



Capacity Development Report

Training Course on Seed Collection & Conservation and Nursery Management of Indigenous Silvopastoral Species

24 – 27 October 2023

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INITIATIVE ON
Livestock and Climate

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Acronyms

CGIAR	The Consortium of International Agricultural Research Centers
CRDA	Regional Commissary for Agricultural Development
DGF	the General Directorate of Forests
GDA	Agricultural Development Groups
ICARDA	The International Center for Agricultural Research in the Dry Areas
INRGREF	National research Institute of rural engineering, Water and Forestry
IRA	the Arid Regions Institute (IRA) Medenine
IRESA	National Institute for Agricultural Research (IRESA)
LCSR	The Livestock and Climate OneCGIAR initiative
MENA	The Middle East and North Africa
NGO	Non-governmental organization
ODYSYPANO	Office du Développement Sylvo-Pastoral du Nord-Ouest
OEP	Office of livestock and pasture
SWOT	Strengths, Weaknesses, Opportunities, and Threats
WP3	Work Package Three of The Livestock and Climate OneCGIAR initiative (System-level research and interventions for building resilient, low-emission livestock production systems)



Group Photo: Participants of the Seed Collection & Conservation Training Course and Indigenous Silvopastoral Species Nursery Management (Sawsan Hassan)

1. Background

Pastoral and silvopastoral lands are one of the most important natural resources in Tunisia, covering a significant area and contributing significantly to the livestock feed requirements, which amount to around 30% in a normal year. However, overexploitation of rangelands (overgrazing, early grazing, wood cutting, etc.) has led to their deterioration and low productivity. Both the General Directorate of Forests (DGF) and Office of Livestock and Pastures (OEP) have therefore prioritized actions geared at rehabilitation, development, and sustainable management of the rangelands.

To reach this goal, many rangeland restoration rehabilitation projects and programs are underway. While public nurseries play a crucial role in providing access to a diverse range of plant species, the availability of seeds and seedlings of indigenous species in these nurseries, combined with concerns about the quality of seedlings, presents a significant challenge in efforts implementation. This situation hinders endeavors to promote local ecosystems and their associated benefits and has resulted in the failure of many rangeland rehabilitation projects. This failure often stems from the use of exotic species, such as *Acacia saligna* (syn. *cyanophylla*) due to their high ecological demands and often their competitive behavior in addition to their either low palatability or nutritive value. This requires a reliable supply of native range shrub and tree seeds and seedlings and calls for capacity for seed collection, processing, storage, transportation, and the production of healthy seedlings. Recognizing that the quality of seeds and seedlings serves as the cornerstone of rehabilitation programs, determining successful post-planting survival and development, underscores the significance of prioritizing these aspects in our restoration initiatives. Effectively addressing this gap needs a comprehensive approach, involving collaboration between nurseries, conservation organizations, and local communities.

To produce quality seeds and seedlings, Tunisia requires manpower with the necessary knowledge and skills. To address this need, ICARDA organized a course within the framework of Work Package Three (WP3)

of the Livestock and Climate OneCGIAR initiative (LCSR). WP3 focuses on system-level research and interventions aimed at building resilient, low-emission livestock production systems. Specifically, the work package prioritizes the development of climate-related resilience in livestock agrifood systems. This involves promoting resilient, socially inclusive governance of land and natural resources, ensuring the engagement of all relevant stakeholders in land-use planning. Activities such as regenerative livestock practices and initiatives to enhance the effective integration of trees play a pivotal role in reversing degradation and restoring land, particularly in rangelands. The approach places a strong emphasis on strengthening the appropriate integration of trees throughout the entire process. The course, designed to strengthen the capacity of development agencies at both national and local levels, aligns with this broader goal by contributing to rangeland rehabilitation efforts. Its focus is on building the capacity to effectively manage indigenous plant seeds and produce healthy seedlings.

2. Course Objectives

The training program is intended to achieve the following specific objectives:

- Develop and enhance the skills and capacities of the DGF, OEP, and other stakeholders' staff to ensure their active participation in the implementation of the various rangeland rehabilitation projects.
- Share with the staff knowledge about seed production (collection, viability testing, conservation, etc.)
- Build the appropriate skills for nursery and seedling management.
- Identify the challenges and opportunities of the seed and seedling sector through SWOT analysis as well as the promoting species and their potential agroecological areas in the rehabilitation projects.

