theoretical research to practical, impactful applications in the real world.



Empowering Consumers through Data Driven Technologies in the Food Market

Anagnostis Argiriou

Expert in Food Technology, Professor
at the University of the Aegean, Greece
email: argyriou@aegean.gr

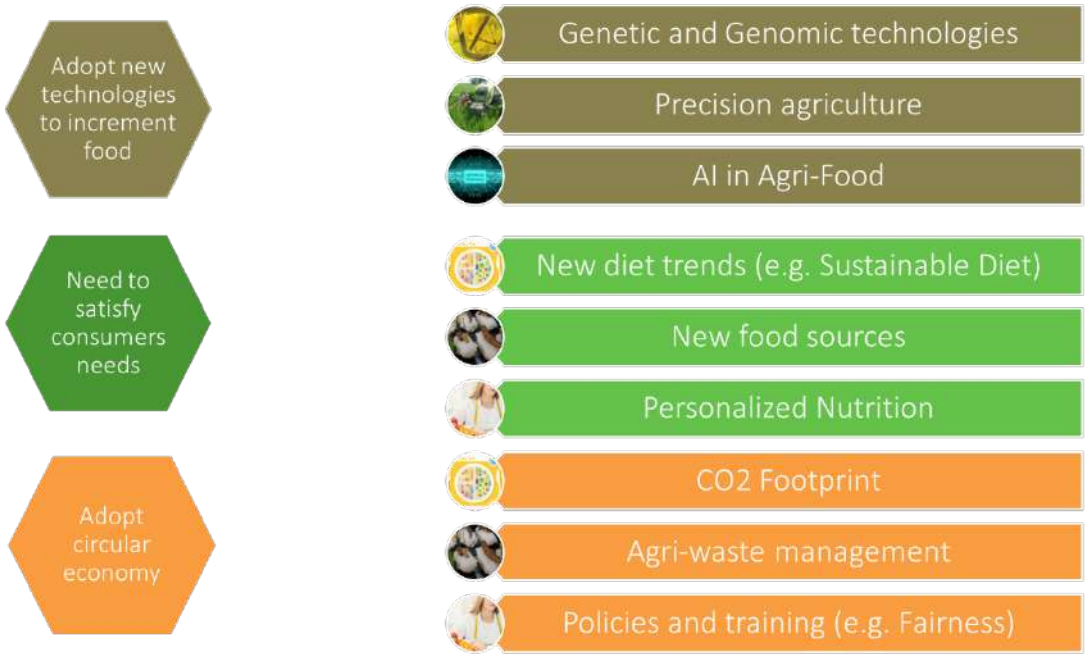
"This presentation aims to analyze the consumers attitudes in the food market through data-driven technologies. This is achieved using online consumer surveys to understand purchasing habits and fairness perceptions. The use of advanced genomic techniques leads to better crop varieties with superior traits, while blockchain technology ensures complete traceability, certified quality, and fair pricing."

Introduction

In the rapidly evolving food market, the adoption of data-driven technologies holds significant potential for empowering consumers. The primary targets in this sector are ensuring food safety and security, minimizing environmental impacts, contributing to economic growth, and enhancing the resilience of the supply chain. These objectives address the fundamental aspects of sustainability and consumer trust, which are critical for the future of the agri food industry.

Ensuring food safety and security involves rigorous standards and monitoring throughout the supply chain to guarantee that food products are safe and reliable. Minimizing environmental impact is essential in mitigating the effects of climate change, conserving natural resources, and maintaining biodiversity. Economic growth and job creation are vital for supporting communities and fostering innovation within the industry. Resilience, on the other hand, involves building a robust food system capable of withstanding various shocks, from climate crises to economic disruptions.

However, the sector faces significant challenges, including the loss of arable land due to urbanization and industrial activities, which threatens food production capacity. The climate crisis exacerbates weather extremes, impacting crop yields and farming practices. The loss of biodiversity, resulting from monoculture farming and habitat destruction, reduces ecosystem resilience. Additionally, the push to use fewer chemicals to protect human health and the environment presents challenges for maintaining crop yields. High energy costs and food prices, coupled with supply chain uncertainties, further complicate the scenario, necessitating innovative solutions to maintain a stable and sustainable food supply.

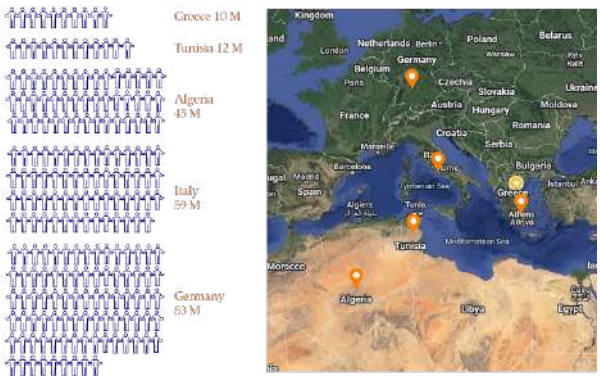


Method Overview

Achieving fairness across the entire agri-food value chain involves both ethical and economic considerations. Understanding fairness means recognizing the equitable treatment of all stakeholders in the system, from producers and suppliers to distributors and consumers. Fairness extends through the entire chain, ensuring that everyone involved is treated justly and equitably.

To explore these dimensions, a comprehensive consumer survey was conducted online, consisting of 28 questions across six thematic blocks. These blocks included the importance of purchasing habits and food attributes, fair food revenue distribution, fair-trade purchasing intentions, understanding the fairness of the food chain, choice experiments, and demographic data.

In addition, the presentation focused on the development of new varieties of Greek tomato landraces to improve the quality and nutritional value of Greek tomato cultivars. Techniques such as Simple Sequence Repeats (SSR) for genetic diversity, selection of plants, and the stability of offspring were employed. Furthermore, next-generation sequencing (ddRAD protocol) was used to study genetic diversity and population structure, identifying new Single Nucleotide Polymorphisms (SNPs) and tracing them up to the F7 generation.

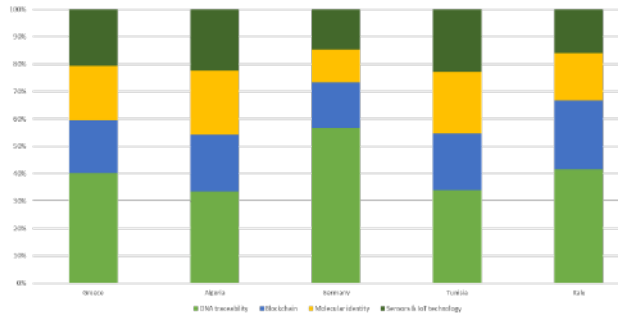


Regions and Targeted Population

Main Findings and Discussions

The survey revealed several key insights into consumer behavior and attitudes toward fairness in the food market. Consumers place high importance on purchasing habits and food attributes, with taste and price being the most prioritized factors. Economic

constraints significantly shape consumer preferences, emphasizing the freshness, locality, and seasonality of food products. However, fair trade food products currently have a low impact on consumers' choices, indicating a gap in awareness and perceived value.



Authenticity and traceability technologies

Fairness in the agri-food system involves both upstream and downstream practices. Upstream practices include banning unfair trading practices, ensuring ethical treatment of workers, promoting transparency through technology, and providing fair remuneration. Downstream practices focus on transparency regarding costs and prices, enhancing perceived value, and supporting informed food choices. The role of technology in promoting fairness is significant, with molecular traceability and digitalization enhancing transparency and building trust among stakeholders. Transforming fairness-related costs into sustainable business models can demonstrate that fairness is not only ethical but also profitable.

The case study on Greek tomato landraces demonstrated significant progress in improving the quality and nutritional value of cultivars. By selecting plants with superior traits such as productivity, flavor, aroma, and disease resistance, and utilizing advanced genomic techniques, new and improved varieties were developed. Records on various attributes such as fruit shape, weight, diameter, color, chamber number, plant internode distance, number of flowers, and total yield per plant were meticulously maintained to ensure the desired improvements.

In addressing the value chain problem in the agri-food sector, challenges of trust and transparency were highlighted. Farm management systems, compliance with food safety standards, and the provenance of food are critical areas where improvements are needed. Implementing blockchain technology offers significant advantages, including complete traceability, certified quality, and fair pricing based on product quality. Blockchain can improve logistics, reduce environmental impact, and provide consumers with access to all production steps, thereby building trust. However, the implementation and maintenance costs, along with the need for infrastructure, present notable disadvantages.

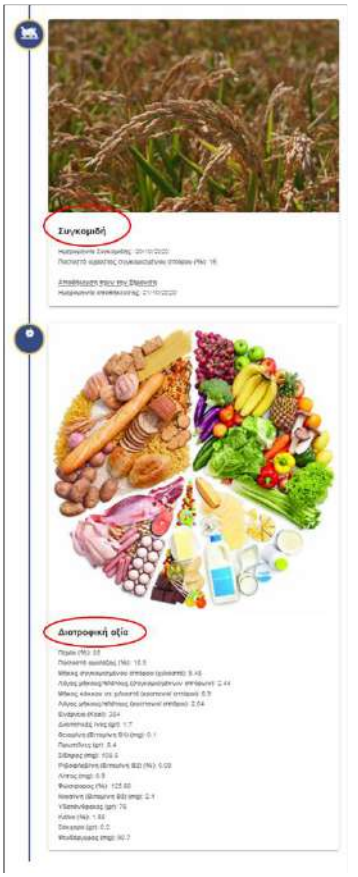
Improvement of quality and nutritional value of Greek tomato cultivars – SSR - Genetic diversity - Selection of plants - Stability of offspring. Trace cultivars that
give superior crosses Productivity, Flavor, aroma, and Disease resistant

Case of Greek tomato landraces: developing new varieties

Concluding Remarks

The presentation underscores the importance of understanding consumer purchasing habits and food attributes. While consumers prioritize taste and price, economic constraints heavily influence their preferences, particularly regarding the freshness, locality, and seasonality of food products. Despite the low current impact of fair-trade food products on consumer choices, there is potential for growth through increased awareness and perceived value.

To gain a competitive advantage, it is essential for producers to understand what makes their product different, measure quality, and compare with competitors. Training consumers to understand the value of these products is equally important. The role of technology is paramount in this process. Digitalizing the value chain, producing and providing data to clients, and giving access to information support informed decision-making and foster trust and respect among value chain actors.



The platform scheme

Assessing the Fair Prices of Algerian Tomato Paste: An Analytical Approach to Contract Farming in Algeria

Mallidis Ioannis

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"This presentation provides a comprehensive summary of the key findings and insights derived from the analysis of data on contract farming to evaluate fair pricing structures within the Algerian tomato paste industry. These insights underscore the significance of employing advanced methodologies and technologies to optimize pricing structures and enhance profitability within the Algerian tomato paste industry."

Objective and Scope

The primary aim of this study is to evaluate fair prices for Algerian tomato paste by conducting a comprehensive analysis of data collected from 1,326 farms across Algeria. This research aims to incorporate various technological advancements into the contract farming business model (BM) to assess their impact on pricing and overall profitability. By doing so, the study seeks to provide a detailed understanding of how these technologies can enhance the financial outcomes for farmers and contribute to the sustainability of the tomato paste supply chain.

The contract farming business model under examination in this study includes a unique clause that allows farmers the flexibility to renege on the contract if the market price of tomato paste increases significantly. This feature is designed to protect farmers from potential market volatility and ensure that they can benefit from favorable market conditions. The study will analyze the effectiveness of this clause and its implications for both farmers and processors. Through this analytical approach, the research aims to propose actionable recommendations for establishing fair pricing mechanisms that support the economic viability of Algerian tomato farmers.

Methodology Overview

Clustering

To effectively analyze the diverse operational dynamics of the farms, the Elbow Method was employed to cluster the farms into three distinct categories based on operational parameters such as size, yield, and proximity to processing facilities. This clustering approach helps in understanding the varying impacts of contract farming on different farm sizes and tailoring strategies accordingly.

1. Cluster 1: Small Farms – This cluster includes farms that produce lower quantities of tomatoes, are located in closer proximity to processing units, and exhibit a consistent yield. These farms benefit from lower transportation costs and potentially more stable production rates.
2. Cluster 2: Medium Farms – Farms in this cluster produce higher quantities than those in Cluster 1 but experience moderate variability in yield. They represent a middle ground in terms of size and production stability, facing moderate logistical challenges and operational costs.
3. Cluster 3: Large Farms Characterized by highest production quantities, these farms are spread over variable distances from processing units. Despite logistical complexities, they show effective contract performance due to their scale of operations and resource availability.

Fair Price Function Estimation

The study employs a comprehensive approach to estimate the fair price function within the contract farming business model (BM). This model considers a scenario where farmers enter into contracts with processors but retain the option to renege if the market prices of their products rise significantly, providing them with a safeguard against market volatility.

The fair price function is formulated as follows:

$$FP = (p - cs + cf) + \beta f \cdot cf$$

Where p represents the processor's sales price of the crop, cs denotes the processor's cost of goods sold, cf is the farmer's harvesting costs, βf signifies the farmer's return on investment rate, which represents the cost of one euro investment.

This function is designed to ensure that farmers receive a fair price that covers their costs and provides a reasonable return on investment, while also being sustainable for processors.

By incorporating these variables, the model aims to balance the interests of both farmers and processors, promoting a fair and equitable agricultural supply chain. The analysis will explore how different farm sizes and operational conditions affect this fair price function, providing insights into optimizing contract terms and enhancing profitability for all stakeholders involved.

Main Results

Model Parameter Values Considered

The following table presents the parameter values considered for small, medium, and large farms in the study. These parameters are critical for understanding the cost dynamics and profitability within the different farm sizes. From the table, it is evident that the fundamental cost structure is consistent across all farm sizes, with specific differences in harvesting and transportation costs, as well as the farmer's return on investment rate. Small farms have lower harvesting and transportation costs, while large farms incur higher costs due to greater distances and larger operational scale. The return on investment rate increases with farm size, reflecting the higher risks and capital requirements associated with larger farms.

The relative impact of various parameters on the fair price function is summarized in the following table. This analysis helps to identify the sensitivity of the fair price to changes in key cost components and sales prices. This table illustrates how changes in the processor's sales price, processor's cost of goods sold, farmer's harvesting and transportation costs, and the farmer's return on investment rate affect the fair price of tomato paste.

Notably, the farmer's harvesting and transportation costs have the highest relative impact across all farm sizes, indicating that efficiencies in these areas could

significantly influence profitability. Additionally, the processor's sales price shows a considerable impact, particularly for medium and large farms, underscoring the importance of market-driven pricing strategies.

Parameters	Small Farm	Medium Farm	Large Farm
Retailers labor and operation costs as % of purchase price per kg of tomato paste	0.25	0.25	0.25
Kgs of Industrial Tomatoes required per kg of tomato paste		3	
Farmer's initial sales price (dinars per kg of tomato paste equivalent unit)	48	48	48
Farmer's harvesting and transportation costs (dinars per kg of IT)	6	8	10
Processor's initial average sales price (dinars per kg of tomato paste)	215	215	215
Processor's initial cost of goods sold (dinars per kg of tomato paste)	148	148	148
Retailer's initial average sales price (dinars per kg of tomato paste)	290	290	290
Farmer's return on investment rate %	0.1	0.3	0.5
Algerian Dinars per €		224	

The relative impact analysis reveals that while the processor's cost of goods sold and the farmer's return on investment rate also affect the fair price, their impacts are comparatively moderate. This suggests that targeted improvements in harvesting and transportation logistics, along with strategic pricing adjustments, can substantially enhance the economic outcomes for all stakeholders in the tomato value chain.

Parameter	Relative Impact T1	Relative Impact T2	Relative Impact T3
processors sales price	1.7 %	2.3 %	2.3 %
Processor' s cost of goods sold	1.4 %	1.2 %	1.4 %
Farmer' s harvesting and transportation costs	2.7 %	1.8 %	1.8 %
Farmer' s return on investment rate	2.1 %	1.3 %	1.4 %

Derived Contract Farming Prices

The main findings on Farmer's contract prices after BM and technology implementation presents the derived contract prices for farmers across different farm sizes (small, medium, and large) after implementing the basic contract farming business model (BM) and additional technological advancements (T1, T2, T3).

The results on Dinar impact of the fair BM and technology implementation through a higher fair contract price show a significant increase in contract prices for all farm sizes under the basic business model (BM), with small farms experiencing an 81% increase. This substantial rise highlights the effectiveness of the BM in ensuring fairer compensation for farmers. However, the integration of technologies (T1, T2, T3) shows marginal reductions in the contract prices, indicating slight efficiency gains and cost reductions.

These advancements help streamline operations and reduce overheads, though the impact on pricing varies slightly across different farm sizes.

The main findings on the financial impact of the fair business model and technological implementations on the contract prices illustrates the dinar impact of

implementing the fair business model and subsequent technological advancements. The initial adoption of the BM yields substantial financial benefits, particularly for large farms, which see an increase of 64 dinars. The incremental application of technologies (T1, T2, T3) slightly reduces these gains but indicates improved operational efficiencies and cost savings. Small farms, while benefiting significantly from the BM, see a minor reduction in gains with the integration of each technology, reflecting optimized processes and cost reductions.

Overall, the analysis underscores the potential of the fair business model to elevate farm incomes substantially. The technological enhancements, though slightly reducing the initial gains, provide valuable efficiency improvements, promoting sustainability and profitability in the long term. The detailed insights derived from these tables highlight the importance of balanced strategies that integrate fair pricing models with innovative technological solutions to support the agricultural sector's growth and stability.

Consumer Price Function Attribute Impacted by the Business Model

One critical aspect of the business model (BM) analyzed is its impact on consumer pricing due to perceived unfair revenue distribution between farmers and processors. This attribute carries a significant -0.66 € value coefficient per kilogram of tomato paste. In practical terms, if consumers perceive that revenue distribution is unfair, they are likely to pay 137 dinars less per kilogram of tomato paste. This price sensitivity reflects consumer demand for fairness and equity in the supply chain.

The impact of implementing the business model on this unfair revenue distribution attribute is expressed through the percentage increase in contract prices. Essentially, the BM aims to ensure a fairer distribution of revenue, which in turn is expected to alter consumer prices positively by mitigating concerns over fairness.

Under the basic business model, the main findings on the impact of the fair business model and subsequent technological implementations on consumer prices reveal that consumer prices rise significantly, reflecting the 81% increase in contract prices for small farms. Medium and large farms also experience notable increases, reaching 154.6 and 197.1 dinars per kilogram of tomato paste, respectively. These figures underscore the impact of fair revenue distribution on consumer pricing, as the higher contract prices ensure fairer compensation for farmers, which is partially transferred to consumers.

The integration of technologies (T1, T2, T3) slightly reduces the consumer price increases. For instance, with the implementation of T1, the price for small farms drops to 114.9 dinars, medium farms to 151.3 dinars, and large farms to 195.5 dinars. This trend continues with T2 and T3, showing marginal reductions in consumer prices. These reductions reflect efficiency gains and cost savings achieved through technological advancements, which help moderate the price increases while maintaining fair revenue distribution.

Overall, this analysis highlights the importance of equitable revenue distribution in shaping consumer prices. Implementing the business model alongside technological innovations can enhance fairness in the supply chain while balancing consumer price impacts, ensuring a sustainable and profitable agri-food sector.

Total Value Chain Dinar Impact

The main findings on total dinar Impact of BM and technology implementation showcase the total dinar impact of the business model (BM) and its combination with various technological advancements (T1, T2, T3) on the entire value chain (VC) for small, medium, and large farms. The results reveal that the implementation of the BM alone provides the highest dinar impact on the entire value chain, as it results in the highest farmer's contract price. The introduction of technologies T1, T2, and T3, while still beneficial, slightly reduces the overall dinar impact. This reduction reflects efficiency gains and cost optimizations achieved through technological advancements, which help distribute value more effectively across the value chain.

Considering a fair dinar impact allocation of 40% for farmers, 30% for processors, and 30% for retailers, the following tables derive the fair prices for each stakeholder after implementing the BM and its combination with technologies T1, T2, and T3. Under the BM implementation, farmers, processors, and retailers see significant price increases, with large farms benefiting the most. This indicates a substantial value addition across the chain, ensuring equitable distribution of benefits.

Introducing T1 slightly reduces the fair prices for all stakeholders compared to BM alone. This reflects the efficiency and cost-saving benefits of the technology, which are distributed across the value chain. The implementation of T2 results in similar impacts to T1, maintaining slight reductions in fair prices while optimizing overall value chain efficiency. Finally, the integration of T3 shows consistent trends with T1 and T2, slightly lowering fair prices but enhancing the overall efficiency and sustainability of the value chain. Overall, these results highlight the importance of balancing fair pricing models with technological advancements. The business model alone maximizes direct financial benefits for farmers, while the addition of technology ensures long-term sustainability and efficiency, benefiting all stakeholders in the agri-food value chain.

Total VC Gross Profit Margin: While the BM alone results in the highest dinar impact across the value chain, it does not yield the highest gross profit margins. Instead, the combination of the BM with blockchain technology (T1) prevails in maximizing gross profit margins. This highlights the efficiency gains and improved traceability offered by blockchain technology, which help optimize profitability across the value chain. The current allocation model of 40% to farmers, 30% to processors, and 30% to retailers significantly increases the farmer's sales price. This, in turn, raises the costs of goods sold for both processors and retailers, thereby reducing their gross profits. The data suggests that while the initial sales price boost benefits farmers, the overall value chain profitability could be enhanced by a more dynamic allocation strategy that maximizes the total VC gross profit margin.