This course aims to build the capacity of the national partners' staff and other interested parties to effectively manage all aspects of range seed and seedling production. It will introduce a wide range of Develop and enhance the skills and capacities of the DGF and OEP and other stakeholders to ensure their active participation in the implementation of the various rangeland rehabilitation projects.

- Share with the staff knowledge about seed production (collection, viability testing, conservation, etc.)
- Build the appropriate skills for nursery and seedling management.

On successful completion of the course, participants will have skills, knowledge, and capacities that will enable them to:

- i. Effectively manage and oversee the production of quality range seeds and seedlings.
- ii. Effective management and oversight of the establishment and operation of silvopastoral nurseries.
- iii. Collect, process, analyze, and report data for efficient management of range seed and seedling production.

3. Target beneficiaries

The target beneficiaries of this training course are staff of the Development agencies including the General Directorate of Forests (DGF), Office of livestock and pasture (OEP), and Office du Développement Sylvopastoral du Nord-Ouest (ODYSAPANO) as well as young researchers from National research institute of rural engineering, water and forestry (INRGREF) and the Arid Regions Institute (IRA) Medenine and other interested parties including the Communities based Organizations (Agricultural Development Groups; GDA) who have limited or no prior experience or training in range seed and seedling production and management skills.

4. Course modules and topics

The course is organized into 3 main modules covering a range of topics related to seed management, seedling production and management, and the operation of range nurseries (Annex-1). The course follows a “learning by doing” and has many practical topics. The topics covered in the course are summarized below.

Module	Topic
Module 1 – Seed management	1. Importance and viability of seeds 2. Factors affecting seed viability and germination 3. Techniques of seed germination 4. Techniques of collecting, conserving, and storing seeds 5. Establishing and managing mother collections 6. Soil seed bank
Module 2 – Nurseries seedling production	7. Introduction to pastoral nurseries 8. Establishment of pastoral nurseries 9. Pastoral nurseries operations and management
Module 3 – Field visit	10. Seed production of native forages in Al Grine (OEP) 11. Seedling production and nursery management in Al Grine (Forest Service in Kairouan) 12. Visit of <i>Acacia saligna</i> plantation in Kandar
Module 4– Brainstorming sessions	13. SWOT analysis on seed production 14. SWOT analysis on nursery and seedling management 15. Mapping selected rangeland/ silvopastoral species to agroecological zones in Tunisia

5. Training methodology

The methodological approach was intended to deliver a set of training materials that provides a broad overview of the key elements of seed collection and conservation as well as nursery management. The training was based on a series of sessions that have been designed to be fully flexible to meet a wide range of audience requirements and needs. A participatory approach was adopted, both during PowerPoint presentations and practical exercises. In addition to the PowerPoint presentations the following training approaches were implemented:

An introductory part of all sessions to encourage a free and open environment where everyone can participate and share their ideas freely related to the topics. It was based on a sound process with catalyzing questions that address related challenges.

The discussion method was used to build a collaborative and interactive exchange of ideas among the trainers and trainees on seed production and nursery management in Tunisia for the purpose of furthering participants thinking, learning, and problem-solving understanding. Participants were encouraged to present multiple points of view, respond to the ideas of others, and reflect on their own ideas to build their knowledge and understanding of the related matters.

This collaborative and participatory learning method was also used to enhance the participants learning and increase participants' understanding of training contents and build transferable skills to encourage and promote participants to work together to maximize their contribution to addressing challenges and recommend joint solutions or corrective measures. Working Groups were formed to provide the opportunity for participants to work collaboratively to discuss specific related training topics/issues and perform a particular planning task. This was practiced mainly in the sessions related to the sector SWOT analysis and mapping of selected rangeland/ silvopastoral species to agroecological zones in Tunisia.

6. Trainers

The course is facilitated by Dr. Azaiez Ouled Belgacem and Dr. Sawsan Hassan. Dr. Mounir Louhaichi supported the delivery of the course.

7. Training participants

The "Seed Collection & Conservation and Nursery Management of Indigenous Silvopastoral Species" training course was held in Le Royal Hotel, Hammamet on 24 – 27 October 2023. A total of 33 participants attended the Training Course of which 15 from the DGF, 9 from the OEP, 5 from the INRGREF, 1 from IRA, 1 from ODYSOPANO, and 2 from GDA (Appendix 1). Among the trainees, 9 ladies attended the training. The attendance sheet is attached as Annex-2 for ready reference. Despite the enormous range of experience of the participants, the training-related experience range was somewhat narrow, making the training program manageable and fun to work with. Towards the end of the event, the group had evolved into a team of cohesive and performing individuals.

8. Training approach

A flexible approach was adopted for the training and participants were able to ask questions and provide feedback at any point during different sessions, making the engagement between the trainers and participants interactive and lively.

9. Proceedings

9.1. Day 1

9.1.1. Opening Session

The training course was inaugurated by Mr. Abdessattar Belkhoja, the Director of the Forest Service in Zaghouan, on behalf of the Director General of the DGF who warmly welcomed all participants. He thanked ICARDA for working together with DGF and other partners to organize the training and acknowledged the continuous ICARDA technical support. He highlighted the importance of the silvopastoral Seed and nursery sector to strengthen the DGF's capacities for effective involvement in the implementation of different afforestation and rehabilitation projects. He finished by insisting on the importance of this training that will equip the staff of the DGF, OEP, and other partners to actively engage in the implementation of different programs.

Dr. Azaiez Belgacem, a Senior Scientist, on behalf of the ICARDA Program Coordinator, presented the ICARDA opening talk. He highlighted the fruitful and historical, solid, and sustainable collaboration between Tunisia institutions including IRESA and Development agencies and ICARDA. He expressed ICARDA's willingness to develop collaboration with IRESA institutions and development agencies. He insisted on the importance of this training course as per the request of all stakeholders for developing the seed and seedling sector to promote the multipurpose native species in the restoration and rehabilitation of degraded rangelands and silvopastoral areas instead of the exotic ones.



Fig. 1. Inaugural ceremonies and keynote address during the event

Dr. Lamia Hamrouni Head of a Research Program at INRGREF thanked ICARDA for inviting her with her team to this very important training course. She expressed her willingness and that of INRGREF to be more

involved in this field and in the implementation of the training recommended activities and wished the success of the event.

9.1.2. Presentation session

Dr. Azaiez initiated the session by addressing the challenges and opportunities surrounding Indigenous rangeland and silvopastoral seeds in the MENA region, emphasizing their pivotal role. He underscored these areas as fundamental fodder sources for livestock, vital contributors to pastoral community income, and significant drivers of the national economy. Notably, they function as vital hubs for environmental conservation, nurturing various wild plants, including medicinal and aromatic species. He stressed their strategic significance in combatting climate-induced stresses and agricultural pests.

Yet, within this critical landscape, challenges surfaced. The deteriorating condition of natural vegetation, the struggle to acclimate introduced species to harsh environments, and the complexities in gathering seeds from local species were notable concerns. The rising interest in native species stems from their resilience, efficiency in resource utilization, and the imperative to preserve genetic heritage for sustainable development.

Dr. Azaiez emphasized the profound impact of pastoral seeds on rural development and desertification combat. However, challenges persist in the seed sector, such as limited variety, inadequate adaptation to diverse environmental conditions, and substantial gaps in scientific data.

His recommendations included a SWOT analysis, outlining strengths like existing infrastructure and the growing support for afforestation. Identified weaknesses ranged from limited knowledge to waning interest in local species. The opportunities revealed a burgeoning demand and the potential for awareness initiatives. Threats were notable, encompassing budget constraints, lack of experienced technicians, grazing pressures, and inadequate community involvement in vegetation programs.