Comparison with Fair Tomato Paste of GourMed

The fair tomato paste product identified in the context of Deliverable 1.2 (D1.2) of the GourMed project is sold at a retail price of €7.43 per kilogram. When we analyze the average price across all farm sizes, we find an average price of €1.58 per kilogram. This results in a retail price difference of €5.85 per kilogram.

To ensure the competitiveness of Algerian tomato paste in the international market, it's crucial to consider the export related costs. The comprehensive costs associated with exporting tomato paste from Algeria, including transportation, tariffs, and logistics, amount to less than €5.85 per kilogram. Given this cost structure, Algerian tomato paste can be positioned competitively in the market. The fair retail price aligns with the international standards for fair trade products while also covering all necessary expenses.

This price differential not only highlights the potential profitability of Algerian tomato paste but also emphasizes its viability as a fair trade product. By maintaining a competitive pricing strategy that accounts for all export costs, Algerian tomato paste can secure a strong position in the global market, ensuring fair returns for farmers and sustaining the value chain. This approach underscores the success of the GourMed project's aim to balance value distribution and enhance the competitiveness of Mediterranean agri-food products.

Summary and Insights

In this presentation, we provide a comprehensive summary of the key findings and insights derived from the analysis of data collected from 1,326 farms to evaluate fair pricing structures within the Algerian tomato paste industry. The study utilized advanced methodologies, including the Elbow Method for clustering farms and examined the impact of a business model (BM) both alone and combined with three distinct technologies: T1 (Analytical methods for food authenticity), T2 (Blockchain technology), and T3 (Consumer guidance apps). Additionally, we assessed

the gross profit margins of various stakeholders within the value chain (VC) after the implementation of the BM and its combination with these technologies.

Main insights of the presentation

1. Farm Size and Contract Prices: Larger farms experienced higher contract prices attributed to greater operational costs and distances from processors. The analysis revealed a substantial 13% difference in contract prices between small and medium-sized farms, and a significant 29% variance between small and large sized farms.
2. BM Impact on Value Addition: The implementation of the BM significantly increased the dinar value of the entire agrifood supply chain. Specifically, the average dinar value impact was calculated as 158.3 for small farms, 204.8 for medium sized farms, and 261.1 for large farms, illustrating substantial gains across all farm sizes.
3. Allocation Ratio Optimization: The current allocation ratio of 40%/30%/30% to farmer/processor/retailer prices, as defined by GourMed's stakeholders, was found to not maximize the gross profit margin of the entire value chain. This highlights the necessity for a more dynamic setting of these allocation ratios to optimize profitability and sustainability.
4. Competitive Positioning in Global Markets: Algerian tomato paste emerged as a competitive product in international markets, with export costs falling below the retail price difference identified in the fair tomato paste product analysis. This indicates a favorable position for Algerian tomato paste in global trade, supporting fair returns for farmers and enhancing the overall competitiveness of the value chain.

These insights underscore the significance of employing advanced methodologies and technologies to optimize pricing structures and enhance profitability within the Algerian tomato paste industry. By leveraging data driven insights and adopting dynamic pricing strategies, stakeholders can ensure fair returns for farmers, promote sustainable value chain practices, and position Algerian tomato paste as a competitive player in the global marketplace.

Bioactivity Potential of Mediterranean Tomato Paste: An Aspect to be Further Valorized for Fair Pricing

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"The presentation aimed to compare the lycopene content, volatile organic compounds (VOCs) profile, and prebiotic activity of tomato paste from Algeria with benchmark products from Italy and Greece. While the Algerian tomato paste demonstrated higher lycopene content and a richer VOC profile, it lacked prebiotic activity due to the increased growth of E. coli. Despite this, its chemical properties indicate potential competitiveness in the European market."

Introduction

Tomato is one of the main components of the Mediterranean diet, being the average tomato consumption per capita about 2.5 times the average world consumption (STATISTA, 2024). In particular, Italy, Spain and Greece are among the top 10 countries in terms of tomato consumption per capita (STATISTA, 2024). Tomato is also largely produced and consumed in African countries, with Egypt being the leading producer and consumer, followed by Nigeria (Dube et al., 2020).

Tomatoes are a staple ingredient in Mediterranean dishes, used both raw and cooked. They are rich in nutrients such as vitamins A and C, folate, potassium, carotenoids, and polyphenols, which provide various health benefits including antioxidant, anti-inflammatory, and anti genotoxic effects (Naureen et al., 2022). Lycopene, the primary carotenoid responsible for the distinctive deep-red color of ripe tomato fruits and their derivatives, has garnered significant attention in recent years due to its therapeutic potential in disease management (Naureen et al., 2022).

The concentration of lycopene in fresh tomato fruits is influenced by several factors, such as variety, ripening degree, and pedo-climatic conditions. Tomato can also be processed into various industrial products, like juice, paste, purée, ketchup, and sauce (Jeong et al., 2023). Furthermore, each product category exhibits distinct organoleptic characteristics influenced by processing treatments (such as cooking) to which tomatoes are subjected. Hence, the profiling of the volatile organic compounds (VOCs) and the quantification of lycopene content of tomato paste could provide relevant information about their aroma/flavor compounds and their bioactivity potential.

Tomato paste, due to the approx. 4% content in dietary fiber, could also possess prebiotic activity versus the good microbes of the human intestine. Prebiotics are in fact fibers and oligosaccharides, and by definition, "a prebiotic is a substrate that is selectively utilized by microorganisms to confer health benefits to the host" (Gibson et al., 2017). However, in literature there are just a couple of works remarking the prebiotic potential of tomato products, but not tomato paste. A first study (Alonso-Garcia et al., 2017) investigated the prebiotic like effect of tomato juice on rats induced with NAFLD (non-alcoholic fatty liver disease) and found that tomato juice has the potential to positively modulate the beneficial microbial species, as for the prebiotic concept. Coelho et al. (2023) have investigated the effect of tomato flour on gut microbiota with fecal fermentation approaches, and have highlighted its ability as a prebiotic, positively modulating *in vitro* the gut microbiota of human and producing short chain fatty acids. Based on such indications, it is of high interest to investigate the prebiotic activity of industrially transformed tomatoes as paste.

Materials & Methods

Samples. The tomato paste samples were double tomato pastes and were purchased in the supermarket from 3 different GourMed partners (Greece, Algeria and Italy). Algerian tomato paste represents the pilot product, while the Greek and the Italian ones were the benchmarks.

Lycopene content. The determination of the lycopene content was carried out according to Rubio-Diaz et al. (2011). Briefly, two g of tomato paste were weighed, added with *n*-hexane:acetone solution (1:1, v/v) and shaked. The supernatant was recovered and washed with a saturated sodium chloride solution and 1 M sodium carbonate solution. The remaining organic phase was then filtered, dried and dissolved with dichloromethane. An aliquot of this solution was transferred to a quartz cuvette and the absorbance was read with a spectrophotometer at a wavelength of 470 nm. Lycopene was quantified using calibration curves constructed with standard solutions (10-100 mg/mL). The results were expressed as mg/kg of tomato paste. Three independent replicates were analyzed for each sample.

Volatile organic compounds (VOCs) profile. VOCs were determined in tomato paste samples, by using solid-phase microextraction-gas chromatography-mass spectrometry (SPME-GC-MS), according to Tura et al. (2022). Approximately 2.0 g of samples were weighed into a 20-mL SPME crimp neck vial. The sample was first equilibrated in the autosampler thermostat; the triphasic SPME fiber was then exposed to the headspace of the sample and, finally, desorbed in the injection port of the GC-MS. Mass spectra were acquired in full scan mode (total ion current); VOCs were identified by comparing their retention times and their mass spectra with those found in our library and NIST147 library. Results were expressed in area counts, as area/sample weight (g) × 10^3. Three independent replicates were analyzed for each sample.

Prebiotic activity. Prebiotic evaluation was composed by two different protocols, eventually adapted to the different food matrix of pilot products. The first protocol was the quantitative prebiotic index towards lactobacilli (Fissore et al., 2015; Nissen et al., 2020), while the second was the quantitative bifidogenic ac

tivity (Candela et al., 2015). Both protocols were composed of different steps, namely: i) selective growth of target bacteria on selective media; ii) growth evaluation by enumeration of microbial cells with quantitative PCR; iii) application of the prebiotic index equation; iv) statistical analysis. All microbial strains tested were commercial ones or property of the microbial collection of Dept. of Agricultural and Food Sciences, University of Bologna (Bologna, Italy) and had been previously isolated from plant-based products and extensively studied or from commercial probiotic formula. *Lactiplantibacillus plantarum subsp. plantarum* 98 b, *Limosilactobacillus fermentum* MR13, *Lacticaseibacillus rhamnosus* C1112, *Bifidobacterium bifidum* NCIMB 700795, *Bifidobacterium Lactis* BL-04, *Bifidobacterium Bifidum* BB-06, *Bifidobacterium Breve* BB-03, *Bifidobacterium Longum* BL-05 *and Escherichia coli* ATCC 25922 *and E. coli 555* were cultured from glycerol stocks stored at −80 °C and were propagated in selective media (Oxoid, Thermo Fisher Scientific, Waltham, MA, USA) at specific conditions (Nissen et al., 2020). Three bacterial mixes were then cultivated as a pool of species, namely: i) lactobacilli mix; ii) bifidobacteria mix; iii) *E. coli* mix.

The prebiotic index. This index was calculated with the related formula from two independent experiments and triplicates as previously described (Fissore et al., 2015), including qPCR quantifications (Nissen et al., 2020). Food samples were homogenized in 1:1 vol of distilled sterile water, in order to add a 1 mL of product to 9 mL of culture media. FOS from chicory (Sigma, USA) was used as prebiotic positive control. The media employed as control to calculate the prebiotic scores were instead added with 1 g/dL of glucose. The bacterial type strains were all used at final concentration of 6 Log10 CFU/mL (Fissore et al., 2015; Nissen et al., 2020).

Bacterial culture dependent counting. For all bacteria, 1 mL of each sample was aseptically transferred into a sterile tube with 9 mL of physiological solution (0.9 g/dL NaCl) to be serially diluted (1/10) and plated in duplicates. Lactobacilli mix was propagated and counted on MRS agar (Oxoid, Thermo Fisher Scientific, USA) after incubation for at least 24 h at 37 °C in jars with anaerobiosis catalyst (Oxoid, Thermo Fischer Scientific, USA). Bifidobacteria mix was propagated and counted on MRS agar supplemented with 0.005 g/dL l-cysteine (Sigma, USA) after incubation in the same conditions of lactobacilli. *E. coli* mix was propagated and counted on BHI agar (Oxoid, Thermo Fisher Scientific, USA) at 37 °C for 24 h.

Quantification by real time PCR. Bacterial DNA from fermented hemp bran and from broths for prebiotic activity assay was extracted with the Nucleo Spin Food DNA extraction kit (Macherey-Nagel, Germany). Genetic standards for qPCR were prepared from serially diluted PCR products (1/10) obtained amplifying gene targets with specific primers with ProFlex PCR System (Thermo Fisher Scientific, USA) and SuperFi Platinum Taq (Thermo Fisher Scientific, USA), and purified with GeneJet PCR purification kit (Thermo Fisher Scientific, USA). qPCR was performed with a QuantStudio 5 (Applied Biosystem, USA), the QuantStudio Design and Analyse Software 2.1 (Applied Biosystem, USA). Primers pairs, PCR and qPCR reactions were used according to previously published protocols (Candela et al., 2015; Nissen et al., 2020; Nissen et al., 2020).

Statistical analysis. Differences among samples were evaluated with Analysis of Variance (ANOVA). For post hoc test a Tukey's HSD was employed. The dataset was normalized using the mean centering method. All results are expressed as mean values obtained at least from duplicates batches in two independent experiments. qPCR results are expressed as the mean values of three replicates from two independent experiments.

Results and Discussion

Lycopene content. Similar lycopene content was found for all samples (≅ 25 mg/kg of tomato paste). However, if the lycopene content is expressed in dry basis, the Algerian product (pilot) has about 12% more lycopene than the Greek and Italian ones (benchmarks). These results agree with those reported by Górecka et al. (2020).

Volatile organic compounds (VOCs) profile. The SPME-GC-MS analysis enabled the identification of a complex mixture of VOCs (n<135) belonging to diverse classes of compounds, whose profile and concentrations varied depending on the type of double tomato paste. In fact, as evidenced by the heat map (Figure 1), the pilot product contained a wider variety of VOCS (n=92), followed by the Italian (n=84)

and the Greek benchmark products (n=77). The aldehyde class was the most abundant in the Italian and Algerian tomato paste samples (≅ 40% of the total VOCs), which was mainly correlated to the presence of furfural, associated to a flavor of sweet and caramel (Koltun et al., 2021). Furfural is formed during paste production, due to hydrolysis of hexose and pentose or dehydration of sugars in the final stages of the Maillard reaction (Kelebek et al., 2018). On the other hand, the ketone class was the most relevant in the Greek benchmark product (≅ 42% of the total VOCs), with 6 methyl 5 hepten 2 one being the most abundant; a flavor of green/leafy, typical of tomato paste, is attributed to this ketone (Kelebek et al., 2018). This compound is formed during tomato processing and storage, by heat-induced degradation of lycopene or it can be released from glycosidically bound precursors through enzymatic hydrolysis during tomato processing (Kelebek et al., 2018).

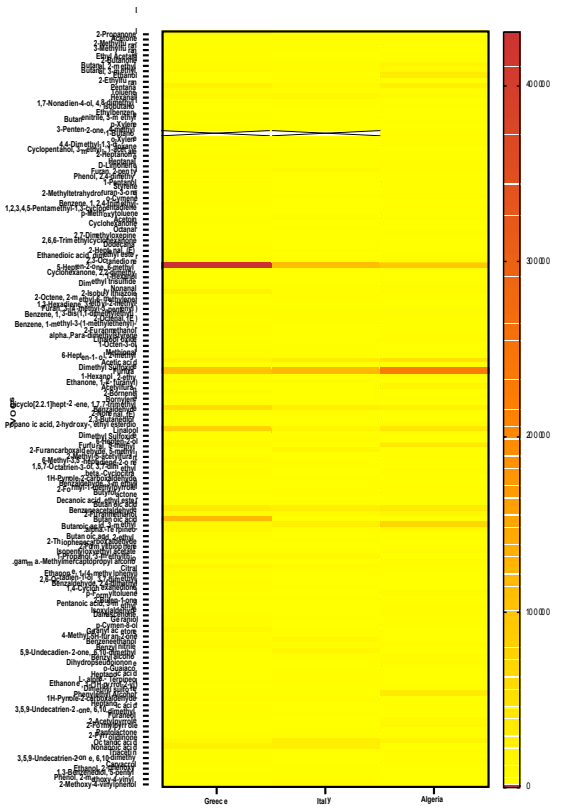

Figure 1. Heat map of the VOCs detected in tomato paste pilot product and benchmarks.

The other VOCs classes (acids, terpenes, alcohols, hydrocarbons, phenols and acids) were present at lower (< 20%) and diverse concentrations depending on the sample. These differences could be due to the different origin and ripening stage of the raw tomatoes used for their production, and/or processing conditions (evaporation and concentration) used by manufacturers. The VOCs results agree with data published by Kelebek et al. (2018).

Selective bacterial growth on pilot products: Microbial selective growth in presence of homogenized tomato paste samples was independently tested against three different mixes of bacteria, i.e. the mix of lactobacilli, the mix of bifidobacteria and the mix of *Escherichia coli*. Specific bacterial growth was performed and compared onto specific culture media with the addition of 10% (w/v) of product sample from the Algerian pilot (TOM DZ) and with the addition of 10% (w/v) of two similar benchmark products, one from the Italian large distribution (TOM IT) and one from the Greek large distribution (TOM GR). Considering the growth of lactobacilli mix, the addition of the pilot Algerian tomato paste fostered the growth of lactobacilli mix up to 9.05 Log10 cells/mL to a superior extent in comparison to the benchmark products (8.17 and 8.35 Log10 cells/mL for TOM GR and TOM IT, respectively), with significant differences. However, TOM DZ fostered lactobacilli significantly less in comparison to the positive control FOS (Figure 2A).

Considering the growth of bifidobacteria mix on the tomato samples, the maximum growth was recorded on the benchmark products, chiefly TOM GR (9.22 Log10 cells/mL) than TOM IT (8.92 Log10 cells/mL), followed by the Algerian product TOM DZ (8.76 Log10 cells/mL). No significant differences were recorded amongst the samples (Figure 2B).

Lastly, the addition of 10% (w/v) of TOM DZ in comparison to the additions of the benchmark products showed significant differences for the growth of *E. coli* mix. The Algerian product made *E. coli* grow up to 10.29 Log10 cells/mL, while the benchmark products made *E. coli* grow up to 9.18 and 9.32 Log10 cells/mL for TOM IT and TOM GR, respectively. The Algerian tomato paste made *E. coli* grow significantly more than the positive and the negative controls (Figure 2C).

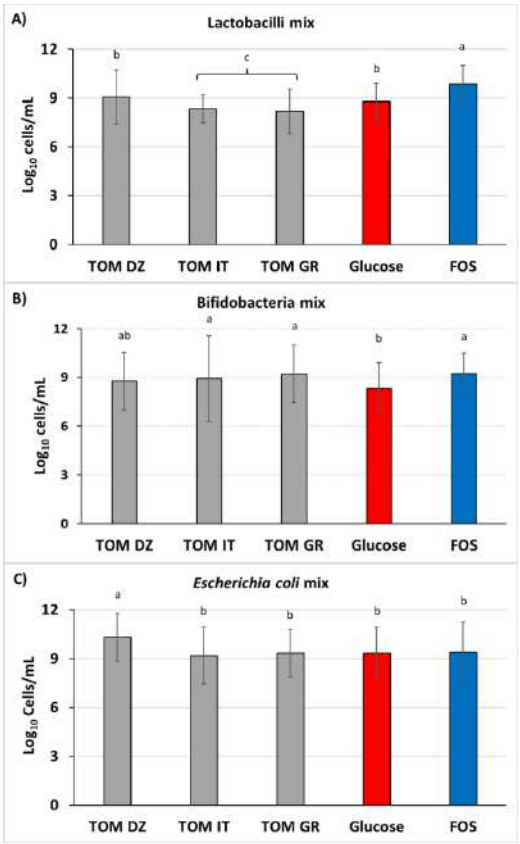

Figure 2. Selective bacterial growth on tomato pilot product and tomato benchmarks. TOM DZ = Tomato paste from Algerian pilot; TOM IT = Tomato paste benchmark from Italian large distribution; TOM GR = Tomato paste benchmark from Greek large distribution. Glucose = negative control; FOS (Fructooligosaccharides) = positive control. A) Aerobic growth on MRS agar of lactobacilli mix; B) Anaerobic growth on MRS cysteine agar of bifidobacteria mix; C) Aerobic growth on BHI agar of *Escherichia coli* mix.

Prebiotic activity: Prebiotic score of FOS towards lactobacilli mix was 0.36 ± 0.11, being similar to values reported in literature (Figure 3A). Tomato paste from the Algerian pilot showed to have no prebiotic score towards lactobacilli mix, but had little differences with respect to both tomato Italian and Greek benchmarks; in fact, it was significant just with respect to the latter (p = 0.04). Prebiotic score of FOS towards bifidobacteria mix was 0.33 ± 0.04, which is similar to data reported in literature (Figure 3B). Tomato paste from the Algerian pilot did not have prebiotic score towards bifidobacteria mix, so it resulted significantly different with respect to both benchmarks (p < 0.05). The latter, in contrast, displayed a marked prebiotic activity towards bifidobacteria mix, being similar to that of the positive control FOS (mean p = 0.14). From the analyses conducted, it is evident that no prebiotic activity was due to the addition of 10% (w/v) of Algerian tomato paste to the culture media. This feature was clear for both the probiotic mixes, lactobacilli and the bifidobacteria.

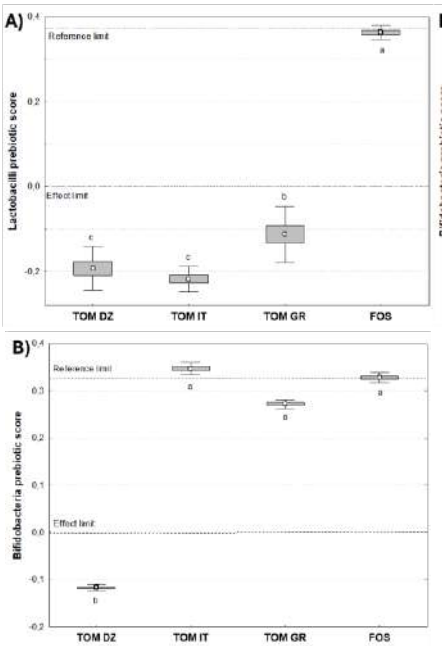

Figure 3. Prebiotic scores towards probiotic strains of lactobacilli and bifidobacteria. TOM DZ = Tomato paste from Algerian pilot; TOM IT = Tomato paste benchmark from Italian large distribution; TOM GR = Tomato paste benchmark from Greek large distribution. Glucose = negative control; FOS (Fructooligosaccharides) = positive control. A) Lactobacilli prebiotic score; B) Bifidobacteria prebiotic score.