Fig. 2. Day One Presentations

The second presentation was conducted by Mr. Soufian Hadidi from the DGF, spotlighting the pivotal role of the Seed Service section within the training. This sector entails a myriad of responsibilities, including

oversight of seed harvests in designated areas, continuous management of seed populations, and procurement of seeds from exotic arboretum species. The focus lies on upholding established standards for tree selection, coordinating the collection of seeds from valuable pastoral plants, managing seed stocks, treatment, analysis, supply to forest nurseries, and short to medium-term seed preservation. The comprehensive process involves on-site visits for harvest, identification of seed-bearing trees, operational planning for harvest, seed drying, collection, transportation to central hubs, temporary storage, and final delivery to the seed service. Noteworthy species harvested encompass acacia, pine, casuarina, carob, assorted pastoral species, and eucalyptus. Mr. Soufian highlighted Tunisia's rich biodiversity, housing a diverse array of species highly valued for their nutritional benefits and varying preferences among Tunisian livestock. This diverse spectrum serves as an ideal resource for pastoral use. Species like *Ceratonia siliqua*, *Colutea atlantica*, *Acacia tortilis*, and *Medicago arborea* exhibit unique adaptations enabling them to thrive across the varied landscapes of Tunisia.

However, identified challenges encompass the identification of pastoral species, immature seed harvesting, low germination rates, and limited or moderate seed quantities, necessitating attention. Proper species identification before harvesting remains pivotal. To address this, collecting not only seeds but also fruit and leaf samples for botanical identification with specialist assistance is recommended. Conclusively, addressing these challenges stands as a critical factor in ensuring efficient seed management.

The subsequent session explored the Importance and Viability of Seeds and Techniques of Germination, shedding light on critical methods involved in this pivotal agricultural process. Stressing the timeliness of seed collection, Dr. Aziez emphasized the significance of gathering seeds right before their natural dispersal, leveraging visual indicators of their varying maturity. To assist this, a comprehensive schedule of indigenous rangeland and silvopastoral species, along with their specific maturity dates, was provided to enhance accurate collection timing. Dr. Aziez detailed various methods for seed collection, distinguishing between manual and mechanical techniques based on seed size and type. The presentation emphasized key stages of seed preparation, encompassing both natural and mechanical drying methods to preserve seed quality. Furthermore, Dr. Aziez explained the use of manual and mechanical threshers to process collected seeds efficiently and detailed subsequent cleaning processes to ensure high-quality seeds for storage. The significance of treatments, especially regarding moisture and temperature control, was highlighted for effective seed conservation. Finally, the presentation concluded with a comprehensive exhibit of machinery types critical in seed collection, cleaning, threshing, and essential treatments, providing an in-depth understanding of machinery's role in this crucial agricultural process.

This was followed by a presentation on Seed Germination and Factors Impacting Seed Germination, exploring the vital processes involved in seed testing and germination. Dr. Aziez highlighted the pivotal role of seed tests, specifically focusing on purity and physiological evaluations. Purity tests aim to determine seed quality by identifying contaminants such as inert matter, other crop seeds, or weed seeds. The presentation detailed the methods used to assess seed purity, emphasizing the importance of achieving a safe seed percentage for optimal crop growth. The session navigated through the intricate steps of seed germination, emphasizing the significant influence of external factors. Factors such as water, light, and temperature were discussed for their profound impact on seed germination. Additionally, the correlation between moisture content and successful seed germination was underlined. The presentation explored stress factors affecting seed germination, underscoring their significant impact on success rates. Dr. Aziez

elucidated methodologies to estimate germination percentages and factors influencing success rates, providing a deeper understanding of the mechanisms driving seed germination.

9.1.3. Presentation session

The latter part of the day was dedicated to conducting a SWOT analysis concerning the Indigenous Plant Seed Sector in Tunisia. The focus was on examining the challenges and constraints it faces in two distinct systems: the Rangelands (Pastoral) and agropastoral systems. The rangeland covered the southern area, while the silvopastoral covered the middle and northern geographical areas of Tunisia (Fig. 3).