This evidence was mediated by the high growth of *E. coli* that was quantified after propagation on culture medium. Such growth was significantly higher of almost 1 Log unit of cells/mL than those reported for the addition of 10% (w/v) of both benchmarks or the control (Figure 2). The prebiotic activity that is here reported relies on an equation that considers the growth of three different bacterial groups, namely lactobacilli, bifidobacteria and *E. coli*. The prebiotic activity of a substrate is due to the ability to foster the beneficial bacteria and

counteract that of *E. coli*. Tomato paste from Algerian pilot showed to foster lactobacilli and bifidobacteria a little bit more than the negative control, but not significantly (Figure 2). Moreover, the pilot product did not have the possibility to counteract the growth of *E. coli*, as it grew significantly more than the negative control (Figure 2). These are the reasons for the negative prebiotic scores recorded for the pilot product towards lactobacilli and bifidobacteria.

Conclusions

Among the studied tomato paste samples, the benchmark products had some prebiotic activity, while the pilot product did not. Notwithstanding, benchmark tomato and pilot tomato pastes were similarly able to foster beneficial microbes, and this is a competitive advantage, but the pilot product was not able to counteract *E. coli*. Regarding the chemical characterization, the pilot product had a richer volatiloma than benchmarks, which may result in a diverse aromatic profile due to the quali-quantitative VOCs differences. Anyway, the pilot Algerian product turned out to be more similar to the Italian benchmark product than to the Greek one. In the case of lycopene, the pilot product had a similar content with respect to those of benchmarks, which would represent a marketing advantage for its distribution in Europe. Considering these promising results, it would advisable to further explore these aspects related to the bioactivity potential of Mediterranean tomato paste, in order to further valorized it with a fair pricing perspective.

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Session 2

Insights from Agriculture in Algeria

Paintings from the Biskra Oasis / Yacine Magnaji is an artist from Biskra Province
لوحات فنية من واحة بسكرة / الفنان ياسين مغناجي من ولاية بسكرة

The second conference session, was dedicated to exploring the agricultural developments and policies within Algeria. This session provided an in-depth look at the evolution of agricultural practices and their broader implications for food security and value chains in Algeria. The presentations highlighted both historical perspectives and contemporary analyses, offering a comprehensive understanding of the agricultural landscape in Algeria. The session was designed to shed light on how public policies have shaped agricultural outcomes and to analyze specific case studies within the region, particularly focusing on Saharan agriculture. The session began with Soumeya Bekkis from the Ministry of Agriculture, Algeria, examining the trajectory of agricultural policies over several decades, detailing how these policies have influenced food security in Algeria. Her presentation provided valuable insights into the successes and challenges faced by the agricultural sector, underscoring the critical role of policy in shaping agricultural sustainability and resilience.

Evolution of Public Agricultural Policies and Their Impact on the State of Food Security in Algeria: From 1962 to 2024

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"This presentation reviews Algeria's public agricultural policies since independence, highlighting their positive impact on the country's food security and economic development. Over six decades, these policies have created jobs, expanded agricultural land and irrigation, and significantly contributed to GDP. While international institutions commend Algeria's agricultural model, the state of food security in the nation is still heavily relies on imported food products."

Introduction

All the public agricultural policies (PPA) mobilized in Algeria are based on the government's action plans, and are reflected in the reorganization of agricultural and rural policy as a whole, particularly the refocusing of assigned operational projects. Their main objective was to increase agricultural production and promote food security for the population. Algeria's progress in achieving food security can be explained by the implementation of sectoral programs and strategies that have made for better food and nutritional security for the majority of the population. It has been mentioned in all the founding strategic documents of the PPA adopted by the government.

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In the first four year plan of 1970 73, in the National Agricultural and Rural Development Plan (NARDP), initiated in the early 2000s, and in the Agricultural Orientation Law N°08 16, which gave birth to the Agricultural and Rural Renewal Policy (PRAR). The main idea of this study is that Algeria has become an FS state because of the efforts made by the national government. PPA and FS have remained inseparably linked. Algeria has been praised by various international organizations and forums for its efforts to improve food and nutritional security. However, it has come to light that Algeria's food security is still heavily reliant on food imports.

Main Findings and Constatations

The public agricultural policies (PPA) initiated by the government since independence have experienced two distinctive periods: the first period from national independence to 1989, and the second period from 2000 to 2024.

Transition from centralized structures and investment to progressive decentralization and disengagement (1962-1989)

This period (1962 1989) spans from autogestion (1962) to the implementation of the Structural Adjustment Program (SAP) in the early 1990s following the collapse of oil prices and increasing debt. This period included the agrarian revolution (1971) and agricultural restructuring (1981). It marked the initial effects of reorganizing the public agricultural sector and dismantling socialist agricultural domains (DAS) into relatively small Collective Agricultural Exploitations (EAC) and Individual Agricultural Exploitations (EAI). The 1990s were challenging for Algeria, marked by significant internal and external debt, leading to the implementation of SAP imposed by international institutions like the World Bank and IMF. This program aimed to liberalize prices, adjust market protection, promote exports, reform taxes, restructure public enterprises, eliminate most indirect subsidies for inputs and equipment, and reorganize agricultural administration (Bedrani *et al.,* 1997; Bessaoud, 2019).

Since 1989, Algeria's agricultural public policies have undergone significant transformations due to globalization and decentralization (Saidoun *et al.,* 2022). During this period, agricultural policies remained dependent on the paradigm of "conventional intensification" for agricultural development (Adair *et al.,* 2022). Financial mechanisms such as the National Agrarian Revolution Fund (FNRA) aimed to distribute land to landless or small-scale farmers with insufficient resources, while the Price Compensation Fund of the 1990s sought to minimize guaranteed production prices to support production, typically set below market levels. The state adopted local production support principles through guaranteed prices primarily for wheat and barley while prices for maize, and oats were market-determined.

While the successful production model has been important for Algerian food security since 2000, food imports have a substantial influence.

The second period (2000-2024) was marked by a gradual return of peace in Algeria, improved public finances, and the conclusion of the structural adjustment program. This favorable political and economic environment enabled the government to launch ambitious agricultural policies (PNDA and PNDAR) in the early 2000s to strengthen national food security and develop agricultural sectors. The PNDAR policy aimed at new governance models, including territorial development (Boudedja, 2017; Saidoun *et al.,* 2022). The Agricultural and Rural Renewal Policy (PRAR) initiated in 2009, following law n°08-16 of August 3, 2008, proposed measures targeting agricultural and rural communities to maintain agricultural production and implement corrective measures against desertification. The Filaha plan, launched in 2019, reorganized the entire agricultural and rural policy based on the government's 2014 action plan. The 2020 2024 sectoral roadmap aimed to reduce food dependency by developing strategic sectors like cereals, milk, and oils, which heavily impact the state budget. Enhanced by numerous financial mechanisms, this period saw significant investments aimed at reinforcing food security and sovereignty through various programs and projects.

In terms of financial resources, this period saw increased mobilization of several sectoral and intersectoral financial mechanisms financed and supported by the state. These include the National Fund for Agricultural Development and Investment (FNDIA), which became the National Fund for Agricultural Development (FNDA), the National Fund for Regulation of National Production (FNRPA), the Fund for Combating Desertification and Steppe Pastoral Development (FLDDPS), the Rural Development and Land Development Fund by Concession (FDRMVTC), the Fund for the Promotion of Animal Health and Phytosanitary Protection (FPZPP), and various programs financed from the Ministry of Agriculture's equipment and operating budgets, among others such as subsidized loans, campaign loans (RFIG), investment loans (Ettahadi), and other financing mechanisms such as National Agency for Support and Development of Entrepreneurship (ANADE), National Micro-Credit Management Agency (ANGEM) and National Unemployment Insurance Fund (CNAC). Adair *et al.* (2022) noted that from 2000 to 2020, 917 billion DZD out of a total allocated 1067 billion DZD was utilized, resulting in an 86% consumption rate. Public spending was distributed as follows: 46% for investment in agricul

tural enterprises, 31% for regulation, and 16% for rural development and combating desertification and small farms and livestock.

Regarding national production, the Algerian production model was highlighted by the World Economic Forum in its "Food, Nature, and Health Transitions, Repeatable Country Models" report published in January 2023. Algeria has doubled its food production since 2000. It is ranked among the leading countries in food security due to its production model. Food production per capita increased by 114%, compared to an average of 5% in developed and emerging countries and 9% in African countries. Algeria's food system is characterized by an increase in medium and large sized farms, while small farms remain dominant. Processed food products are now common in both urban and rural areas (De Cleene *et al.,* 2023).

The impact of several investment programs on national production in the main sectors (2020-2024) has resulted in a diverse range of plant and animal production. According to statistics and reports published by the Ministry of Agriculture (2023), cereal production reached over 41 million quintals despite significant droughts from November 2022 to April 2023 during crucial growth periods. This cereal production was supported by efforts in the southern regions, achieving average yields of 70 to 75 quintals/ha with peaks of 85 quintals/ha, and securing two thirds of cereal areas in the north through supplementary irrigation. Legume production reached approximately 793 quintals. Vegetable production saw significant levels, particularly for potatoes (136 million quintals) and industrial tomatoes (23 million quintals), thanks to the adoption of new production techniques and securing water resources. Fruit production, including stone fruits, pome fruits, and rustic species, reached over 16 million quintals. A significant government program supports rustic fruit farming (2021-2024) to reach an overall target of 60,000 hectares. Citrus production reached 16 million quintals, and record levels were recorded for date production at around 11 million quintals. Animal production saw significant levels by the end of 2022, with white meat (5.7 million quintals), red meat (5 million quintals), and raw milk (3.2 billion liters, including 2.3 billion liters of cow's milk). These results were corroborated by the De Cleene *et al.* (2023) report.

The latest World Bank report on Algeria's economic situation, published in May 2024, highlights the dynamic economic activity and decreased inflation, driven by dynamic private consumption and strong investment growth, leading to a marked increase in imports (World Bank, 2024). In this context, the government launched multiple investment projects. The Baladna Al Djazair project for milk powder production is a concrete example of the state's strategic vision. A framework agreement was signed on 24/04/2024 between the Algerian Government and Qatar Baladna after 20 months of studies, discussions and planning. In fact, the project will be carried out in 4 phases, the first of which will begin in 2026 and the last of which will take place 9 years after the launch of the project. The investment amount is estimated at $3.5 billion project to be established on 117,000 hectares in southern Algeria (Adrar province), aims to produce 194,000 tons of milk powder annually. It will benefit from fiscal advantages and facilities granted by the Algerian Agency for Investment Promotion (AAPI) under investment law 22 18. To promote investment in the country, the state provided two digital platforms for investors to easily access agricultural land. National Agricultural Land Office (ONTA) will manage agricultural land in the north, while Industrial Agriculture Development Office (ODAS) will manage agricultural land in the south. ODAS has created a green corridor for those interested in agricultural investment in southern provinces, particularly in strategic sectors, providing facilities for land acquisition, well drilling authorizations, and electrical network connections.

The AAPI agency also has a digital platform to facilitate access to industrial, urban, tourist, and economic land, but not agricultural land. Through these digital platforms, the Algerian state aims to encourage agricultural investment and improve land access to achieve its food security and sovereignty goals, particularly in developing strategic sectors like cereals, milk, sugar, and oils to reduce dependence on external markets. For sustainable development in the south, the state allocated ODAS over 400,000 hectares. Several areas exceeding one million hectares have been granted for development. Other ambitious programs are intended to reinforce food security and sovereignty, such as the cereal storage reinforcement program, including 16 metallic silos and a new program with 30 strategic silos and 350 proximity centers for short- and long-term cereal storage. The creation of Algerian company for the regulation of agricultural products (SARPA) in 2023 is part of this strategic vision to promote investment, created to regulate the domestic market for widely consumed agricultural products, especially during lean periods.

Public agricultural policies (PPA) are analyzed here by measuring their impact on the country's food security. In recent years, Algeria has made significant progress in improving food security indicators, formalized in various specialized indexes and published internationally. These include food security indicators for Algeria from the FAO, the Global Food Security Index (GFSI) from the Economist Intelligence Unit, and the Global Hunger Index (GHI) from IFPRI (Bouzid *et al.,* 2018; Bessaoud, 2022; Bekkis, 2023). The GFSI, published annually by the Economist Intelligence Unit (EIU), considers accessibility, availability, quality, and safety of food, as well as natural resources and resilience in 113 countries (Bekkis, 2023). In this context, Algeria ranks 54th globally, ahead of Tunisia (55), Morocco (57), and Egypt (68). However, this improvement has not been accompanied by a qualitative improvement in the food ration or the preservation and sustainable use of natural resources.

For example, in terms of nutrient quality, Algeria ranks 67th, behind Tunisia (50) and Morocco (53) according to The Economist Group (2021) in a group of 113 countries. Regarding the Sustainable Development Goals (SDG2, zero hunger), Algeria is among countries with low prevalence, less than 2.5% of the population suffering from undernourishment, compared to 8.5% globally, 3% in Tunisia, 4.2% in Morocco, and 5.4% in Egypt (FAO, 2022; De Cleene *et al.,* 2023, Bekkis, 2023, Bekkis & Benmehaia, 2024). Algeria is categorized similarly to most European countries, the United States, Canada, China, Russia, Brazil, and Australia, as revealed in the FAO report in collaboration with international institutions IFAD, UNICEF, WFP, and WHO in 2022.

Additionally, food security has improved due to the success of the national production model (De Cleene *et al.,* 2023). However, the study by Bekkis & Benmehaia (2024) identified macroeconomic variables that influence food security in Algeria. The study's results showed a significant long-term causality between food security and the studied macroeconomic variables. There is also short-term causality between food security and variables such as food imports, precipitation, population, and cereal areas. The improvement in Algeria's food security is the result of cumulative public agricultural policies mobilized since 2000. This study's hypothesis is confirmed, but it also revealed that food imports remain a determining variable for food security in Algeria (Bekkis & Benmehaia, 2024). The share of imports in the Algerian food ration composition increased from an average of 38% to 68% (Bouzid *et al.,* 2018), with a high dependence rate of 70.1% on cereal imports recorded in the last decade (FAOSTAT, 2020). Similar studies by Le Mouël & Schmitt (2017) and Bekkis *et al.* (2022) highlighted the increased food dependence, especially on wheat. This situation could worsen with climate variation and population growth.

Main Conclusions

The aim of this study is to review all public agricultural policies adopted by the government since national independence to examine their impact on the country's food and nutritional security. Over the past 62 years, various public agricultural policies initiated by the state have had a positive influence on food security in Algeria. This is evidenced by commendations from numerous international institutions, including the FAO, World Bank, and The Economist Group. Macroeconomic indicators reflect significant improvements in the agricultural sector: more than 2 million jobs have been created, over 8.6 million hectares of usable agricultural land have been developed, more than 1 million agricultural enterprises have been established, and over 1.5 million hectares of agricultural land have been irrigated. The agricultural sector also generates more than 4,000 billion dinars, which corresponds to 14.7% of the Gross Domestic Product (GDP) at the end of 2022.

The agricultural production model adopted by Algeria has ensured quantitative food security for the entire population over the past two decades. Algeria ranks among countries with a low prevalence of undernourishment, with less than 2.5% of the population suffering from undernutrition, compared to the global average of 8.5%, 3% in Tunisia, 4.2% in Morocco, and 5.4% in Egypt (FAO, 2022; Bessaoud, 2022 & Bekkis, 2023). This production model has been praised by international institutions for its effectiveness. However, the study by Bekkis & Benmehaia (2024) revealed that the country's food security remains highly dependent on the importation of food products.

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Development of Food Value Chains in Saharan Agriculture: Elements for Analysis of Algerian Case

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"Saharan agriculture in Algeria has seen impressive growth in recent years. It has been proven to be both technically feasible and economically profitable, with significant socio-economic benefits. Developing Saharan agriculture requires a multi-pronged approach: prioritizing modern technology and efficient practices to lower costs, continual institutional reform to incentivize production, integrating research findings, building strong markets and value chains, and implementing sustainable practices for long-term success."

Introduction

Arid regions have long been known for an oasis agricultural production system composed of three essential and complementary plant strata. Firstly the date palm which constitutes the main axis of this system secondly comes the oasis arboriculture, and the underlying market gardening and fodder crops in third place. In association sometimes with a restricted breeding system of a few heads of sheep and goats for self-consumption and improvement of income and also the valorization of waste from the oasis and the production of organic manure. However, this system has undergone profound changes over the last two decades. Indeed, many cultivation systems are developed outside of the Palm plantations, greenhouse, mass arboriculture and intensive breeding.

Problematic

In this presentation, we sought to answer the following questions: What are the trajectory and dynamics of Saharan agriculture based on the experiences of certain value chains in the wilaya of Biskra? What are the technical and economic impacts of new agricultural policies on the region's agriculture? What are the constraints facing this agricultural sector? And, what opportunities can be leveraged to promote Saharan agriculture in Algeria?

Methodology

The analysis relied on field surveys with key stakeholders across various value chains, our own expertise, and relevant bibliographic sources. The presentation is structured in two phases. First, we examine the current state of several agricultural value chains in the region, including date palms and greenhouse farming in Biskra. Second, we discuss the constraints, opportunities, and development prospects for Saharan agriculture.

Crops under greenhouses value chain in Biskra

Situation of Greenhouse cropping in Biskra

According to DSA Biskra (2022), the Biskra region is ranked number one nationally in all techno-economic indicators for this cultivation system. Since 2000, it has seen remarkable growth, expanding from over 1,000 hectares to 8,000 hectares and increasing production from 1 million tons to 9 million tons between 2003 and 2022.

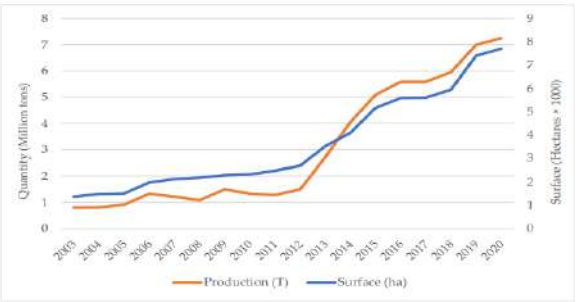


Figure 1. Greenhouse surface and production in Biskra region, 2000–2020.

According to Benziouche (2018), the distribution of greenhouse crops in Algeria by wilaya shows that Biskra holds the largest share, accounting for 35% of the area cultivated under greenhouses and 43% of greenhouse production at the national level in 2020. In the Biskra region, the most significant greenhouse crops are tomatoes, chili peppers, and bell peppers, which occupy approximately 58%, 21%, and 13% of the greenhouse surface area and production, respectively. The municipalities of Elghrous, Mezeraa, and Ain Naga are particularly notable, contributing to over 60% of the greenhouse crop production in Biskra.

Socioeconomic impacts of greenhouse crops in Biskra

The development of greenhouse crop cultivation in Biskra has led to numerous socioeconomic benefits. It has significantly reduced poverty, improved living standards, created jobs, altered land ownership patterns, increased the production of organic products, boosted exports occasionally, and changed consumption patterns.

Problems faced by this agriculture in Biskra

Despite the development of greenhouse crops, the sector still falls short of its objectives due to several technical and socio-economic challenges. These include soil nutrient deficiencies, high soil salinity, strong seasonal winds, and occasional market issues such as low demand and price drops.

Reasons for the success of greenhouse crops in Biskra

The success of greenhouse crops in Biskra can be attributed to several key factors. These include the unemployment crisis and its repercussions, the adaptation of early vegetables to the region's pedoclimatic conditions, the availability of production factors, especially water, and the availability of labor, particularly from the north of the country. Additionally, the economic performance and technical feasibility of this agriculture, a solvent market for agricultural products, the commitment of public authorities and farmers to promote Saharan agriculture, peasant innovation based on northern experiences, and financial subsidies from the State through the PNDA have all played crucial roles.

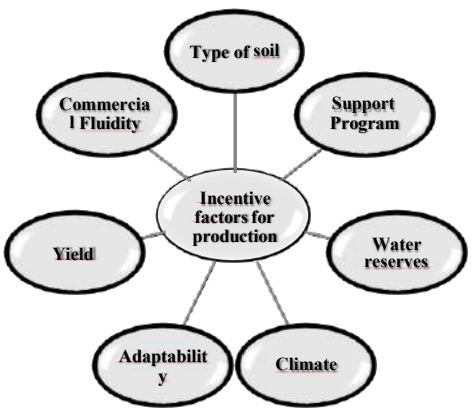


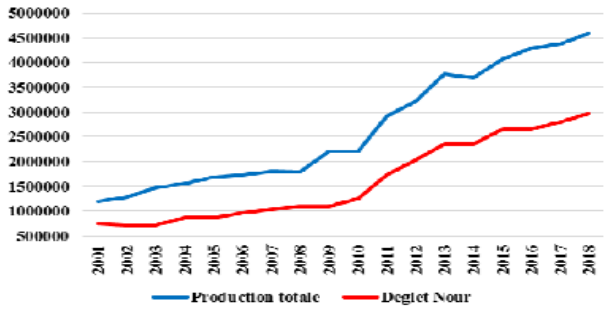
Fig 2. Incentive factors for production

The date palm value chain in Biskra.

Situation of Date Palm in Biskra

For several years, Algeria has been recognized as a leading global producer and exporter of dates. The country boasts a phoenicultural heritage of approximately 20 million palm trees, cultivated over an area

of 180,000 hectares, with production exceeding 1,200,000 tons in 2023. These technico-economic indicators have been steadily increasing since independence. While Algeria's phoenicultural heritage spans 27 Saharan wilayas, the wilaya of Biskra, along with Ouled Djela (prior to administrative division), holds a significant share, accounting for 24% of the cultivated area and 42% of the country's date production in 2022. Biskra also records the best technical-economic performances in this value chain, particularly with the renowned Deglet Nour variety. Consequently, the number of palm trees and production has grown substantially, reaching 4.5 million palm trees and a production capacity of 4.5 million tons in 2022.