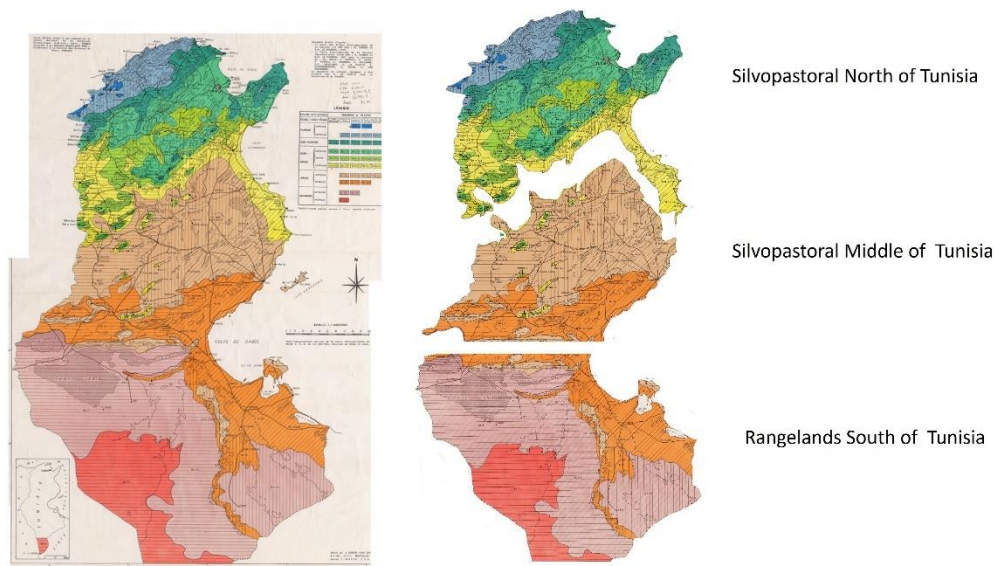


Fig 3. Geographical Areas of Rangelands and Silvopastoral Systems in Tunisia.

To facilitate this analysis, participants were organized into three distinct groups, symbolizing the significant domains of rangelands, silvopastoral practices, and research as cross cutting, each group was tasked with delving into the subject matter, discussing their findings, and consolidating the outcomes of their analyses (Fig. 4). This led to each group presenting its work, showcasing their perspectives and conclusions derived from their respective discussions and analyses.



Fig. 4. Collaborative SWOT Analysis Working Groups for the Indigenous Plant Seed Sector in Tunisia

Following the group discussions and presentations, a comprehensive synthesis was conducted, aiming to combine the conclusions drawn from each team's/system analysis. The purpose was to compile a unified SWOT analysis that summarized the collective insights. This comprehensive summary provided an integrated view, consolidating the diverse perspectives from the rangelands, silvopastoral practices, and research groups. The final SWOT analysis presented a comprehensive overview of the Indigenous Plant Seed Sector in Tunisia, merging the varied viewpoints and understandings derived from these distinct spheres.

Indigenous plants seed sector in Tunisia: challenges and constraints (SWOT analysis)

Strengths

- **Expansive Pastoral Zones:** Extensive areas dedicated to pastoral activities.
- **Diverse Species Selection:** Wide variety of species present.
- **Rich Genetic Resources:** Abundance of indigenous pastoral and silvopastoral species like Hallab, Jadari, and Arfaj.
- **Accessible Nurseries:** Availability of nurseries for vegetation growth.
- **Available Infrastructure:** Existing infrastructure to support pastoral activities.
- **Specialized Publications:** Access to resources like forest magazines.
- **Seed Propagation Companies:** Presence of companies specializing in seed propagation and production.
- **Experienced Staff:** A team with valuable expertise in the field.
- **Educational Resources:** Provision of extension

Weaknesses

- **Environmental Degradation:** Deterioration of the environmental system due to inadequate management strategy
- **Inadequate Mother Plant Management:** Insufficient care impacting seed quality during production
- **Lack of Sector Strategy:** Absence of a clear plan for sector development.
- **Species at Risk:** Certain species facing extinction due to inadequate conservation.
- **Workforce Shortage:** Limited skilled labor affecting operations.
- **Untapped Water Sources:** Underutilization of alternative water sources for seed production.
- **Communication Gap:** Absence of a centralized platform for stakeholder achievements.
- **Outdated Legislation:** Lack of updated regulations and a clear industry roadmap.
- **Funding and Coordination Issues:** Insufficient funds and poor stakeholder coordination hindering

Opportunities

- **Utilization of Unconventional Water Sources** like Sewage Water
- **Encouraging Enhanced Collaboration** among Involved Parties
- **Growing Market Demand** for Medicinal and Aromatic Plants
- **Rising Interest** in Ecotourism
- **Urgency for Responsible Exploitation** of Natural Reserves
- **Active Involvement** of NGOs and Development Programs
- **Expansion of Pastoral Seed Multiplication Centers**
- **Empowering Economically Marginalized Groups**
- **Enhancing Local Livestock Sector Profitability**
- **Targeting National Self-Sufficiency** in Seedling Production
- **Development of Climate-Resilient Hybrid Varieties**

Weaknesses

- **Soil Salinity and Land Degradation**
- **Agricultural Expansion Diminishing Pastoral Areas**
- **Regulatory Barriers Hindering Investment**
- **Heightened Risk of Wildfires**
- **Climate-Induced Drought Frequency**
- **Insufficient Strategic Seed Stock**
- **Challenges from Invasive Species**
- **Emergence of Novel Diseases and Pests.**

9.2. Day 2

9.2.1. Presentation session

The second day commenced with Dr. Azaiez's presentation on pastoral and silvopastoral seed germination and Factors Impacting Seed Germination. The session delved deeply into the intricate processes related to seed testing and germination. It initiated by underscoring the significance of seed tests, focusing particularly on purity and physiological evaluations. The tests aimed to ascertain seed quality by scrutinizing the presence of contaminants or impurities like inert matter, crop seeds, or weed seeds, employing various tools such as sieves and sorting machines for a comprehensive examination. Dr. Azaiez detailed the methods used to assess seed purity, emphasizing the necessity of a safe seed percentage for successful crop growth and optimal yield.

Moreover, the session explored the complex process of seed germination, emphasizing the role of external factors such as water, light, and temperature. It extensively discussed their profound impact on seed germination, especially the correlation between moisture content and successful seed growth. The presentation highlighted stress factors impacting seed germination, emphasizing their critical influence on success rates and germination speed. Dr. Azaiez explained the methodologies for estimating germination percentages and their influence on success rates, providing a deeper understanding of the complex mechanisms behind seed germination (Fig. 5).



Fig. 5. Day Two Presentations

Following this, Dr. Azaiez conducted a comprehensive exploration of the dynamics within the soil seed bank, focusing on the silvopastoral and rangeland ecosystems. The presentation scrutinized the classification of plant species based on their seed viability, analyzing the multifaceted factors that influence seed vitality. It offered insights into soil conditions, climate variations, and ecological nuances governing seed longevity in diverse environments. The discussion underscored the environmental significance of the soil seed bank, dictating the density and plant cover of silvopastoral species, significantly impacting the ecological balance and biodiversity of these landscapes. The presentation also detailed methodologies to estimate the seed bank, unveiling vital insights into these pivotal reserves. It included a noteworthy study conducted in the Kingdom of Saudi Arabia, meticulously evaluating the relationship between the soil seed bank and resulting plant cover. This comprehensive study revealed 102 distinct plant species, showcasing the intricate interplay between the soil seed bank and the resulting plant diversity, defining the biodiversity and health of these environments.

Lastly, Dr. Sawsan Hassan presented on the " Establishment and Management of Silvopastoral Nurseries (Propagation Techniques), commencing with the imperative to rehabilitate degraded rangelands and silvopastoral lands. She intricately delved into the definition, purpose, and significance of silvopastoral nurseries in agroforestry, emphasizing their pivotal role in restoring these ecosystems. Dr. Sawsan elucidated various types of silvopastoral nurseries, considering their sizes and diverse purposes, catering to the specific needs of rehabilitation efforts (Fig. 5).

The presentation provided a detailed sequence, meticulously outlining the essential steps to establish these nurseries. Covering everything from initial planning and design considerations to the careful selection of suitable sites based on soil quality and environmental factors, each phase received thorough attention. Dr. Sawsan highlighted the necessary infrastructure, including structures, facilities, tools, and equipment vital for successful propagation.