Evolution of date's production in Biskra

Socioeconomic impacts of date palm value chain in Biskra

The development of the date palm value chain has significantly impacted Biskra's socioeconomic landscape. It has created substantial socio-economic dynamism in the region, improved living standards, and reduced poverty. Job creation and increased commercial activity have followed, attracting several investments. The state has also benefited from substantial income through date exports, and the development has helped minimize agricultural and rural exodus.

Problems faced by date palm value chain in Biskra

Despite the growth of this agricultural value chain in Biskra, it still falls short of its objectives due to various technical and socio economic challenges. Key issues include the abandonment and aging of producers, the small and fragmented nature of palm groves, aging palm trees, high input costs, and the unavailability of some inputs. Additionally, the region faces numerous phytosanitary problems, such as Boufaroua, a scarcity of qualified labor, marketing difficulties for dates, and water constraints, including the drawdown of the water table.

Date palm development opportunities in Biskra.

The development of this value chain necessitates leveraging several opportunities within the political, economic, social, and technical environments. Key opportunities include controlling production costs, positioning Algeria as a leading date producer due to its significant production levels and varietal diversity, and capitalizing on the high productivity and quality of Deglet Nour dates. Additionally, the creation of various by-products can enhance and diversify income. The presence of a diverse range of importing countries and growing global demand further supports the potential for value chain growth.

Main agricultural development programs and their impacts on Saharan Agriculture

Over the past two decades, the Algerian government has initiated several agricultural development programs and projects aimed at promoting agriculture across the country. Saharan agriculture has particularly benefited from these initiatives. Key programs include the National Agricultural Development Program (PNDA), General Agricultural Concessions (GCA), Agricultural and Rural Renewal, the Proximity and Rural Development Project (PPDRI), and the Access to Agricultural Land Ownership (APFA) program.

The key agricultural policies dedicated to date palms and greenhouse crops include subsidies for the construction of cold storage facilities, support for the regeneration of palm groves, provision of bank credits to producers, land distribution to farmers, and offering agricultural extension services. Additionally, these policies encourage exports, the processing and valorization of dates, agricultural scientific research, organic farming, and the labeling and certification of Deglet Nour and organic dates.

Conclusion

Saharan agriculture has seen impressive growth in recent years. It has been proven to be both technically feasible and economically profitable, with significant socio-economic benefits. However, the long-term sustainability of this agriculture is still being investigated. To further develop Saharan agriculture, all technical, socio-economic, and administrative constraints need to be addressed, while also capitalizing on all available opportunities.

What must be done to develop Saharan Agriculture? Developing Saharan agriculture requires a multi-pronged approach: prioritizing modern technology and efficient practices to lower costs, continual institutional reform to incentivize production, integrating research findings, building strong markets and value chains, facilitating exports, and implementing sustainable practices for long-term success.

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Open Innovation Community

Tomato sector and its challenges

Session

The third conference session was dedicated to addressing the various challenges and innovations within the tomato sector, drawing on experiences from both Italy and Algeria. This session aimed to provide a comparative analysis of the tomato value chains in these two regions, highlighting governance structures, pricing policies, and pest management strategies. By examining these critical aspects, the session sought to identify best practices and potential areas for improvement, thereby contributing to the overall goal of enhancing sustainability and efficiency in the tomato sector. The session featured three insightful presentations.

Governance of the Italian Processed Tomato Value Chain

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"This presentation presents an in-depth analysis of the governance mechanisms within the Italian processed tomato value chain. The focus is on the role of Interbranch Organizations (IBOs) and Producer Organizations (POs) in enhancing the bargaining power of farmers and stabilizing the market for high-quality, safe Italian processed tomato value chain."

Introduction

The processed tomato sector represents a significant component of Italy's agro-food economy. This study aims to elucidate the governance structures that underpin this vital industry, with a focus on the role of Interbranch Organizations and Producer Organizations in mediating the relationship between tomato producers and processors, particularly in the northern regions. By examining these governance mechanisms, a better understanding is gained of how they contribute to the overall efficiency and stability of the market. The importance of this sector is underscored by its contribution to the national economy and its role in sustaining rural livelihoods.

Main Aim

The primary objective of this presentation is to explore the governance of the Italian processed tomato value chain. The interactions of various stakeholders, including farmers, processors, and regulatory bodies, in creating a balanced and equitable market are examined. The study investigates the effectiveness of Interbranch Organizations and Producer Organizations in facilitating negotiations, ensuring quality control, and promoting industry integration. Key factors that contribute to the success and sustainability of the processed tomato sector in Italy are highlighted. Specifically, mechanisms that enhance collaborative efforts, improve market transparency, and support the equitable distribution of value among stakeholders are uncovered.

Methodology

The research methodology involved a comprehensive review of industry reports, statistical data, and legislative texts from the European Union. Interviews with key stakeholders in the North Italian Processed Tomato System were also conducted. This multi-faceted approach allowed for the gathering of a broad spectrum of insights and data, providing a robust foundation for the analysis. The qualitative interviews, in particular, offered in depth perspectives on the practical challenges and successes experienced by those directly involved in the value chain.

Main Results and Findings

The findings indicate that the North Italian Processed Tomato System has evolved a sophisticated governance structure. The IBO, recognized by the EU in 2012, plays a crucial role in coordinating between approximately 2,000 producers, 13 producer organizations, and 20 processors. The POs, regulated by the EU, concentrate supply, improve marketing, and provide technical assistance to their members.

Key Findings presented are as follows:

Production Statistics: In 2022, Italy produced over 5.5 million tons of processed tomatoes, representing a 17% increase from the previous year. The majority of this production comes from Emilia-Romagna (70%), followed by Lombardy (20%), Piedmont (6%), and Veneto (4%). This growth highlights the sector's resilience and capacity to adapt to market demands.

Role of IBOs and POs: The IBOs and POs have significantly enhanced the bargaining power of farmers by consolidating their efforts and providing a unified front in negotiations with processors. They also play a vital role in ensuring quality control and compliance with market standards. The establishment of these organizations has led to more structured and fair trading practices, fostering trust among stakeholders.

Market Stabilization: These organizations have contributed to stabilizing production costs and aligning production with market demand, thereby enhancing the overall efficiency and predictability of the market. By mitigating price volatility and coordinating supply, they help maintain a stable income for farmers and ensure a consistent supply of raw materials for processors.

Main Conclusions

The governance structures of the Italian processed tomato value chain, particularly the IBOs and POs, have significantly enhanced the bargaining power of farmers. They have also contributed to stabilizing production costs and aligning production with market demand. However, the number of IBOs in Italy is relatively low compared to other EU countries, suggesting potential for further development in this area.

Key conclusions drawn:

Enhanced Bargaining Power: The consolidation of farmers into POs and IBOs has provided them with a stronger voice in negotiations, leading to fairer pricing and better contractual terms. This empowerment has been crucial in protecting the interests of small and medium-sized producers.

Market Alignment: The coordination facilitated by these organizations helps to balance supply and demand, reducing the risk of overproduction or shortages. This balance is essential for maintaining market stability and preventing waste.

Quality Assurance: By setting and enforcing quality standards, Interbranch Organizations and Producer Organizations ensure that Italian processed tomatoes meet the high expectations of both domestic and international markets. This focus on quality enhances the reputation of Italian tomatoes and supports market expansion.

Recommendations

To further strengthen the governance of the processed tomato value chain, the following recommendations are made:

Encouraging the formation of additional IBOs: Expanding the number of IBOs to cover more agro-food sectors can enhance the overall governance and market stability of the broader agricultural industry. This expansion would provide more comprehensive support across different products and regions, promoting sector-wide growth.

Enhancing support for POs: Providing greater support for POs can facilitate better market integration and knowledge transfer, improving the efficiency and competitiveness of the sector. Investment in training and development programs for POs could yield significant long term benefits.

Implementing supportive policies: Addressing challenges such as labor shortages and climate change through targeted policies can help sustain and grow the processed tomato industry. Policies should focus on innovation, sustainability, and resilience to future market and environmental changes.

This presentation provides a comprehensive overview of the governance mechanisms in the Italian processed tomato value chain, highlighting the crucial role of Interbranch Organizations and Producer Organizations in enhancing the sector's efficiency and stability. By focusing on these key organizations, valuable insights are gained into how they support farmers, stabilize markets, and ensure the production of high-quality processed tomatoes. These insights are critical for policymakers, industry stakeholders, and researchers aiming to foster a more sustainable and equitable agro-food system.

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Some Consequences of Unfair Prices in Algeria's Industrial Tomato Sector

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"This presentation addresses the challenges faced by the industrial tomato sector in Algeria, which include mainly severe market concentration among processors, declining farmer participation, and inefficient regulatory frameworks. These issues threaten national food security by increasing reliance on imports. Establishing fair pricing mechanisms are essential to foster a more competitive and sustainable industrial tomato sector."

Introduction

This presentation addresses the challenges faced by the industrial tomato sector in Algeria, and mainly drawn from the study by Benmehaia et al. (2024). Historically, the sector has undergone numerous restructurings driven by public policy, with an interventionist and centralized approach dominating the first 30 years post-independence, ultimately proving ineffective. However, the early 2000s marked a significant shift towards an open market, leading to a revitalization and complete overhaul of the sector's structure. A pivotal moment occurred in 2010 with the establishment of a public entity aimed at organizing and coordinating industrial tomato production and supply.

The National Inter-professional Office for Vegetables and Meats (ONILEV) was created to facilitate vertical coordination between tomato producers and processors. Acting as a key intermediary, ONILEV has implemented regulatory mechanisms to promote contract farming, which has proven highly successful. Numerous studies (Benmehaia et al., 2017; Benmehaia and Brabez, 2018; Assassi et al., 2020; Assassi and Souillier, 2023; Benmehaia et al., 2024) highlight that this practice has helped realize the benefits of contract farming and supported the government's food security objectives.

Recently, however, there are emerging indicators of potential sectoral collapse, prompting experts (Branthôme, 2023; Benmehaia et al., 2024) to speculate on a possible return to importing tomato paste. This situation raises concerns about the effectiveness of the public regulatory mechanisms in managing supply relationships and the challenges faced by stakeholders. This presentation aims to analyze the structure of Algeria's industrial processed tomato sector, drawing on extensive data from field surveys conducted over four years (2019-2021) and aggregated statistics from public office reports to understand the sector's dynamics and challenges.

Industrial Tomato Chain Governance in Algeria

Since Algeria's independence in 1962, its industrial tomato sector has seen substantial market structure transformations. A key development occurred in 2010 with the creation of the National Interprofessional Office for Vegetables and Meat (ONILEV). ONILEV's role includes coordinating the industrial tomato market along with other sectors related to vegetables and meat. Specifically, ONILEV facilitates the vertical integration between industrial tomato producers and processing plants, primarily canneries, across the country. Figure 1 illustrates the current organizational structure, highlighting the various stakeholders involved in the product delivery chain. In this setup, tomato producers must deliver their contracted quantities to the canneries via a regulated channel. Should there be a shortfall, canneries may import triple concentrate tomato (TCT) to meet their needs, though this is costly. Additionally, tomato producers have the option to sell their crops through various marketing channels, ultimately reaching consumers in local fresh vegetable markets.

The initial regulatory mechanism established between 2010 and 2013 proved inadequate in resolving the production shortages faced by the canneries. Consequently, in 2013, a revised organizational strategy was implemented by the public office, introducing formal production contracts between producers and processors. This new approach aimed to reinvigorate the industrial tomato supply chain in Algeria by providing a more incentivized structure. The benefits of these contracts include income stabilization for farmers, improved management of downstream processed tomato products, and enhanced food security and sustainability. This shift underscored the limitations of both centralized administration and *laissez faire* market approaches, suggesting that a hybrid model of vertical coordination might be the most effective for managing the complexities of the sector.

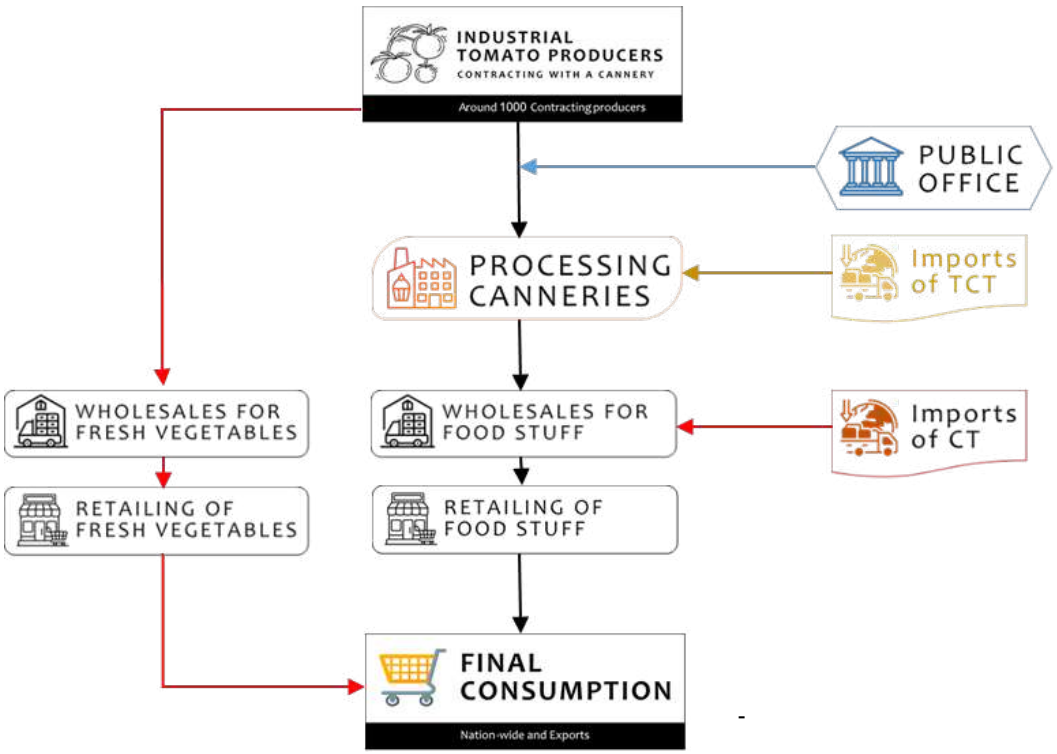


Diagram of the industrial tomato sector organization in Algeria (2010 2023) (Benmehaia et al., 2024)

The introduction of these formal production contracts has been instrumental in addressing the sector's challenges. By stabilizing incomes and ensuring a more reliable supply chain, these contracts have helped mitigate the risks associated with production shortfalls. The move towards a hybrid coordination model has demonstrated that neither extreme centralization nor complete market liberalization is sufficient. Instead, a balanced approach that incorporates elements of both can better handle the intricacies of the industrial tomato supply chain, ensuring the sector's sustainability and contribution to Algeria's food security.

Main Findings and Discussions

The research study on Algeria's industrial tomato sector highlights significant structural dynamics by analyzing key actors such as farmers and canneries, as well as production areas and quantities. Table 1 shows a clear regression in these structural aggregates over time. The number of contracting growers decreased from 3,713 in 2018 to 920 in 2021, while the number of contracting canneries fell from 20 to 15. Similarly, total contracted areas and produced quantities have also seen significant declines, illustrating a downward trend in the sector.

Table 1. Evolution of the main structural aggregates of the industrial tomato sector in Algeria

Structural aggregates	2018	2019	2020	2021
Number of contracting growers	3 713	2 627	1 867	920
Number of contracting canneries	20	16	16	15
Total areas contracted (ha)	19 409	14 118	12 030	7 462
Total produced quantities (1000 tons)	642	499	538	351

A closer look at the spatial distribution of industrial tomato producers reveals significant regional dynamics. Table 2 shows the number of contracting growers in different regions, with Skikda, Guelma, Annaba, and El Tarf standing out as key areas. These northeastern regions form the core of Algeria's industrial tomato production. Over time, the dominance of Skikda has been overtaken by El Tarf, which had 56% of contracting growers in 2021, indicating intense interregional competition within the sector.

The contractual performance between tomato producers and canneries reveals challenges in their vertical relationships. Many canneries struggle to reach their planned capacity, facing risks of default, while farmers perceive potential profit losses from contract fulfillment. This indicates complications in the sector's regulatory and contractual mechanisms, raising questions about the effectiveness of public regulatory frameworks and the adequacy of production contract structures.

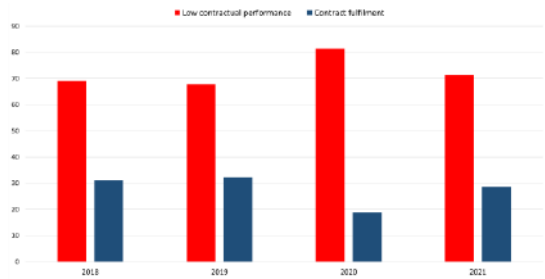
Table 2. Evolution of the number of contracting tomato growers by region

Regions	2018	%	2019	%	2020	%	2021	%
Skikda	1 717	46,24	1 122	42,71	541	28,98	179	19,46
Guelma	676	18,21	565	21,51	518	27,75	80	8,70
El Taref	601	16,19	561	21,36	539	28,87	518	56,30
Annaba	498	13,41	304	11,57	262	14,03	131	14,24
Others	221	5,94	75	2,85	7	0,37	12	1,30
Total	3 713	100	2 627	100	1867	100	920	100

Empirical analyses point to severe concentration within the processing segment, with a computed concentration index rising from 0.68 in 2018 to 0.87 in 2021. This oligopolistic market structure threatens to monopolize the sector, marginalizing new or small-scale entrepreneurs. Meanwhile, the declining number of tomato producing farmers and their disengagement from production contracts pose significant problems for processing firms, which are increasingly turning to importing tomato concentrate. This trend underscores the urgent need for policies to incentivize farmer participation and secure a stable supply of industrial tomatoes, crucial for the country's food security.

Several factors contribute to the sector's current challenges, including slow payment processes and simplistic contractual clauses. To improve the situation,

policymakers must address bureaucratic inefficiencies, enhance the rigor of contract enforcement, and introduce stronger incentives for both farmers and canneries.



The dynamics of contractual performance in the industrial tomato sector in Algeria (Benmehaia et al., 2024)

Additionally, establishing a fair price negotiation process is essential to balance power between the parties and foster trust-based relationships. Prioritizing the regulation of this sector is critical for reducing dependency on imports and achieving food security, highlighting the need for robust, sustainable policies to support the industrial tomato sector.

Facts, Challenges, and Policy Implications

Empirical analyses from field surveys highlight the severe concentration within Algeria's industrial tomato processing segment. The computed concentration index, which rose from 0.68 in 2018 to 0.87 in 2021, indicates a high level of market power consolidation among processing firms. This oligopolistic structure suggests a potential trajectory toward monopolization or the marginalization of new and small-scale entrepreneurs, thereby weakening overall sector performance. Such market concentration limits competition and innovation, posing significant barriers to new entrants and potentially harming the industry's long-term viability.

On the production side, the sector faces challenges with a notable decline in the number of tomato-producing farmers and their engagement in production contracts. Many farmers are abandoning the activity, making industrial tomato production less attractive. This decline poses a critical problem for processing firms struggling to secure a stable tomato supply. The increasing tendency of firms to import Tomato Concentrate and Tomato Paste (TCT) underscores a pressing food security issue. Addressing farmer disengagement and incentivizing their participation in tomato production is essential for strengthening the sector's resilience and ensuring national food security.

The weakening performance in the vertical relationship between producers and canneries signals complications within the regulatory and contractual frameworks. Despite firms' efforts to align with imposed incentive structures, persistent issues raise questions about the efficacy of the public regulatory mechanism and the adequacy of production contracts. Fundamental problems include the lack of robust enforcement clauses and negotiated prices, which contribute to producer disengagement and potential crises in the sector. Investigating these root causes is crucial for improving the regulatory environment and ensuring the sector's stability.

Addressing the sector's challenges requires a comprehensive approach from policymakers. Streamlining bureaucratic procedures, ensuring timely payment settlements, and revising contract structures to include stronger incentives and enforcement clauses are critical steps. Additionally, establishing a fair price negotiation process is essential to balance power between producers and canneries. Prioritizing these reforms will help build trust-based relationships within the supply chain, fostering a stable and efficient industrial tomato sector that supports Algeria's food security objectives. Reducing reliance on TCT imports and enhancing domestic production capabilities are pivotal for mitigating the country's vulnerability to external factors.

Concluding Remarks

The analysis of Algeria's industrial tomato sector reveals significant challenges and complexities that need urgent attention. The sector faces severe concentration in the processing segment, as evidenced by a rising concentration index, which threatens to monopolize the market and marginalize smaller players. This concentration not only limits competition but also weakens overall sector performance, necessitating policy interventions to foster a more competitive environment.

On the production side, the declining number of tomato producing farmers and their disengagement from production contracts pose critical threats to the sector's stability. The reduced attractiveness of industrial tomato farming has led to supply shortages for processing firms, pushing them towards importing Tomato Concentrate and Tomato Paste (TCT). This trend exacerbates Algeria's vulnerability to external

market fluctuations, highlighting a crucial food security issue that needs to be addressed through farmer incentives and support mechanisms.

The vertical relationships between producers and canneries are deteriorating, raising questions about the effectiveness of current regulatory and contractual frameworks. Issues such as slow payment processes, simplistic contract clauses, and the absence of negotiated prices are contributing to farmer disengagement and sector inefficiencies. Addressing these issues requires comprehensive reforms, including the incorporation of stronger incentive structures and enforcement clauses within contracts and ensuring a fair price negotiation process.