She then guided the audience through the process of seedling production, starting with soil mixtures and moving on to seedling care, pest and disease management, and the vital monitoring of growth and development. Her discussion culminated in exploring the hardening and transplanting phases, shedding light on the meticulous procedures required for successful transplantation.

The presentation concluded by delving into propagation methods, encompassing both traditional and modern techniques. This highlighted the evolving landscape of silvopastoral rehabilitation practices. Dr. Sawsan's extensive coverage provided a valuable guide, illuminating the multifaceted process of establishing and managing silvopastoral nurseries, crucial for restoring degraded lands.

9.2.2. Working groups session

The groups assembled earlier were assigned a task: analyzing the challenges faced by the Indigenous seedlings and plants sector in Tunisia. Each group took on the subject, discussed their findings, and organized their analyses. This was followed by each group sharing its work, presenting their unique perspectives and conclusions.

After these discussions and presentations, a comprehensive synthesis was conducted to bring together the findings from each team's analysis. The goal was to create a unified SWOT analysis that summed up the collective insights. This all-encompassing summary provided a holistic view by bringing together different perspectives from rangelands, silvopastoral practices, and research groups. The final SWOT analysis offered a complete understanding of the Indigenous Plant Seedling Production Sector in Tunisia by merging different viewpoints and understandings from these unique spheres.

Indigenous seedlings production sector in Tunisia: challenges and constraints (SWOT analysis)

Strengths

- Availability of nurseries covering the Republic's territory
- Diverse range of pastoral and forest species
- Accessible knowledge resources
- Insights gained from developmental projects
- Presence of seed purification and filtration equipment
- Available workforce that needs skill enhancement.
- Adaptability of indigenous species to various stresses
- Herbarium collection of specimens

Weaknesses

- Absence of specialized labor in collecting and sorting seeds
- Lack of interest in planting pastoral seedlings
- Challenges with water quality and scarcity in nurseries
- Shortage of human resources
- Insufficient field materials
- Issues with seed quality and monitoring
- Lack of expertise in identifying rangelands and silvopastoral plant species
- Challenges with soil mixture

Opportunities

- Establishing an agricultural development group for seed production
- Establishing specialized private greenhouses for pastoral and silvopastoral species
- Utilizing non-traditional water sources
- Engaging scientific and development research institutions
- Meeting the substantial demand for pastoral and silvopastoral species
- Exploring potential public-private partnerships
- Developing a digital platform
- Expertise in domesticating pastoral plants
- Combatting desertification and enhancing livestock productivity
- Contributing to national economic improvement

Weaknesses

- High salinity level
- Free distribution of seedlings
- Degradation of vegetation cover and seed scarcity
- Increase in diseases and pests due to climate change
- Limited availability of water

9.3. Day 3

The training included a field trip to Al Grine in Chebika (Kairouan) where the fields of seed multiplication (OEP) and the forest nursery and seed cleaning and processing machines (Forest Service of the Kairouan CRDA and DGF) have been presented. During this visit, participants have also visited the *Acacia cyanophylla* plantation in Kandar and noted the failure of the exotic species and the constraints of its management and grazing (Fig.6).



Fig. 6. Field trip activities

9.4. Day 4

9.4.1. Working groups session

According to their knowledge and expertise, each group was tasked with suggesting a selection of indigenous trees, shrubs, and herbs suitable for use in rehabilitating pastoral and agropastoral systems. Each group then presented their chosen list along with the reasons supporting their selections (Fig. 7).

Following these insightful presentations, a comprehensive discussion unfolded among the participants. This discourse aimed to amalgamate collective insights and suggestions, paving the way for a series of recommendations for the next course of action. These recommendations include:

- Identify recommended plant species and outline the necessary steps for seed procurement, seedling production, and optimal propagation methods, considering both traditional and modern approaches.
- Establish pilot sites and greenhouses in the northern, central, and southern regions to nurture the selected species in collaboration with DGF, OEP, INRGREF, IRA, and ICARDA.
- Initiate operations at the Pastoral Seed Production Center in Ghaizan, forming a partnership between the private and public sectors.
- Create informative brochures and instructional leaflets focused on the identified forest pastoralist species.
- Promote the utilization of non-conventional water sources in the cultivation of seedlings and seed fields.