Policymakers must prioritize the regulation of the industrial tomato sector to enhance its sustainability and resilience. Streamlining bureaucratic procedures, ensuring timely payments, and revising contract structures are essential steps. By fostering a more balanced and fair relationship between producers and canneries, Algeria can reduce its reliance on imports and strengthen its food security. Ultimately, a robust and sustainable industrial tomato sector is vital for meeting the country's consumption needs and achieving long-term economic stability.

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Challenges and Innovations in Pest Management for the Algerian Tomato Sector

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"This presentation highlights the crucial role of pest management for the Algerian tomato context, while also addressing the significant challenges it faces. These challenges include quality control issues due to pests and diseases, inadequate infrastructure, and pesticide residue problems. It emphasizes the need for coordinated efforts from value chain stakeholders to improve infrastructure, adopt sustainable farming practices, enhance market linkages, and invest in research and development."

Introduction

Tomatoes (*Solanum lycopersicum* L.), originating from Peru and first domesticated in Mexico, are classified into cultivated and wild types. Fresh tomatoes are grown either in open fields (determinate varieties) or under greenhouses (indeterminate varieties), while tomatoes for processing are exclusively cultivated in open fields. Globally, tomatoes are the second most utilized vegetable, following potatoes. World per capita consumption of tomatoes is on the rise due to the increased demand for processed tomato products, enhanced trade, urbanization, and population growth. In 2020, Turkey and Tunisia had the highest per capita consumption, with over 100 kg per person per year, while Algeria ranked 26th with 36.91 kg per person per year, according to FAO statistics.

However, agricultural producers face significant challenges as their earnings often do not keep pace with rising operational costs. This issue is compounded by labor shortages and decreasing availability of water and arable land due to urban expansion. Additionally, globalization has led to the rapid spread of various pests and diseases through increased global trade and tourism. As a result, scientists are tasked with developing solutions to combat these complex problems and safeguard tomato cultivation against these growing threats.

Tomato Production and Importance in Algeria

In Algeria, tomato production has also seen significant growth. In 2022, Algeria was the 14th largest tomato producer globally and the third highest in Africa,

with a total production of 1,661,664 tons across over 25,000 hectares of open fields, achieving an average yield of 66 t/ha. Northern and western provinces like Skikda, El-Tarf, and Guelma are leading in open-field tomato production, with Biskra province showing high yields under plastic covered areas. Southern provinces such as Adrar and Ouargla are emerging as new production areas.

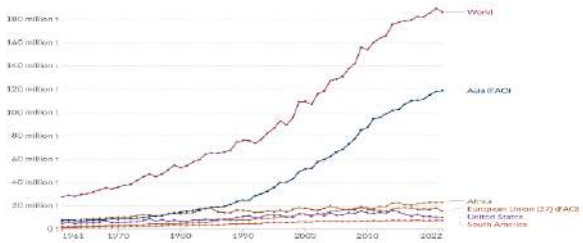


Fig 1. Tomato production (in tons) evolution between 1961 and 2022 (FAO, 2023)

Algeria grows various tomato varieties, including Panekra and Valouro in greenhouses and Zéralda and Halida in open fields, with industrial varieties like Rio Grande and hybrids such as Aicha and Fehla also prominent.

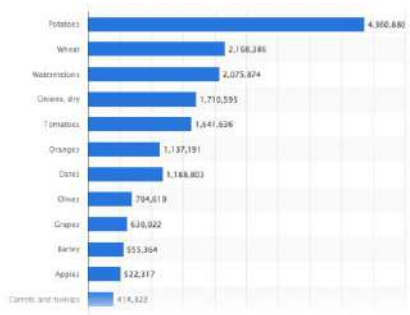


Fig 2. Production of agricultural crops in Algeria in 2021, by product (in metric tons) (Statista, 2024)

Challenges of the Tomato Sector in Algeria

The tomato sector can be defined as the set of economic activities involved in the value chain of tomatoes, from initial production to final consumption and encompasses agricultural, industrial, logistical, and commercial aspects related to this specific crop. In Algeria, the tomato sector is particularly important due to the high national demand for this staple product as well as its export potential. However, the tomato sector in Algeria faces several types and levels of interconnected challenges, including:

Production Efficiency: Inconsistent and inefficient production methods often result in lower yields. Factors such as inadequate irrigation systems, limited access to quality seeds, and poor farming practices contribute to this challenge.

Quality Control: Maintaining consistent quality standards throughout the production and supply chain is a significant challenge. Issues such as pest infestations, diseases, and poor handling practices can affect the quality of tomatoes, leading to market rejection or lower prices.

Infrastructure: Inadequate infrastructure, including transportation and storage facilities, hampers the timely delivery of tomatoes to markets. Poor roads and insufficient cold storage facilities can result in post-harvest losses and decreased profitability for farmers.

Market Access: Limited market access and distribution channels often restrict the reach of tomato farmers, particularly those in rural areas. Lack of proper market linkages and price information exacerbate this challenge, leading to lower returns for farmers.

Policy and Regulation: Inconsistent or unclear policies and regulations related to tomato production, trade, and pricing can create uncertainty for farmers and hinder investment in the sector. Streamlining regulatory processes and ensuring fair market practices are essential for fostering growth and competitiveness.

Climate Change: Erratic weather patterns, including droughts, floods, and temperature fluctuations, pose a significant threat to tomato cultivation. Climate change impacts can disrupt production schedules, increase pest and disease pressure, and reduce overall crop yields.

Moreover, in quality *control challenge,* issues such as *pest infestations and diseases* can also pose others significant challenges and problems for several reasons:

Crop Losses: Pest infestations and diseases can lead to significant losses in tomato yields. Pests such as aphids, whiteflies, and tomato fruitworms, as well as diseases like bacterial wilt, tomato yellow leaf curl virus, and powdery mildew, can damage tomato plants, reduce fruit quality, and ultimately result in lower yields.

Increased Production Costs: Controlling pest infestations and diseases often requires the use of pesticides, fungicides, and other control measures. These inputs increase production costs for tomato growers, potentially reducing their profitability.

Quality Issues: Infestations and diseases can affect the quality of tomatoes, leading to lower market prices or rejection of produce by buyers. Consumers may also avoid tomatoes that show signs of pest damage or disease, impacting market demand.

Environmental Concerns: Excessive use of chemical pesticides and fungicides to control pests and diseases can have negative environmental impacts, such as soil and water contamination, harm to non-target organisms, and pesticide resistance in pest populations.

Trade Barriers: Pest infestations and diseases can trigger phytosanitary regulations and trade restrictions in export markets. If Algerian tomatoes are found to be contaminated with pests or diseases, it could lead to trade disruptions or bans, limiting market access and export opportunities.

Risk of Spread: Pests and diseases can spread rapidly within and between tomato fields, posing a risk to neighboring farms and regions. Effective pest and disease management strategies are essential to prevent outbreaks and limit the spread of infestations.

Furthermore, contaminated tomatoes with pesticide residues can also be a challenge for the Algerian tomato sector, and this challenge falls under the category of "Quality and Regulatory Compliance." That can have more issues such:

Quality Issues: Pesticide residues on tomatoes can compromise their quality and safety for consumers. Excessive pesticide residues may lead to concerns about food safety and health risks, resulting in consumer distrust and reduced demand for tomatoes.

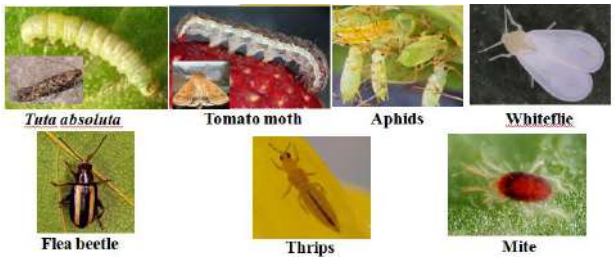
Conformity to Regulations: Algerian tomatoes intended for export must comply with national and international regulations regarding maximum residue limits (MRLs) for pesticides. Failure to meet these regulatory standards can result in rejected shipments, trade disruptions, and loss of market access.

Pest Infestations and Diseases Issues

The primary objective of this study is to identify and prioritize the major bio aggressors affecting tomato crops in Algeria by analyzing the active substances (ASs) of pesticides used against these pests. Data from the Algerian index of phytosanitary products, the Pesticide Properties Database, the Bio-Pesticides Database, and the EPPO-Global Database were utilized for this purpose. Among the insects and mites, Tuta absoluta (tomato leafminer) is the most significant pest, with 11 ASs authorized for its control. Other major pests include whiteflies (8 ASs), cutworms (6 ASs), mites (3 ASs), and aphids, thrips, and flea beetles (1 AS each). Tuta absoluta, originating from South America, can cause devastating yield losses of up to 100% and was first observed in Algeria in 2008. Its impact varies by tomato cultivar, with some varieties like 'Sahara' suffering significant losses while others like 'Dawson' are less affected.

Tomato crops in Algeria are also vulnerable to 12 significant diseases, with late blight being the most severe, requiring 15 ASs for control. Other notable diseases include early blight (10 ASs), powdery mildew (8 ASs), and Botrytis and anthracnose (4 ASs each). These diseases are caused by various pathogens from different kingdoms and divisions, posing a complex challenge to tomato cultivation. The use of fungicides includes 25 authorized ASs, with copper-based compounds and synthetic organic chemicals being prominent. However, six of these substances are banned in the European Community, highlighting regulatory discrepancies.

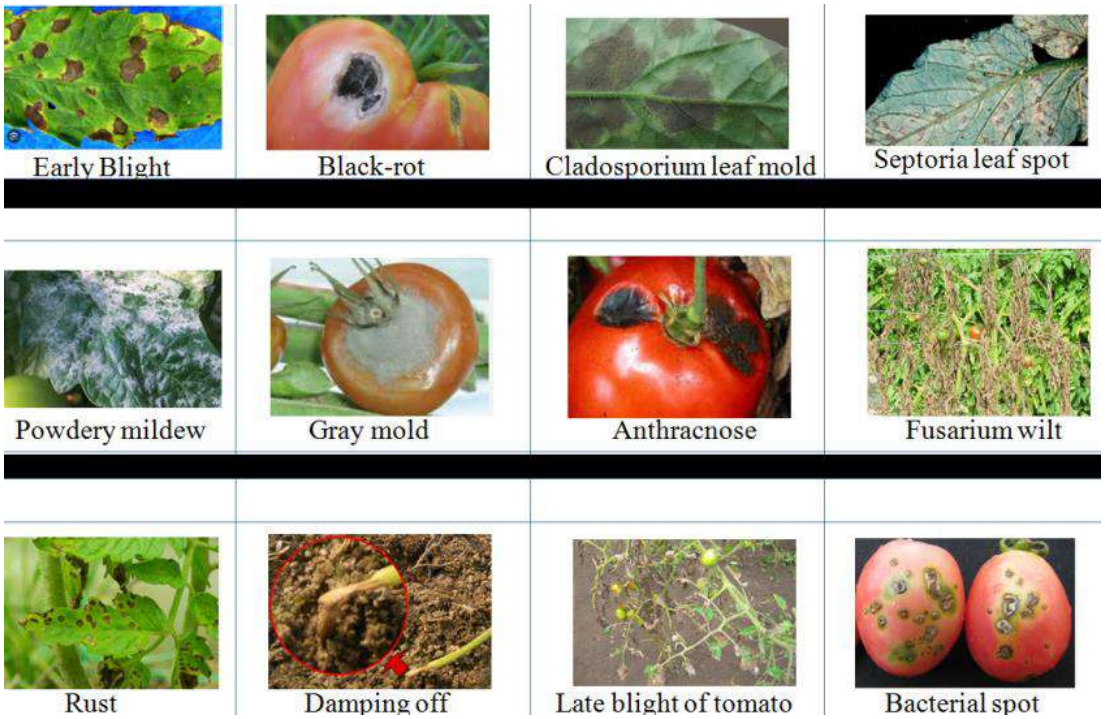
In terms of pesticides, 21 active substances from 10 synthetic organic chemical groups and one mineral group are recommended for controlling insect pests in tomatoes. Pyrethrinoids, neonicotinoids, and avermectins are the most significant, with abamectin being the most common in commercial formulations. However, seven of these substances are banned in the European Community, indicating regulatory differences. Fungicides for tomatoes include 25 authorized ASs, predominantly organic compounds from 11 chemical groups and copper-based mineral compounds. Copper oxychloride based formulations are the most common, followed by mancozeb.



The main pests of tomatoes

Limited research in Algeria has focused on detecting pesticide residues in tomatoes. Studies have found residues of insecticides such as chlorpyrifos-ethyl, fenitrothion, and methomyl, and fungicides like metalaxyl and difenoconazole. While most residue levels were below the Maximum Residue Limits (MRLs) established by the Codex Alimentarius, exceptions like metalaxyl often exceeded these limits.

Comparative studies in countries like Turkey revealed similar concerns, with residues primarily from organophosphates, organochlorines, neonicotinoids, and pyrethrinoids. These findings underscore the need for improved pesticide management and compliance with international safety standards to ensure the quality and safety of Algerian tomatoes.



The main tomato diseases

Innovations in Tomato Pest Management

Integrated pest and disease management in tomato cultivation combines agronomy, genetics, biology, and chemicals to reduce the vulnerability of agroecosystems. Effective management strategies require a deep understanding of pest biology, interactions with plants, predators, and microorganisms. For instance, controlling Tuta absoluta involves developing local biopesticides from plant extracts, microorganisms, and natural enemies. In Biskra, where T. absoluta has persisted for 12 years, researchers have identified 37 native natural enemies, suggesting the potential for locally adapted biocontrol solutions.

Disease management in tomatoes focuses on early detection, understanding disease distribution and spread, and recognizing symptoms. Biostimulants are emerging as crucial tools, enhancing plant resistance to infections. For example, combating late blight,

caused by Phytophthora infestans, requires a multifaceted approach due to the pathogen's rapid infection rate and complex epidemiology. Traditional antibiosis methods are insufficient, necessitating a combination of compounds and microorganisms with different action modes. Strategies include using nutrient rich formulations for biocontrol agents, cultural practices to support antagonists, and activating plant resistance, tailored to disease susceptibility and environmental conditions.

Innovative strategies for managing pests and diseases in tomatoes also emphasize the development of biocontrol agents targeting pathogens' survival structures, especially in areas where sexual reproduction occurs. These approaches, integrating various management methods and focusing on local conditions and pathogen biology, aim to create sustainable, resilient, and environmentally friendly pest and disease control systems. Customizing treatments based on specific environmental factors and disease dynamics is essential for enhancing the effectiveness of integrated pest and disease management in tomato cultivation.

Conclusions

To effectively address the challenges facing Algeria's tomato sector, coordinated efforts from government institutions, agricultural organizations, and stakeholders are essential. Key strategies include improving infrastructure, promoting sustainable farming practices, enhancing market linkages, and supporting research and development. These measures will strengthen the resilience and competitiveness of Algeria's tomato industry, helping to overcome inefficiencies and quality control issues, ultimately increasing yields and profitability for farmers.

Pest infestations, diseases, and pesticide residues present significant challenges that impact production, profitability, quality, market access, and environmental sustainability. Implementing integrated pest management (IPM) practices, promoting disease-resistant tomato varieties, and investing in research and extension services are critical to mitigating these issues and ensuring the long-term viability of the industry. Additionally, strict pesticide management practices and the promotion of organic farming can reduce reliance on chemical pesticides, minimizing residues on tomatoes and enhancing their overall safety and marketability. Through these combined efforts, Algeria can improve the sustainability and success of its tomato sector both domestically and internationally.

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Round Table discussions with socioeconomic partners on

Challenges of Sustainability in Algerian Agriculture

The third conference session culminated in a dynamic round table discussion, moderated by Amine M. Benmehaia from the University of Biskra and Haoua Amrouni from the National Institute of Agronomic Research of Algeria (INRAA). This interactive segment featured five key socioeconomic actors from the Biskra region, each bringing unique perspectives and experiences from various points along the food value chain. The round table provided a platform for practical, ground-level insights into the challenges and opportunities faced by the food value chains in Algeria.

As part of the objectives of the GourMed Project, direct engagement with key actors in agri-food chains is essential for enhancing and enriching the search for innovative solutions. This round table session was designed to facilitate such engagement, bringing together five key actors from the food value chains in Algeria. Their diverse experiences and insights were crucial for fostering a comprehensive understanding of the challenges and opportunities within the sector.

The distinguished participants in the round table included:

Abdelbasset Djellab: A farmer and President of the Association of Geographical Indication of Dates in Biskra, who provided insights into the significance of geographical indications and their impact on market positioning and quality assurance.

Mabrouk Hathat: A farmer and large-scale producer of organic tomatoes and dates, who shared his experiences and the benefits of organic farming practices.

Nadine Tahraoui: A delegate of the Industrial Complex of Tahraoui Group, representing the industrial processing perspective and the importance of integrating processing capabilities with agricultural production.

Mohamed Aziez: A large-scale tomato grower, who discussed the logistical and operational challenges of maintaining high production volumes.

Elhasna Rouina: A farmer and delegate of the Association of Organic Dates in Biskra, who emphasized the growing market for organic produce and the standards required to meet consumer expectations.

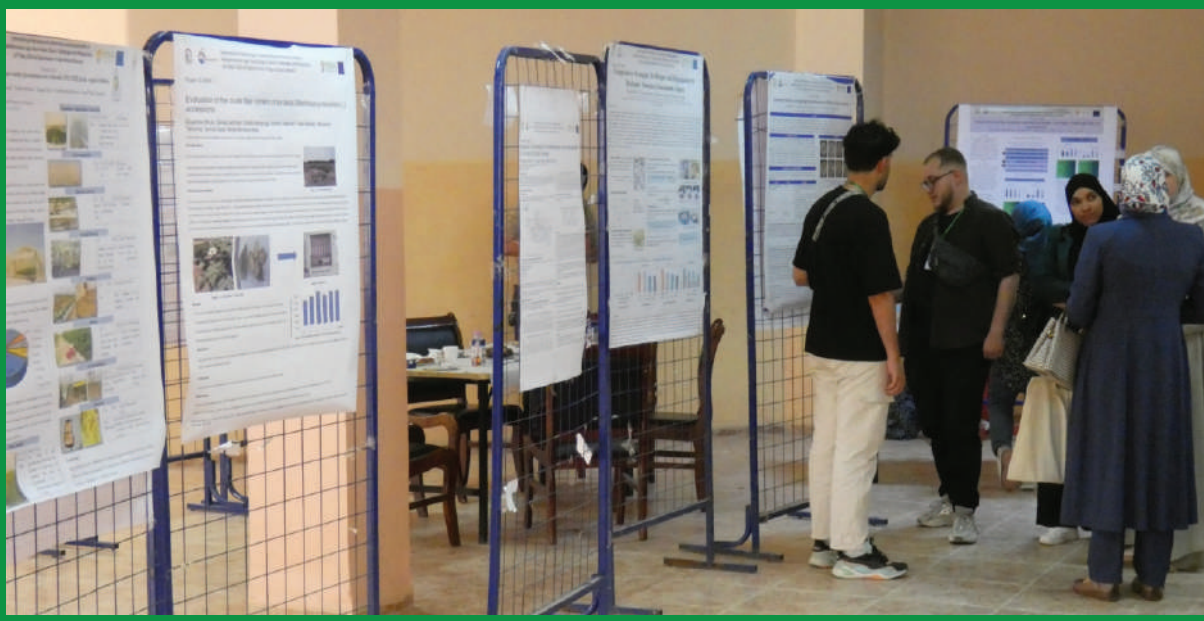
The session began with each actor introducing themselves and their respective roles within the agri-food value chain. This was followed by an interactive discussion with Dr. Georgia Ayfantopoulou, who engaged the participants with targeted questions to elucidate various aspects of Algerian agriculture. Dr. Ayfantopoulou's inquiries covered a range of topics, from the impact of geographical indications on market access to the operational challenges faced by large-scale producers.

Throughout the round table, attendees benefited from the lively debates and the sharing of practical experiences. The discussions provided a deeper understanding of the obstacles and challenges specific to the Algerian context. Participants also explored potential solutions, including the adoption of innovative farming practices, the importance of organic certification, and the integration of value-added processing within the supply chain.

Overall, the round table session was a key component of the workshop, offering a platform for direct dialogue between researchers, industry practitioners, and policymakers. This interaction not only enriched the debates but also contributed to the collective goal of identifying sustainable and innovative solutions for the agri-food sector in the Mediterranean region.

Poster Session for Young Researchers' Presentations

Aspects of Sustainability in the Mediterranean Agriculture



The final segment of the workshop was the poster session under the careful moderation of the scientific subcommittee. This session was a highlight of the event, featuring a total of 28 posters that presented a diverse array of research topics and innovative solutions relevant to the governance and sustainability of Mediterranean agri-food value chains. The poster session was designed to facilitate an interactive and engaging environment, encouraging knowledge exchange and fostering collaborative discussions among participants. Each poster represented a unique piece of research, ranging from theoretical studies to practical applications in the field. Topics covered included advancements in sustainable agricultural practices, innovative technologies for improving crop yields, socio-economic analyses of food value chains, and case studies on specific agricultural sectors within the Mediterranean region. The breadth of topics ensured that there was something of interest for every attendee, whether they were academics, policymakers, industry professionals, or students.

The posters were displayed in a dedicated area, allowing attendees to circulate and engage directly with the researchers. This format provided an excellent opportunity for in-depth discussions and personalized feedback. Researchers were on hand to explain their findings, answer questions, and discuss potential implications and applications of their work. This interaction not only enriched the attendees' understanding of the presented topics but also provided valuable insights and suggestions to the researchers for further refinement of their studies.

To enhance the academic rigor and ensure a high standard of quality, each poster was evaluated by a panel of experts from the scientific subcommittee. The evaluation criteria included the originality of the research, the clarity and quality of the presentation, and the relevance and potential impact of the findings. This evaluative process was not merely a formality; it stimulated constructive feedback and encouraged presenters to articulate their research effectively and professionally.

INTERNATIONAL WORKSHOP ON
GOVERNANCE AND SUSTAINABILITY IN MEDITERRANEAN AGRI-FOOD VALUE CHAINS: CHALLENGES AND PERSPECTIVES

POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

The Dynamics of Cereal Farming in Ziban: Situation, Constraints and Producers Strategies

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Abstract.

In Biskra region, cereal farming has undergone very significant development; and profound changes over the last two decades. In this study, we will try to present the main results obtained from a study based on a bibliographic reading on the research theme and especially on the analysis of data from a survey with certain actors in the sector in the Biskra region on the situation, threats and strategy of farmers in this arid region. We will also present the necessary recommendations to promote this crop in the region. Among the results obtained from the study, cereal farming has experienced a very significant trajectory of evolution; it has strengthened its place in the agricultural production system of the region which has also undergone a profound change over the last two decades. However, these results also remain insufficient compared to the means put in place to make this sector successful. The situation can be explained by the combination of a series of constraints at several levels, which are technical, economic, social and natural. Farmers in the region use different strategies at different levels for better management of water resources, the development of varieties and the development of appropriate cultivation techniques. In order to develop cereal farming in these regions it is necessary to promote existing know how and associate and involve the populations concerned to deal with these constraints but also through the introduction of technical progress.

Keywords: Cereal farming · performances · constraints · development · Ziban · Algeria

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POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Geographical Indication as a Tool to Promote Local Products: Case of Date Deglet Nour Tolga, Algeria

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Abstract.

In Algeria, local products and their valorization are of significant importance in consumption. They are considered as a genuine tool for sustainable development. Public authorities are moving towards the promotion of these products in order to differentiate on competitive markets. The aim of this study is to examine the example of the date Deglet Nour Tolga which is classified as a local product and benefited from a sign of quality related to the origin (geographical indicator), and is the geographical indicator an effective way to promote local products. The first step is to determine the component of the Tolga terroir, namely soil, water by laboratory analyses. Moreover, demonstrate the specificity of the date Deglet Nour de Tolga through a comparative study in the laboratory, namely morphological and physicochemical between dates obtained from different regions of production of Deglet Nour (Tolga, El Ghrous, Sidi Okba, El Oued Ouargla and Tunisia). The main results confirm that the terroir of Tolga is the excellent space for the production of the date Deglet Nour, and that the date Deglet Nour of the region of Tolga and El-Ghrous have specific characteristics compared to the Deglet Nour dates of other regions. Main findings confirm that dates quality is the result of the interaction between several ecological and human factors that attribute the originality and typicity of this product.

Keywords: Deglet Nour · terroir product · geographical indication · Tolga · Algeria

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Assessing the Sustainability of Olive Farms in the Djelfa Region

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Abstract.

Ensuring the sustainability of our farms is not just necessary but imperative. Assessing farm sustainability presents both a scientific challenge and a crucial step towards sustainable development. This study uses the Farm Sustainability Indicators (IDEA) method to evaluate the sustainability of olive farms newly established through public policies since the 2000s in the Wilaya of Djelfa, Algeria. The IDEA method evaluates farm sustainability based on 42 indicators encompassing three dimensions: agroecological, socio-territorial, and economic scales. Surveys were conducted on 30 olive farms in the study region to analyze their sustainability across these dimensions, identifying practices that limit overall sustainability. The main results reveal a consistent trend across all farms: they exhibit strong economic sustainability, with an average score of 69 out of 100, moderate agroecological sustainability with an average score of 56 out of 100, and low socio-territorial sustainability with an average score of 31 out of 100. Farms incorporating livestock showed better sustainability outcomes compared to those without livestock. Farms with livestock scored 62 for the agroecological dimension, 37 for the socio territorial dimension, and 71 for the economic dimension, while farms without livestock scored 51, 27, and 68 respectively. These findings highlight the importance of diversifying farm activities to enhance sustainability.

Keywords: Sustainability · olive farms · economic and socio-territorial scale, agroecological scale · IDEA

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Contribution to the Creation of Multi-Stakeholder Dialogue Platforms and Capacity Building for the Date Value Chain in Biskra, Algeria

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Abstract.

In Algeria, the date value chain (DVC) holds a strategic and multifaceted role in the agricultural economy, particularly in the Saharan regions, due to its significant economic, ecological, and social impact. Despite its considerable production potential and the efforts of public authorities to modernize this sector, the DVC faces numerous challenges that hinder its sustainable development. A critical constraint is the absence of a dedicated trade organization, which stifles any efforts to rejuvenate or revitalize the sector. Addressing this issue is essential for improving the date DVC, necessitating the modernization of professional organizations within the industry. Our initiative, part of the Supporting Programme to the Agricultural Sector, including water management, agro-industry, and agricultural pollution (PASA-pôle Sud), aims to empower DVC stakeholders by providing a robust tool to enhance their capacity to create, manage, and plan actions and projects within professional organizations. This support process unfolds in three distinct stages: identification and diagnostic, planning, and structuring. The identification and diagnostic stage involves a comprehensive analysis of stakeholders, focusing on their identification, characterization, and an assessment of their interest and influence, which enables us to propose the main stakeholders for the future platform. The planning stage sets out a long-term, medium-term, and short-term vision, detailing proposed actions, identifying collaborative projects, and developing a business plan. During this phase, platform members receive training in project management, business plan development, and associative governance. The structuring stage involves determining the appropriate legal status and organizing the constituent general meeting. By adopting a methodical and well-founded approach to creating these dialogue platforms, we aim to contribute effectively to the development of a well-structured, well-organized, and sustainable date value chain. This vision, developed collaboratively by the actors of the dialogue platform DVC of Biskra, represents our practical field intervention's long-term objective, ensuring the sustainable advancement of the date sector in Algeria.

Keywords: Date value chain · dialogue platforms · professional organizations · sustainability · Algeria

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POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Date Palm Farms in the Oued-Righ Valley (South-East Algeria) in Search of Sustainability: Assessment Using the IDEA Method

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Abstract.

This study, conducted as part of the national research program, aims to assess the sustainability of date palm farms in the Oued Righ valley, an essential segment in the agri food value chain. The Farm Sustainability Indicators (IDEA) method was utilized to evaluate agricultural production sustainability. Nineteen farmers, who consented to evaluate their farms, were surveyed using a detailed questionnaire. The results indicated that only five farms achieved scores above 50 points out of 100 across the three sustainability scales: agro-ecological, socio territorial, and economic. The agro ecological and economic scales showed scores above average for a significant portion of the sample, highlighting that these farms' agro-ecological and economic practices significantly contribute to their sustainability. In contrast, the socio-territorial scale, particularly the components "quality of products and territories, ethics, and human development," emerged as a limiting factor for the sustainability of these farms. This study underscores the need for targeted improvements in the socio territorial aspects to enhance overall sustainability in the date palm farms of the Oued-Righ valley.

Keywords: Sustainability · IDEA · development · date palm farms · Oued-Righ · Algeria

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Determining Environmental Sustainability in the Context of Climate Change: A Case Study of Drought in Ain Defla, Algeria

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Abstract.

Drought, a critical aspect of climate change, poses a significant challenge, particularly in regions reliant on rain fed agriculture. This study aims to identify and analyze the most drought prone areas in Ain Defla, Algeria, both temporally and spatially, to determine strategies for achieving environmental sustainability. The standardized precipitation index (SPI) was calculated annually over 38 years for 13 stations in the Ain Defla region. Geographic Information System (GIS) technology was utilized to cr eate digital maps showing the spatial distribution of precipitation, rainfall variation, and the aridity field based on SPI values. The Kriging statistical method was employed to ensure precise spatial analysis. Ain Defla region experienced droughts of varying intensity and impact in the years 1983, 1989, and 2000, with a gradient of decreasing severity from east to west. Conversely, some years, such as 2013 and 2018, were notably wet. The majority of the years, approximately 60%, fell into the moderate drought category. The study indicates that the western regions of Ain Defla are more suitable for rain-fed agriculture, being less susceptible to drought during the study period compared to the eastern regions, which experienced persistent drought conditions. This differentiation suggests that strategic agricultural planning and resource management are crucial for enhancing environmental sustainability in the region.

Keywords: Drought · meteorology · SPI · Kriging · GIS · Aïn Defla · Algeria

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POSTER COMMUNICATION

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Valorization of Low-Quality Commercial Dates: Turning a Challenge into an Opportunity

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Abstract.

This study focuses on valorization of low-grade dates by preparing date molasses from four downgraded quality cultivars: Tantboucht, Tinicine, Rejects of Deglet Nour, and Mech Degla. These molasses, widely used in the food industry, were extracted to maximize yield while preserving the nutritional qualities of the raw material. To achieve our goals, we extracted molasses from the four date palm cultivars and conducted comprehensive physicochemical and phytochemical analyses. The physicochemical analyses included measuring total sugars and hydroxymethylfurfural (HMF) content, while the phytochemical analyses involved quantifying polyphenols and flavonoids. Also, a comparative characterization of the molasses samples is performed and conducted a sensory evaluation to assess their organoleptic properties. Key findings from the study are as follows: Total sugar content of the molasses ranged between 50% and 73% across all cultivars, with no significant differences detected among them. This indicates a consistent level of sweetness irrespective of the date variety used. The ANOVA analysis revealed that the molasses from the Tantboucht cultivar had a significantly higher HMF content compared to the other cultivars. In contrast, the molasses from Mech Degla and Deglet Nour contained relatively low HMF levels, suggesting varying degrees of thermal processing or storage conditions. The highest concentrations of the Polyphenols and Flavonoids compounds were found in the molasses from the Tinicine and Tantboucht varieties. Deglet Nour and Mech Degla molasses followed, with slightly lower levels. These findings highlight the antioxidant potential and health benefits associated with the different molasses types. The sensory evaluation revealed that tasters significantly preferred the molasses from the Mech Degla cultivar. It was noted for its smooth texture, medium viscosity, and exceptional brightness, making it more appealing to consumers. The results of this study highlight the successful valorization of downgraded date varieties. The molasses produced not only met the nutritional quality standards but also possessed favorable organoleptic properties. The high content of phenolic compounds and flavonoids in the molasses underscores its potential as a health-promoting food product. This research supports the sustainable use of lower-grade dates in the food industry, offering a nutritious and appealing option for consumers.

Keywords: Low-grade dates, valorization, date molasses, physicochemical characterization, phytochemical analyses, organoleptic properties

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POSTER COMMUNICATION

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The Olive Value Chain in Djelfa: Situation and Constraints

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Abstract.

This study aims to understand the situation of the olive value chain in arid zone (the region of Djelfa) through the analysis of some technico-economic indicators. The analysis is based first on the results of field surveys with particular actors in the chain, mainly olive growers and agroindustrial processors in two communalities of Birine and Benhar in Djelfa from 2018 to 2020, then, a strategic analysis of the organizational model including the microeconomic vision of the different links in the sector. The main results reveal that olive sector has experienced very significant growth, and it shows interesting technical and economic performances from an economic point of view, in particular through the extension of the areas and volumes of olive and olive oil production. It is economically efficient also through the benefits derived from concrete action systems for olive production. From a technical point of view, the analysis showed that apart from the size of the farms, there are no significant differences between the sampled olive producers in studied area, essentially in the technical route applied for this crop. However, it remains insufficient in its operation and it does not manage to exploit all the opportunities available both upstream and downstream.

Keywords: Value chain · olive growing · industries · valorization · opportunities · Djelfa

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POSTER COMMUNICATION

UNIVERSITY OF BISKRA 14/05/2024

Role of Rural Women on the Valorization of Date Products in the Ziban Region (Southeast Algeria)

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Abstract.

This study aims to examine the crucial role of women in ensuring the economic viability of the date value chain in the Oasis zone of Biskra, Algeria. Utilizing a comprehensive research approach, the study involved administering a detailed questionnaire within the local community and collecting data from four canning and processing factories. The foremost finding revealed that women constitute 70 to 80% of the workforce, highlighting their dominant presence in the date chain. The questionnaire main results further demonstrated that women are primarily responsible for traditional tasks such as sorting and cleaning dates, producing date flour, syrup, and juice, and managing the loading of date Khabias and Betanas. These findings underscore the high-level involvement of women in the date value chain, emphasizing their substantial contribution to the sector's economic viability. The study suggests that recognizing and supporting the roles of women in this industry could lead to significant improvements in productivity and sustainability. It implies that implementing targeted policies and initiatives to empower women and enhance their working conditions could substantially benefit the overall growth and development of the date value chain in Algeria and similar regions, promoting a more inclusive and sustainable agricultural economy.

Keywords: Rural women · labor force · product valuation · dates · Ziban · Algeria

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GOVERNANCE AND SUSTAINABILITY IN MEDITERRANEAN AGRI-FOOD VALUE CHAINS: CHALLENGES AND PERSPECTIVES

POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Assessing Environmental Sustainability through Supplementary Irrigation in Northern and Southern Algeria

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Abstract.

Cereals are a cornerstone of Algeria's economic, social, and agricultural sectors, playing a vital role in the national diet and economy. From 2000 to 2012, cereal cultivation covered approximately 40% of the agricultural area annually, equating to around 3.2 million hectares. Durum wheat and barley dominate this cultivation, representing about 74% of the total cereal area. Water, essential for plant growth, significantly influences cereals' growth and production. This study evaluates cereal water requirements using the Cropwat 8.0 program, incorporating climate data and agricultural statistics from 30 regions across Algeria. The study found that water consumption during cereal cultivation averaged 615.14 mm per hectare, comprising adequate rainfall (about 237 mm) and irrigation water (approximately 378.01 mm) per hectare. Supplementary irrigation needs varied significantly from north to south, with the northern regions requiring as little as 186.5 mm, while the southern regions necessitated up to 1209 mm. The increased water consumption in the south is attributed to higher atmospheric demand (ETM) and challenges in meeting national yield standards. The substantial water needs in the southern regions underscore the significant depletion of water resources due to agricultural dependence, posing a challenge to environmental sustainability. These findings highlight the critical need for strategic water management and sustainable agricultural practices to ensure the long-term viability of cereal cultivation in Algeria.

Keywords: ETM · cereal · Cropwat · irrigation · rainfall · sustainability · Algeria

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GOVERNANCE AND SUSTAINABILITY IN MEDITERRANEAN AGRI-FOOD VALUE CHAINS: CHALLENGES AND PERSPECTIVES

POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Date Palm Density Prominence and Benefits in Protecting Arid Microclimates

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Abstract.

Date palms (*Phoenix dactylifera*) play a significant ecological role in arid environments, particularly through their influence on the microclimate. This study explores the importance and benefits of date palm density in protecting and enhancing the arid microclimate. Using simulation software of field measurements and ecological modeling, we assess how variations in date palm density affect local temperature regulation, humidity control, and sand stabilization. Our findings indicate that higher densities of date palms are associated with more substantial improvements in microclimatic conditions. This study aims to determine the optimal density of date palm (*Phoenix dactylifera* L.) with the use of computer simulation for Deglet Nour cultivar. The results have confirmed in very accurate computer models, which show the best distance between the trees of palm groves (8*12), or 96 trees/ha, for a modern plantation ensuring an ecological balance with a high yield. Also, we have seen the distance 9m between the palm trees, formed a palm plantation of 121 trees/ ha, which guarantee the largest number of palm trees, on the other hand we lose the help of modern machines in the pollination and harvesting

Keywords: Date palm · density · arid microclimate · ecological modeling · Saharan agriculture · Algeria

INTERNATIONAL WORKSHOP ON
GOVERNANCE AND SUSTAINABILITY IN MEDITERRANEAN AGRI-FOOD VALUE CHAINS: CHALLENGES AND PERSPECTIVES

POSTER COMMUNICATION

UNIVERSITY OF BISKRA 14/05/2024

Investigating the Genetic Potential of Local Camel Breeds for Sustainable Camel Milk Production in Algeria

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Absract.

The present study investigates the genetic potential of local camel breeds for sustainable camel milk production and value chain enhancement under local Algerian breeding conditions. The research focuses on milk production, lactation curve, and fat and protein content in Sahraoui breed she-camels from southeastern Algeria, comparing two breeding systems: semi intensive and intensive. Thirteen Sahraoui she camels were included in the study, with six in the semi-intensive system and seven in the intensive system. Milk recording and sampling were conducted regularly throughout a complete lactation period. The lactation curve was estimated using Wood's gamma function, and statistical tests compared lactation performance, curve characteristics, and reproductive parameters between the two systems. Results showed an average daily milk yield (DMY) of 6.77±0.82 kg/day, with fat (DFY) and protein (DPY) concentrations of 4.15±0.91% and 4.49±0.20%, respectively. The total milk yield (TMY) averaged 2696.39±343.86 kg over a lactation length (LL) of 398.38±20.65 days, with peak milk production of 6.79±0.68 kg occurring around 93.9±55.8 days post-calving. The open day (DO) and inter-calving interval (ICI) were 348.38±30.33 days and 723.38±30.33 days, respectively. No significant differences were observed between the intensive and semi-intensive systems for TMY, DMY, and LL. However, the intensive system had a significantly higher total fat content (182.02±33.91 kg), while the semi-intensive system had a significantly higher protein content (4.60±0.13%). The lactation, fat, and protein curves showed significant differences between the two systems, particularly regarding milk production curve parameters and time to peak yield. Coefficient of determination (R2) values varied between systems, with higher values for milk yield (0.62 and 0.35), fat (0.12 and 0.13), and protein (0.03 and 0.11) in the intensive and semi intensive systems, respectively. Although DO and ICI did not significantly differ between the two systems, they were higher in the intensive system. The intensive system demonstrated higher milk performance and a more efficient lactation curve. Enhancing female camel milk production through improved nutrition, healthcare, welfare, and breeding practices is crucial for ensuring the sustainability and value of the camel milk industry.

Keywords: Dairy camel · lactation curve · livestock system · milk composition

INTERNATIONAL WORKSHOP ON
GOVERNANCE AND SUSTAINABILITY IN MEDITERRANEAN AGRI-FOOD VALUE CHAINS: CHALLENGES AND PERSPECTIVES

POSTER COMMUNICATION

UNIVERSITY OF BISKRA 14/05/2024

Cooperative Strategies to Mitigate Soil Degradation in Drylands: Towards a Sustainable Future

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Abstract.

Soil degradation is a major issue, often exacerbated by poor agricultural practices, leading to reduced soil fertility and severe consequences for food production and ecosystem health. Degraded soils are typically characterized by significant nutrient loss. The use of amendments based on date palm waste, such as compost, is a simple and natural technique to improve soil structure and fertility. This study aims to evaluate the effects of various organic and chemical fertilizers (farmyard manure, palm-based compost, NPK mineral fertilizer) on the physical properties of soil, including moisture, density, porosity, and useful water reserve. The experiment was conducted in a greenhouse at the Department of Agronomic Sciences, University of Biskra. Results indicated that the application of date palm waste compost had the most positive impact on the soil's physical parameters, particularly enhancing soil water retention, porosity, and structure, which promotes good biological activity. This led to improved plant growth. While NPK mineral fertilizer also positively affected plant growth, its impact on the soil's physical properties was less significant compared to compost. Farmyard manure showed less significant results than both compost and NPK mineral fertilizer. In conclusion, compost made from date palm waste is a sustainable, economical, and environmentally friendly alternative for improving soil quality in arid regions, offering a viable solution to combat soil degradation and promote agricultural sustainability.

Keywords: Soil degradation · palm waste · fertility · physical parameters · arid zone · Algeria

INTERNATIONAL WORKSHOP ON
GOVERNANCE AND SUSTAINABILITY IN MEDITERRANEAN AGRI-FOOD VALUE CHAINS: CHALLENGES AND PERSPECTIVES

POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Assessment of Aridity Pressures on Livestock's Breeder in Biskra Province (Algeria)

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Abstract.

To meet the continued needs of the population (approximately 9.8 billion people by 2050 according to the United Nations in 2017), agricultural production must continue to grow by approximately 70% (Alexandratos & Bruisma, 2012). Unfortunately, the livestock industry plays a huge role for millions of people around the world. According to Dimon *et al*. (2022), it is negatively affected by climate change. To reduce climate stress, growers must adapt and invent smarter practices to survive. The aim of this study is to assess environmental pressures on livestock production in Biskra province, 400 km southeast of Algeria, using deterministic and probabilistic Inverse Distance Weighting (IDW) methods that enable spatial precipitation estimation. Satellite tracking results indicate extreme drought, especially in 2010 (SPI < 0). Frequent dry periods in the target area therefore affect spontaneous shrub production in pastures in the target area. To alleviate the situation of farmers, breeders have intensified production by producing irrigated feed, especially in Lucerne, using non renewable groundwater.

Keywords: Aridity · pressures · rangeland · livestock · Biskra · Algeria

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POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Using alternative biodegradation methods to stop the invasion of the Aleppo pine moth caterpillars *Thaumetopoea Pityocampa* Denis and Schiff. (lep., thaumetopoeidae) at Green Dam

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Abstract.
The marching caterpillar is a major pest of pine forests, which account for 63% of Algeria's forest area. In the 1990s, this pest caused huge damage to the Green Dam reforestation project. Significant investments have been made to save these reforestations through control methods such as the use of insecticide products or mechanical methods. This study mainly focuses on two aspects: the first aspect was conducted by El Khal et al. (2016) inspired and participated in the testing of biocontrol agents (essential oil insecticides) suitable for effective combat against this pest without causing harmful effects on flora and fauna. The second aspect is understanding the effectiveness of pheromone traps, flight dates and lifespan of adults. Essential oil was extracted from rosemary, a plant of the Lamiaceae family, using a Cléveinger-type water still. For the use of sex pheromones, we draw on the studies of Zamoum (1998) and Martin et al. Get inspired. (2013), we selected two locations: Setif and Bejaia. With essential oils, we apply these treatments directly to the trees, maintaining their lifestyle by taking into account internal and external conditions. These treatments are applied to third and fifth stage larvae. Pheromone traps showed interesting effects, with a 37% to 47% reduction in the number of nests per hectare. Flight duration varies from 45 to 60 days. We observed greater effectiveness of fungicides in the L3 stage compared to the L5 stage. We found that rosemary essential oil has very significant insecticidal activity in terms of sex pheromones, but only at sites with heavy insect infestations.

Keywords: Sex pheromone · essential oil · biodegradation · Green Dam · Algeria

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POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Effect of Innovative High Pressure and Low Temperature Process on the Shelf Life Preservation of Organic Cucurbitaceae: Case of Butternut Squash and Melon

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Abstract.

Consumers today seek convenient, visually appealing, great-tasting, nutritious, and fresh products, especially in the fresh-cut produce category. High-pressure processing (HPP) and modified atmosphere packaging (MAP) are key technologies used to extend the shelf life of these products, which are prone to spoilage and microbial contamination. This study aimed to validate and evaluate a prototype's effect on the microbiological characteristics of organic butternut squash and melon. Ready-to-eat fruits and vegetables were evaluated under different storage conditions for their physicochemical and microbiological parameters. The products were prepared using hurdle technology, which included pasteurization at high pressure and low temperature with 100% CO2. They were then packed under three MAP conditions: air, 100% CO2, and 100% CO2 treated at 45°C and 60 bar. The samples were stored for 3 to 21 days at 4°C. The study targeted several contamination indicators and found that the treatments effectively controlled microbial loads, including total aerobic mesophilic flora, Staphylococcus aureus, lactic acid bacteria, Clostridium sp., coliforms, Listeria monocytogenes, Streptococcus, E. coli, yeasts, molds, and Salmonella/Shigella. The findings showed that MAP-CO2 and HPMAP-CO2 effectively managed contamination in squash and melon, ensuring the superior quality and safety of the preserved products.

Keywords: modified atmosphere packaging · butternut squash · melon · high pressure · microbiological control · low temperature

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POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Landscape Composition Governs the Abundance Pattern of Eurasian Collared Dove Invasive in a Mediterranean Arid Agroecosystem

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Abstract.
Assessing the effects of landscape composition on invasive wildlife abundance patterns is crucial for effective biodiversity management planning and to ensure sustainability in its suitable environment. However, our understanding of the relationships between landscape components and bird abundance remains limited. Recognizing this knowledge gap, we adopted an urban–rural gradient approach to evaluate the relationships between the abundances of the invasive Eurasian collared dove and landscape composition. The goal was to identify the key landscape elements that explain the abundance patterns observed for this dove. Bird surveys were conducted by car during the peak of Columbidae breeding activity. In total, six transects were randomly selected in the Biskra region. counting 25 points were established per transect, with a distance of 500 m between each point. We determined landscape components along the urban-rural gradient using QGIS V3.4.2-Madeira software. All statistical analyzes were performed with R Development Core Team 2018. The results showed that the abundance of Eurasian collared doves is positively correlated with built-up coverage (t-value = 10.400). The GLMM analyses highlighted the factors significantly influencing the abundance of the Eurasian collared dove. Abundance was quadratically influenced by the number of wells, positively by built-up coverage and distance from the nearest track, and negatively by cereal coverage. In conclusion, Streptopelia decaocto demonstrates a strong preference for urban areas in the Oasis ecosystem.

Keywords: Eurasian collared dove · biodiversity management · sustainability · landscape components

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POSTER COMMUNICATION

UNIVERSITY OF BISKRA 14/05/2024

Effect of Compost and Biochar on Some Biometric Parameters of Dates at Various Development Stages

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Abstract.

This study focuses on the sustainability of agricultural production systems through the use of amendments based on date palm waste, namely biochar and compost, to improve the level of soil fertility in Algerian oases. The aim is to monitor the behavior of compost and biochar made from date palm by-products and the evaluation of their impact on overall soil fertility as well as on the quantitative and qualitative production of dates. We tested in the field different combinations of biochar and chemical fertilizers, compost and fertilizers as well as the biochar-compost combination at the ITDAS station of El-Hadjeb. This experimentation monitor some biometric criteria, namely number of fruits per spikelet, length, width, weight of dates and spikelet length, according to the Loulou, Khalal and Tmar stages of maturity. The main results show that the Biochar-manure treatment gives the best result for biometric parameters as well as for yield.

Keywords: Biochar · compost · date palm · fertilization · biometric parameters

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POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Observations on Cultural Techniques under Greenhouse over a Decade in the Region of Biskra

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Abstract.

The cultural practices can affect and help in managing a crop's growth. Along a ten year course of monitoring and field surveys, we have been able to report several observations and reforms made by the greenhouse farmers of the region of Biskra on both practical and farming techniques. Especially temperature and light manipulation, irrigation practices, plant density, mulching, trellising, pruning and pollination. Through 25 prospections and among 30 farmers spread over 8 localities in the region of Biskra: Mziraa, Zribet El Oued, Sidi Okba, Ain Naga, Garta, El Hadjeb, Tolga and El Ghrous. Most of visited farmers practice temperature manipulation however few practice light manipulation. During 2012 most visited farmers used traditional methods for irrigation however during 2020 and 2022 most visited farmers used drip irrigation.

Keywords: Cultural techniques · greenhouse · Biskra · Algeria

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POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Impact of Date Palm (*Phoenix Dactylifera*) Compost Use on the Agronomic Characteristics of Durum Wheat (*Triticum Durum*) Grown in the Algerian Semi-Arid Zone: Case of Timgad

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Abstract.

Context: Excessive use of chemical fertilizers in Algeria has degraded soil quality, threatening agricultural productivity. This study explores the use of date palm compost, an abundant local resource, as a sustainable alternative to improve soil fertility and durum wheat yield. *Methodology*: Different combinations of organic and chemical fertilizers were tested, including manure, date palm compost at various doses (C1, C2, C3), and compost combined with ammonium phosphate (MAP) or urea. The impact of these treatments on the physico-chemical properties of the soil and the agronomic characteristics of durum wheat was evaluated. *Results*: Manure and date palm compost significantly improved soil parameters and wheat yield. The best results for grain yield, as well as for aerial biomass, were obtained with manure, compost C3 combined with MAP (C3M), compost C3 combined with urea (C3U), and compost C3 alone. *Conclusion*: Date palm compost emerges as a promising alternative to chemical fertilizers for durum wheat fertilization in Algeria. This sustainable approach improves soil health while valorizing local waste.

Keywords: Durum wheat · compost · date palm residues · semi-arid zone · organic fertilization

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POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Contribution to the Study of Actinomycetes in the Soils of Algeria

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Abstract.

The aim of this study is to review through bibliographic examination the inhibitory activity of Actinobacteria isolated from soils in arid regions of Algeria with respect to target fungal germs, and the molecular characterizations of these isolates. The results reported by the targeted studies show that Actinobacteria have a high capacity to produce molecules capable of inhibiting fungal germs that are very pathogenic in humans and the environment, the filamentous fungi studied (*Aspergillus carbonarius, Aspergillus flavus, Fusarium culmorum , Fusaruimgraminearum, Penicillium glabrum, alternariasp, fusarium oxysporum, Penicillium sp, aspergillus fumigatus, aspergillus niger, aspergillus brasiliensis, rhizoctoniasolani*[i]) and the lebre-onvisiacyces cerevisiaemountt a very strong sensitivity Tis, Candida Tropicalis are not very sensitive. Molecular identification by 16S rDNA gene sequencing indicates that all isolates studied genetically belonged to the genus Streptomyces.

Keywords: Actinobacteria · antifungal activity · filamentous fungus · yeasts · arid soil · Algeria

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POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Specificities of Okra Cultivation under Arid Conditions

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Abstract.

This study monitored five okra varieties over two growing seasons in 2020/2021 and 2021/2022 to understand the specific challenges and optimal practices for okra cultivation under arid conditions. The results indicated that drip irrigation, while effective for water conservation, facilitated weed growth during the first planting season. Conversely, switching to flood irrigation in the second season significantly reduced weed prevalence. Soil composition also played a crucial role; clay and calcareous soils proved unsuitable for seed germination, while a mixture of potting soil and sand provided a more favorable environment. Despite a one-month interval between sowing in the two seasons, the flowering and fruiting periods remained closely aligned, indicating that phenological stages of okra are primarily influenced by climatic conditions. These findings suggest that irrigation methods and soil composition are critical factors in optimizing okra cultivation in arid regions, and that climatic conditions heavily influence the plant's developmental stages.

Keywords: Okra cultivation · arid zone · climatic conditions · Algeria

INTERNATIONAL WORKSHOP ON
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POSTER COMMUNICATION

UNIVERSITY OF BISKRA 14/05/2024

Effect of Receptivity Period and Temperature on Parthenocarpic Fruits in Date Palm

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Abstract.

In the date palm (Phoenix dactylifera L), the pollination is considered an important process, because a failure of this step leads to the production of inedible dates called parthenocarpic fruits. This study aims to assess the effect of temperature on the rate of parthenocarpic fruits and the impact of delayed pollination on the yield of the date palm. The experiment was carried out in the experimental station of CRSTRA in the El Outaya region, on palm trees. Deglet Nour pollination was carried out one day after the opening of the female spathe until 19 days after the initial opening, a temperature and humidity sensor was installed. Main results reveal that the optimal period to achieve maximum yield is between the 1st and 7th day after cracking of the spathe with (10.77kg - 9.44kg) respectively, thus the longer the period between splitting and pollination, the longer the period between splitting and pollination is the rate of parthenocarpic fruits increased (35.37% on the 19th day), if temperatures exceed 25°C, they inhibit the development of normal fruits. The main conclusion is that temperatures have an impact on the time of pollination and the latter influences the yield and date quality.

Keywords: Parthenocarpic fruits · pollination · Deglet Nour · dates · Algeria

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POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Variation in the Length of the Phenological Cycle of the Date Palm in the Era of Climate Change

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Abstract.

Recent climate change has significantly impacted humans, animals, and vegetation, directly affecting agricultural production. This study aims to examine the impact of climate change on the phenological cycle length of date palms by monitoring this cycle in seven cultivars in the Wilaya of Biskra. The cultivars Arechti, Degla Beidha, Deglet Nour, Ghars, Lahloua, Litima, and Mech Degla were observed in five palm groves through continuous weekly or bi-weekly monitoring. Over five years (2016-2019), the results showed that spathes begin to appear at the end of January and continue until the end of April. The spathes open gradually from February to April, with male spathes bursting before female spathes. Date ripening starts in July and continues until November, with full ripeness achieved between September and November. The average time required for date ripening varies between 184 and 255 days. The advancement in phenological stages and the harvesting period recorded in Biskra indicates that date palm cultivation needs to adapt to climate change. More research is required to address these changes, as climate change could have future negative impacts on the qualitative and quantitative aspects of date production.

Keywords: *Phoenix dactylifera* L. · climate · phenological stages · sustainability · Sahara · Algeria

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POSTER COMMUNICATION

UNIVERSITY OF BISKRA 14/05/2024

Evaluation of the Crude Fiber Content of Six Okra (*Abelmoschus esculentus* L.) Accessions in Arid Climate

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Abstract.

Okra (*Abelmoschus esculentus* L.) is a popular vegetable crop well known in southern Algeria with good nutritional value notably, the richness in crude fibers. However, this value varies depending on pedoclimatics conditions and the intraspecific variation. This work contributes to the evaluation of crude fiber content in fresh fruit pulp of six accessions of okra grown at the El Otaya Bioresources Experimental Station at CRSTRA. The origin of the seeds of these accessions is : one accession purchased at the local market in the Adrar district, three accessions (A.B.C) collected in different parts of Biskra district, one accession collected from a farmer in the Beni Abbes district and another purchased from a seller in the Ghardaia district. The method used to determine crude fiber content is the Weende's method. The results obtained showed a very significant difference ($p<0.5$) between the accessions fruits pulp. Fruit pulps from Biskra district (B) and Adrar district presented the highest values of crude fiber content (49.06% and 47.72%, respectively). While the lowest crude fiber content was recorded in fruits from Beni Abbès district (36.52%). This property is very important for consumers who mainly focus on soft fruits with low fiber content.

Keywords: *Abelmoschus esculentus* L · accessions · crude fiber · Algeria

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POSTER COMMUNICATION

UNIVERSITY OF BISKRA 14/05/2024

Screening of *Bacillus spp*. from Algerian Ecosystems for Alkaline Protease Production

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Abstract.

This study evaluated the potential for alkaline protease production by Bacillus spp. isolated from various Algerian ecosystems. A total of 89 *Bacillus spp*. strains were obtained from the Applied Microbiology Laboratory collection at the Faculty of Nature and Life Sciences, University Setif 1 - Ferhat Abbas. These strains were cultivated in LB medium for 24 hours at 30°C. Their ability to produce alkaline protease at pH levels of 7 and 10 was tested by inoculating them on TSA agar supplemented with milk (casein) and incubating at 30°C for 24 hours. Out of the 89 strains, thirty with high productivity were selected for further evaluation of enzyme activity. These selected strains were cultured in a casein-rich medium at 30°C and 120 rpm for 24 hours in a shaker incubator. Enzyme activity was assessed using the Folin-phenol method, which identified three strains exhibiting high enzymatic activity, ranging from 50-60 units per minute. These findings highlight the potential of these strains for industrial applications, given their significant production capacity and enzyme activity.

Keywords: *Basillus spp* · alkaline protease · Algerian ecosystems · industrial applications

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POSTER COMMUNICATION UNIVERSITY OF BISKRA 14/05/2024

Study of the Physiological Characteristics of a Strain of *Mauginiella scaettae* Causal Agent of Date Palm Inflorescence Rot

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Abstract.

Inflorescence rot is one of the most serious date palm diseases. It is caused by the fungus *Mauginiella scaettae* Cav., The main goal of this work is to find a combination of variables that influence the risk of occurrence and spread of the disease. To do this, we opted for the study and analysis of the influence of certain environmental factors (growth media, temperature, pH, and salinity) on some physiological characteristics of this pathogen (growth and sporulation rate). For the effect of the growth medium, the media (PDA) and (Czapek-Dox) were chosen. The nitrogen and carbon sources of the media were substituted by asparagine, NaNO3 and KNO3 for nitrogen and by $C_{12}H_{22}O_{11}$ and $C_6H_{12}O_6$ for carbon. Several values of temperature, pH and salinity doses were tested. The results obtained show that the fungal strain studied, after 5 days of incubation, grew well on the mineral medium (Czapek-Dox) at a temperature between 25 – 30C° and pH value 6.8. Also, the NaNO3–Glucose combination gives the best growth and sporulation rates and salinity is not suitable for it. It is concluded that *M. scaettae* gives a preference to the middle sugar over another ingredient. This could explain the nature of its bioenvironmental at the level of the date palm, namely the inflorescences.

Keywords: *Mauginiella scaettae* · inflorescence rot · date palm diseases · physiological characteristics

Paintings from the Biskra Oasis / Yacine Magnaji is an artist from Biskra Province
لوحات فنية من واحة بسكرة / الفنان ياسين مغناجي من ولاية بسكرة

Prize of the Best Poster Presentation

The final segment of the workshop was the poster session under the careful moderation of the scientific subcommittee. This session was a highlight of the event, featuring a total of 28 posters that presented a diverse array of research topics and innovative solutions relevant to the governance and sustainability of Mediterranean agri-food value chains. The poster session was designed to facilitate an interactive and engaging environment, encouraging knowledge exchange and fostering collaborative discussions among participants.

Each poster represented a unique piece of research, ranging from theoretical studies to practical applications in the field. Topics covered included advancements in sustainable agricultural practices, innovative technologies for improving crop yields, socio-economic analyses of food value chains, and case studies on specific agricultural sectors within the Mediterranean region. The breadth of topics ensured that there was something of interest for every attendee, whether they were academics, policymakers, industry professionals, or students.

The posters were displayed in a dedicated area, allowing attendees to circulate and engage directly with the researchers. This format provided an excellent opportunity for in-depth discussions and personalized feedback. Researchers were on hand to explain their findings, answer questions, and discuss potential implications and applications of their work. This interaction not only enriched the attendees' understanding of the presented topics but also provided valuable insights and suggestions to the researchers for further refinement of their studies. To enhance the academic rigor and ensure a high standard of quality, each poster was evaluated by a panel of experts from the scientific subcommittee. The evaluation criteria included the originality of the research, the clarity and quality of the presentation, and the relevance and potential impact of the findings. This evaluative process was not merely a formality; it stimulated constructive feedback and encouraged presenters to articulate their research effectively and professionally.

Based on the outcomes of the meeting of the scientific subcommittee, as detailed in PV no. 129 of the DEDSPAZA Laboratory, which included the following members:

Dr. Amine M. Benmehaia
Pr. Salah Eddine Benziouche
Dr. Kamel Guimeur
Pr. Kahramane Deghnouche

As members of the Scientific Committee of the workshop, and after thorough deliberation, the scientific subcommittee evaluated all 28 posters based on three key criteria:

-Close Relevance to the Workshop's Declared Topics: The posters were assessed for how closely their content aligned with the core themes and objectives of the workshop. This ensured that the research presented was pertinent to the discussions and goals set forth by the workshop organizers.

-Proficiency in English: Given the international nature of the workshop, the ability to communicate research findings effectively in English was a crucial criterion. This included clarity of language, grammatical accuracy, and the overall presentation style.

-The Level of Persuasion: The posters were also judged on their ability to convincingly present their research findings. This involved evaluating the logical flow of arguments, the robustness of the data presented, and the overall impact of the poster's narrative on the audience.

After careful consideration of these criteria, we are pleased to announce that Student **Haifa Bouziane** has been awarded the prize for the best poster presentation for her exceptional work titled, "Valorization of Low-Quality Commercial Dates: Turning a Challenge into an Opportunity." Her research stood out for its

relevance, linguistic proficiency, and compelling presentation, offering innovative solutions to a significant agricultural challenge.

The award was delivered personally by Dr. Safieddine Ounis, the Vice-Rector in charge of the external relations, on the behalf of the Rector of the University.

The Scientific Committee hopes this recognition serves as an inspiration for all participants to continue striving for excellence in their research and presentations. We encourage all participants to build on this experience, leveraging the feedback and insights gained, and aim for even higher levels of achievement in future events. This recognition not only highlights the importance of rigorous research but also underscores the value of effective communication and the ability to persuade an audience, all of which are critical skills in the academic and professional arenas.

The Workshop Closure

As the international workshop drew to a close, the atmosphere was filled with a sense of accomplishment and optimism. Following a day of fruitful discussions and insightful interventions from various experts, the moderators expressed their heartfelt gratitude to all participants. The collaborative spirit and the wealth of knowledge shared throughout the sessions were fundamental in addressing the complex challenges facing Mediterranean agri-food value chains.

Dr. Naima Mebrek, the Head of the Department of Agricultural Sciences, officially concluded the event with a warm and appreciative address. She extended her sincere thanks to all attendees, both those present in person and those who joined online. Dr. Mebrek highlighted the importance of such gatherings in fostering international collaboration and driving forward the agenda of sustainability and equity in agri-food systems. Her closing remarks underscored the collective effort and commitment required to make significant strides in this field, and she encouraged all participants to continue their work with the same enthusiasm and dedication demonstrated during the workshop.

With this, the event officially came to an end, leaving participants inspired and ready to implement the innovative ideas and strategies discussed. The shared experiences and newly formed connections promise to pave the way for ongoing collaboration and future advancements in governance and sustainability within Mediterranean agri-food value chains.

Photos

Gallery

Opening ceremony by the Dean of the Faculty SESNV.
from the left: Benziouche S.E., Attaf A., Benmehaia M.A. and Gianotti A.

الافتتاح من طرف عميد الكلية
من اليسار:
أ.د. بن زيوش صلاح الدين، أ.د. عطاف عبد الله، د. بن مهية محمد أمين والدكتور أندريا جيانوتي

Registrations by members of Organizing Committee

التسجيلات تحت إشراف أعضاء اللجنة التنظيمية

Coffee Break

فترة الاستراحة

Poster Session Hall

بهو الملصقات للمشاركين

Poster evaluations by the Scientific Committee

تقييم الملصقات من طرف اللجنة العلمية

Post-event discussions between some workshop members

مناقشة ودية بعد الاختتام لبعض من مسيّري الورشة

Discussion of the Italian GourMed partner (Andrea Gianotti) with socioeconomic stakeholders of Biskra food value chains: Mr. Hathat M. and Djellab A.

لقاء بين شريك المشروع والشركاء الاقتصاديين والاجتماعيين في سلاسل القيمة الغذائية في بسكرة: السيد هتهات مبروك والسيد جلاب عبد الباسط

Collective photo of the workshop members with University's administrative staff

صورةجماعية لأعضاء الورشة مع مسؤولي الجامعة

القنطرة ومنظرها الطبيعي الأسطوري بريشة الفنان السويدي فالديمار كنوت غوستاف تودي (1859 ـ 1900) بتاريخ 1891.
Le paysage mythique d'El Kantara, par le peintre suédois Waldemar Knut Gustaf Todé (1891 ,(1900-1859.

تطوير سلاسل القيمة الغذائية في الزراعة الصحراوية: عناصر لتحليل الحالة الجزائرية، قدمها الأستاذ صلاح الدين بن زيوش من جامعة بسكرة – الجزائر، التي قدمت تحليلًا معمقًا لسلاسل القيمة الزراعية الصحراوية.

وقد اختتمت الجلسة بمناقشة حيوية، مع تعليقات بارزة من جورجيا أيفاندوبولو التي أكدت على غنى وفائدة العروض المقدمة. الجلسة الثالثة للمؤتمر كانت حول قطاع الطماطم وتحدياته – تجارب إيطاليا والجزائر. بدأت هذه الجلسة في الساعة 11:30 صباحًا وركزت على التحديات والابتكارات في قطاع الطماطم، حيث تضمنت ثلاثة محاضرات ومناقشة مائدة مستديرة:

حوكمة سلسلة قيمة عصيدة الطماطم المعالجة في إيطاليا قدمتها الدكتورة أنتونيللا ساموجيا من جامعة بولونيا – إيطاليا، التي شرحت الهياكل الحاكمة لقطاع عصيدة الطماطم المعالجة في إيطاليا.

بعض عواقب الأسعار غير العادلة في قطاع الطماطم الصناعية في الجزائر قدمها الأستاذ محمد أمين بن مهية من جامعة بسكرة – الجزائر، التي استكشفت تأثير سياسات التسعير على صناعة الطماطم الجزائرية.

تحديات وابتكارات في إدارة الآفات لقطاع إنتاج الطماطم الجزائري قدمتها الدكتورة فريدة بتيش من مركز الأبحاث العلمية والتقنية للمناطق الجافة – الجزائر، التي ناقشت استراتيجيات إدارة الآفات وأهميتها للقطاع.

تضمنت الجلسة مائدة مستديرة أدارها الأستاذ محمد أمين بن مهية والباحثة حوى عمروني من المركز الوطني للأبحاث الزراعية، الجزائر، وضمّت خمسة فاعلين اجتماعيين-اقتصاديين من منطقة بسكرة. قدمت المناقشة رؤى عملية حول التحديات التي يواجهها قطاع الطماطم.

كانت الجلسة النهائية للورشة هي جلسة مناقشة للعروض التقديمية على شكل ملصقات لطلبة الدكتوراه والباحثين الشباب، التي بدأت في الساعة 2:00 مساءً وأدارتها اللجنة العلمية الفرعية. تمّ عرض إجمالي 28 ملصقًا، عرضت مجموعة متنوعة من مواضيع البحث والابتكارات. تم تقييم كل ملصق، مما خلق بيئة تفاعلية ومشجعة لتبادل المعرفة.

اختتمت الورشة في الساعة 4:30 مساءً، من طرف رئيسة قسم العلوم الزراعية الدكتورة نعيمة مبرك، تاركة للمشاركين فهمًا أعمق لتحديات الحوكمة والاستدامة في سلاسل القيمة الزراعية الغذائية في البحر الأبيض المتوسط والتزامًا متجددًا بتطوير الحلول في هذا المجال الحيوي.

ملخص الفعاليات

تألفت الورشة من ثلاث جلسات تحاضرية وجلسة ملصقات واحدة، مما وفر استكشافًا عميقًا للحوكمة والاستدامة في سلاسل القيمة الغذائية الزراعية في البحر الأبيض المتوسط. بدأت جلسات المؤتمر في الساعة 9:30 صباحًا، حيث ركزت كل جلسة على مواضيع محددة ذات صلة بأهداف الورشة. تناولت الجلسة الأولى رؤى من مشروعGourMed. تم تسليط الضوء على رؤى رئيسية من مشروعGourMed، وتضمنت أربع محاضرات تقديمية من شركاء المشروع:

مشروع GourMed : كيفية الوصول إلى سلاسل إمداد زراعية غذائية عادلة في البحر الأبيض المتوسط مقدّمة من طرف جورجيا أيفاندوبولو من مركز الأبحاث والتكنولوجيا - اليونان، والتي ناقشت استراتيجيات هامة لتحقيق سلاسل إمداد زراعية غذائية عادلة.

تمكين المستهلكين من خلال التكنولوجيا المبنية على البيانات في سوق الغذاء مقدّمة من طرف أناجنستيس أرجيرو من مركز الأبحاث والتكنولوجيا - اليونان، والذي استكشف دور التكنولوجيا في تعزيز تفاعل المستهلكين والشفافية.

تقييم تنفيذ الزراعة التعاقدية العادلة في الجزائر مقدّمة من طرف يوانيس ماليديس من مركز الأبحاث والتكنولوجيا - اليونان، والتي قيّمت بطرق كمية ورياضية فعالية ممارسات الزراعة التعاقدية في الجزائر.

إمكانات النشاط الحيوي لعصيدة الطماطم المتوسطية: جانب يجب تقييمه بشكل أكبر من أجل التسعير العادل مقدّمة من طرف أندريا جيانوتي وماريا تيريزا رودريغيز إسترادا من جامعة بولونيا - إيطاليا، والتي حلّلت بدقة الصفات التي تجعل الطماطم الجزائرية تنافسية في السوق العالمية.

أختتمت الجلسة بمناقشة النتائج الرئيسية وآثار مشروعGourMed . كانت الجلسة الثانية للمؤتمر حول رؤى الزراعة في الجزائر. بدأت الجلسة في الساعة 10:30 صباحًا وركزت على التطورات الزراعية في الجزائر وتضمنت المحاضرات التالية:

تطور السياسات الزراعية العامة وتأثيرها على الأمن الغذائي في الجزائر: من 1962 إلى 2024، قدمتها الدكتورة سمية بكيس ممثلة لوزارة الزراعة والتنمية الريفية - الجزائر، التي درست التأثيرات التاريخية والحالية للسياسات الزراعية على الأمن الغذائي.

الافتتاح

بدأت الورشة الدولية بعنوان "الحوكمة والاستدامة في سلاسل القيمة الغذائية الزراعية في البحر الأبيض المتوسط: التحديات والآفاق" في تمام الساعة التاسعة صباحًا يوم 14 مايو 2024. وكان الموظفون المسؤولون الحاضرون يشملون كل من :

محمد أمين بن مهية، رئيس الورشة

صلاح الدين بن زيوش، رئيس اللجنة العلمية

أندريا جيانوتي، شريك في مشروع GourMed

جورجيا أيانتوبولو، المنسق الدولي لمشروع GourMed عبر الإنترنت على المباشر

عبد الله عطاف، عميد كلية العلوم الدقيقة وعلوم الطبيعة والحياة

أدار الورشة الدكتور محمد أمين بن مهية والأستاذ صلاح الدين بن زيوش من قسم العلوم الزراعية بجامعة بسكرة. أطلق الأستاذ بن زيوش الحدث ثم سلّم الكلمة للدكتور بن مهية لإلقاء الكلمة الترحيبية الرسمية.

أعرب الدكتور بن مهية عن امتنانه لرئيس جامعة بسكرة، الأستاذ محمود دبابش، وقدم شكرًا خاصًا للسيدة جورجيا أيفاندوبولو، المنسق الدولي لمشروع GourMed. وأبرز أهمية الورشة في معالجة القضايا الحيوية في سلاسل القيمة الزراعية الغذائية في منطقة البحر الأبيض المتوسط.

بعد تصريحات الدكتور بن مهية، ألقى الدكتور أندريا جيانوتي، الضيف المرموق من جامعة بولونيا بإيطاليا وشريك في مشروع GourMed، كلمة ترحيبية. أعرب الدكتور جيانوتي عن تقديره للجنة المنظمة وشدّد على أهمية الجهود التعاونية في تحقيق أهداف الورشة.

بعد ذلك، انضمت السيدة جورجيا أيفاندوبولو إلى الجلسة عبر الإنترنت وألقت كلمة مختصرة، شكرت رئيس الورشة وقدمت لمحة عامة عن مشروع GourMed مسلطة الضوء على مساهمات الشركاء الأوروبيين الذين شاركوا عن بعد عبر برنامج مايكروسوفت©Teams . أكدت تصريحاتها على هدف المشروع في تعزيز الاستدامة والحوكمة في سلاسل القيمة الغذائية الزراعية في البحر الأبيض المتوسط من خلال التعاون الدولي.

ثم أعلن الأستاذ عبد الله عطاف، عميد كلية العلوم الدقيقة وعلوم الطبيعة والحياة بجامعة بسكرة، عن الافتتاح الرسمي للورشة. وتحدث نيابة عن رئيس الجامعة، ورحّب بجميع المشاركين وافتتح الورشة رسميًا، مما مهد الطريق ليوم مليء بالنقاشات المستنيرة وتبادل المعرفة.

بعد الافتتاح، بدأت جلسات الورشة في الساعة 9:30 صباحًا. قام المنسقون الدكتور بن مهية، والأستاذ بن زيوش، وماريانا جياناكي (من اليونان، متولية التدخلات عبر الإنترنت) بضمان انتقال سلس إلى العروض التقديمية والمناقشات المجدولة، مما أوجد بيئة ملائمة للتعلم والتعاون بين مجموعة متنوعة من الحضور.

اللجنة المنظمة

د. كمال غيمر
رئيس لجنة تنظيم الورشة
جامعة بسكرة، الجزائر

أعضاء اللجنة المنظمة

محمد أمين بن مهية	جامعة بسكرة، الجزائر
صلاح الدين بن زيوش	جامعة بسكرة، الجزائر
ماريانا جياناكي	مركز الأبحاث والتكنولوجيا، اليونان
حكيم دروعي	جامعة بسكرة، الجزائر
نعيمة مبرك	جامعة بسكرة، الجزائر
حنان بجاوي	جامعة بسكرة، الجزائر
أيوب حاجب	جامعة بسكرة، الجزائر
خالد بوكحيل	جامعة بسكرة، الجزائر
هشام عيساوي	جامعة بسكرة، الجزائر
بلقاسم بومعراف	جامعة بسكرة، الجزائر
عبلة كساي	جامعة بسكرة، الجزائر
كلثوم بن عيسى	جامعة بسكرة، الجزائر
لعلى جكيرف	جامعة بسكرة، الجزائر
لمياء أوزير	جامعة بسكرة، الجزائر
كريمة جوادي	جامعة بسكرة، الجزائر
رفيقة علوي	جامعة بسكرة، الجزائر
إيمان عبد اللاوي	جامعة بسكرة، الجزائر
أحمد سي مزراق	جامعة بسكرة، الجزائر
خدوج بن عيسى	جامعة بسكرة، الجزائر
رضوان بن مهية	جامعة مسيلة، الجزائر
حوى عمروني	المعهد الوطني للأبحاث الزراعية، الجزائر
إلهام قطافي	المعهد الوطني للأبحاث الزراعية، الجزائر

اللجنة العلمية

أ.د. صلاح الدين بن زيوش
رئيس اللجنة العلمية للورشة
جامعة بسكرة، الجزائر

أعضاء اللجنة العلمية

محمد أمين بن مهية	جامعة بسكرة، الجزائر
جورجيا أيفاندوبولو	مركز الأبحاث والتكنولوجيا، اليونان
أناغنوستيس أرغيريو	جامعة إيجون، اليونان
أندريا جيانوتي	جامعة بولونيا، إيطاليا
أندرياس ديتزل	معهد أبحاث الطاقة والبيئة، ألمانيا
لطفي عاشور	المعهد العالي للبيوتكنولوجيا بالموناستير، تونس
بوبكر ذهيبي	المركز الدولي للبحوث الزراعية في المناطق الجافة، تونس، تونس
علي شبيل	المعهد الوطني للبحوث في الهندسة الريفية والمياه والغابات، تونس
كمال غيمر	جامعة بسكرة، الجزائر
حكيم دروعي	جامعة بسكرة، الجزائر
نعيمة مبرك	جامعة بسكرة، الجزائر
محمد صغير مهاوة	جامعة بسكرة، الجزائر
بومعراف بلقاسم	جامعة بسكرة، الجزائر
كهرمان دغنوش	جامعة بسكرة، الجزائر
فريد مزردي	جامعة بسكرة، الجزائر
كاميليا فرحي	جامعة بسكرة، الجزائر
أحمد مسعي	جامعة بسكرة، الجزائر
رضوان بن مهية	جامعة مسيلة، الجزائر
أحمد بن ميهوب	مركز أبحاث الاقتصاد التطبيقي من أجل التنمية، الجزائر

المشرفون على الورشة

أ.د. محمود دبابش
مدير جامعة بسكرة
الرئيس الشرفي للورشة

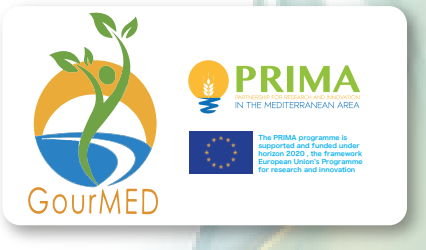
د. جورجيا أيفانتوبولو
مديرة بمركز الأبحاث والتكنولوجيا، اليونان
نائبة الرئيس الشرفي

أ.د. عبد الله عطاف
عميد كلية ع.د.ع.ط.ح، جامعة بسكرة
نائب الرئيس الشرفي

د. محمد أمين بن مهية
قسم العلوم الزراعية، جامعة بسكرة
رئيس الورشة

شركاء الورشة

الهيئات المنظمة



بالشراكة مع

هذه الورشة ليس فقط من البحث الأكاديمي ولكن أيضًا من تطوير السياسات والممارسات الصناعية، مما ساهم في نظام غذائي أكثر استدامة وعدالة في المنطقة.

عقدت الورشة بعنوان "الحوكمة والاستدامة في سلاسل القيمة الزراعية الغذائية في البحر الأبيض المتوسط: التحديات والآفاق"، في 14 مايو 2024، في جامعة بسكرة، الجزائر. تم الحدث في قاعة المؤتمرات السمعية البصرية في المكتبة المركزية. جلبت الورشة 73 مشاركًا من مختلف القطاعات، بما في ذلك الأكاديمية والصناعة والحكومة والجمعيات المدنية.

افتتحت الورشة في الساعة 9:00 صباحًا بافتتاح تضمن كلمات ترحيبية من مسؤولي الجامعة والمنظمين الرئيسيين. تلا ذلك سلسلة من العروض التقديمية للخبراء مقسمة إلى ثلاث جلسات رئيسية للمؤتمر. ركزت كل جلسة على مواضيع محددة للغاية، حيث شارك المتحدثون نتائج أبحاثهم وتجاربهم العملية.

شهدت جلسة بعد الظهر عروضًا تقديمية للملصقات من قبل طلاب الدكتوراه والباحثين الشباب، مما وفر منصة للعلماء الناشئين لعرض أعمالهم والتفاعل مع الخبراء المعروفين في المجال. حفزت جلسة الملصقات تفاعلات ديناميكية ووفرت ردود فعل قيمة للباحثين الشباب.

اختتمت الورشة في الساعة 4:00 مساءً بحفل ختامي لخّص النقاط الرئيسية ووضح الاتجاهات المستقبلية للبحث والتعاون. غادر المشاركون بتجديد الالتزام بتعزيز حوكمة واستدامة سلاسل القيمة الزراعية الغذائية في البحر الأبيض المتوسط، مستوحين من المعرفة التي تمت مشاركتها والروابط التي تم بناؤها خلال الحدث. من خلال هذا التجمع، نجحت الورشة في خلق بيئة من التبادل الفكري والنقاش العملي، ممهدة الطريق للتقدم المستقبلي في حوكمة واستدامة سلاسل القيمة الزراعية الغذائية في البحر الأبيض المتوسط.

محمد أمين بن مهية
جورجيا أيفانتوبولو

كلمة تقديمية

تُعرف منطقة البحر الأبيض المتوسط بتراثها الزراعي الغني وإسهامها الكبير في إنتاج الغذاء العالمي. ومع ذلك، تواجه مجموعة من التحديات المعقدة، بما في ذلك الاستدامة البيئية والأمن الغذائي والجدوى الاقتصادية والعدالة الاجتماعية. يتطلب التعامل مع هذه القضايا فحصًا دقيقًا للحوكمة والاستدامة ضمن سلاسل القيمة الزراعية الغذائية. من خلال استكشاف تعقيدات السلسلة بأكملها – من الإنتاج والمعالجة إلى التوزيع والاستهلاك – يمكننا تصميم استراتيجيات فعالة للتغلب على التحديات واغتنام الفرص المحتملة.

تميزت هذه الورشة الدولية لمشروع GourMed بمنهج متعدد التخصصات، حيث تناولت مجموعة واسعة من المواضيع التي تساهم في فهم شامل للحوكمة والاستدامة في سلاسل القيمة الزراعية الغذائية في البحر الأبيض المتوسط. توافد خبراء وأكاديميون من مجالات مثل الزراعة، والاقتصاد، وعلوم البيئة، والعلوم السياسية لتقديم وجهات نظر متنوعة. يعترف هذا النهج بالطبيعة المتعددة الأوجه والمتداخلة للتحديات والفرص ضمن سلاسل القيمة الزراعية الغذائية، مما يبرز أهمية الرؤى التعاونية في توليد حلول شاملة.

شملت المواضيع الرئيسية التي تم تناولها خلال الورشة:

الاستدامة البيئية: استكشاف استراتيجيات للحد من البصمة البيئية لسلاسل القيمة الزراعية الغذائية، وتعزيز الممارسات الزراعية المستدامة، ومعالجة تأثير التغير المناخي.

الجدوى الاقتصادية: تحليل الجوانب الاقتصادية لسلاسل القيمة الزراعية الغذائية، بما في ذلك ديناميات السوق والسياسات التجارية والجدوى المالية لأصحاب المصلحة.

العدالة الاجتماعية: مناقشة القضايا المتعلقة بظروف العمل والتجارة العادلة والمسؤولية الاجتماعية ضمن سلاسل القيمة الزراعية الغذائية.

السياسة والحوكمة: فحص دور السياسات الحكومية واللوائح في تشكيل استدامة وحوكمة سلاسل القيمة الزراعية الغذائية.

التكنولوجيا والابتكار: دراسة تأثير التقدم التكنولوجي والابتكار والرقمنة على تحسين سلاسل القيمة الزراعية الغذائية.

كان الهدف الأساسي للورشة هو تسهيل النقاشات الهادفة وتبادل المعرفة والتعاون بين المشاركين. عززت الرؤى المستفادة من هذه التفاعلات فهمنا للتحديات والحلول المحتملة لحوكمة وضمان استدامة سلاسل القيمة الزراعية الغذائية في منطقة البحر الأبيض المتوسط. كما كان متوقعًا، استفادت نتائج

كلمة رئيس الجامعة

إنه لمن دواعي سروري وشعوري العميق بالمسؤولية أن أفتتح هذا الورشة الدولية حول الحوكمة والاستدامة في سلاسل القيمة في البحر الأبيض المتوسط. تلتزم جامعة بسكرة التزامًا راسخًا بتعزيز التنمية الاقتصادية وتعزيز الشراكات عبر جميع القطاعات الاجتماعية والاقتصادية، سواء على الصعيد المحلي أو الوطني. تعبر هذه الورشة عن تفانينا المستمر في معالجة القضايا الحاسمة التي تؤثر على منطقتنا، بما يتماشى مع المبادئ التوجيهية للسياسة الوطنية التي تهدف إلى تعزيز الاستدامة والحوكمة الفعالة. يعتبر التركيز على سلاسل القيمة في البحر الأبيض المتوسط مناسبًا بشكل خاص، نظرًا للتحديات والفرص الفريدة التي تواجهها المنطقة.

تدرك جامعة بسكرة أهمية مثل هذه المبادرات في تسهيل الحوار والتعاون بين مختلف الأطراف المعنية. من خلال جمع الخبراء والممارسين وصناع السياسات معًا، تهدف هذه الورشة إلى استكشاف الحلول المبتكرة ومشاركة أفضل الممارسات التي يمكن أن تؤدي إلى سلاسل قيمة أكثر استدامة ومرونة. لن تعزز المناقشات والرؤى التي يتم توليدها هنا فهمنا للواقع الحالي فحسب، بل ستمهد أيضًا الطريق لاستراتيجيات عملية يمكن تنفيذها عبر منطقة البحر الأبيض المتوسط. نأمل أن يكون هذا الحدث بمثابة محفز لعلاقات أقوى وأكثر تعاونًا بين جميع المشاركين، مما يساهم في نهاية المطاف في استدامة مستقبلنا الاقتصادي والبيئي المشترك.

باسم جامعة بسكرة، يشرفني أن أعلن رسميًا افتتاح هذه الورشة. سألتزم شخصيًا بدعم وتعزيز نتائج هذا الحدث العلمي الهام. ستكون المساهمات والنتائج القيمة التي ستنبثق من مناقشاتنا حاسمة في تشكيل السياسات والممارسات التي تفيد مجتمعاتنا. سنغتنم هذه الفرصة للعمل معًا نحو منطقة متوسطية أكثر استدامة وازدهارًا. أقدم شكري الجزيل لجميع المنظمين والمتحدثين والمشاركين على تفانيهم وجهودهم في جعل هذه الورشة ناجحة.

أ.د. محمود دبابش
رئيس جامعة بسكرة

المحتويات

التقرير النهائي
للورشة الدولية حول

الحوكمة والإستدامة في السلاسل الغذائية والزراعية المتوسطية

تحديات وآفاق

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