Fig. 7. Working Groups for selection of indigenous trees, shrubs, and herbs suitable for use in rehabilitating pastoral and silvopastoral systems in Tunisia

9.4.2. Closing ceremony

The closing session and certificates awarding were supervised by Dr. Aymen Fria ICARDA Program Coordinator, Mr. Jamel Kailene Acting DG of the DGF, and Mr. Ezzeddine Chalhaf the DG of OEP. After presenting the main recommendations of the course and the outcomes of the different discussion sessions by 2 selected trainees (Dr. Imtine Hamdeni from INRGREF and Dr. Farah Ben Salem from IRA), all speakers expressed their appreciation to ICARDA for coordinating, planning, and organizing this training course. They also congratulated the participants for their great interaction with the various presentations and practical training included in the training course program and asked them to use the skills and knowledge acquired to disseminate the benefits in the country (Fig. 8 & 9).



Fig. 7. Closing Ceremony and Certificate Distribution for the Training Course



Fig. 8. Group Photo Marking the Conclusion of the Training Program

Annex 1: Training agenda

Group Training Course on Seed Collection & Conservation and Nursery Management of Indigenous Silvopastoral Species Le Royal Hotel, Hammamet 24 – 27 October 2023



Course Description

Rational: Tunisia's extensive rangelands, covering more than 35% of the nation's land, are essential for supplying at least 30% of livestock feed. Unfortunately, overexploitation through overgrazing, early grazing, and wood cutting has caused their degradation and decreased productivity. When this degradation becomes irreversible and natural seed stores are depleted, the only viable solution is to reintroduce vanished plant species, typically using shrub seedlings or seeds. While planting shrub seedlings is preferred for rapid ecosystem recovery and local economic benefits, seeding can cover larger areas faster, though with fewer economic opportunities. High-quality seeds and seedlings are crucial for program success and combining them with soil preparation and water harvesting measures can improve their effectiveness. To enhance seed and seedling production, capacity building and knowledge improvement among human resources are vital, with organizations like ICARDA partnering with DGF, OEP and NARS to empower technical staff for rangeland and silvopastoral system rehabilitation/restoration projects.

Objectives:

- Enhance skills of DGF, OEP, and NARS partners for active participation in silvopastoral rehabilitation projects.
- Share knowledge of indigenous silvopastoral species seed production (collection, viability testing, conservation, etc.)
- Develop skills in nursery and seedling management.

The course topic: The course includes theoretical (lectures) and practical aspects on:

- Challenges and opportunities of indigenous rangeland and silvopastoral species (SWOT Analysis).
- Importance, viability, techniques and factors affecting seed germination.
- Techniques of collecting and conserving seeds.
- Establishment and management of silvopastoral nurseries (propagation techniques).
- Mapping selected silvopastoral species to agroecological zones in Tunisia.

Expected output:

At the end of the training, the participants will be able to understand the principles, requirements, and best-practices for seed collection & conservation and nursery management of indigenous range-land and silvopastoral species.

Target beneficiaries:

The target trainees are technical staff of the DGF, OEP, other development agencies and NARS institutions, with diverse educational backgrounds and experiences in seed and seedling production, multiplication and management. A total of 30 trainees are expected to attend the group training course.

Trainers:

- Dr. Mounir LOUHAICHI (ICARDA – Tunisia)
- Dr. Azaiez OULED BELGACEM (ICARDA – Tunisia)
- Dr. Sawsan HASSAN (ICARDA – Tunisia)
- Mr. Jamel KAILENE (DGF – Ministère de l'Agriculture, Tunisia)



**Group Training Course on
Seed Collection & Conservation and Nursery Management of
Indigenous Silvopastoral Species
Le Royal Hotel, Hammamet
24 – 27 October 2023**



AGENDA

Tuesday 24 October 2023		
08:30 – 09:00	Registration	Ulysse Event
09:00 – 09:30	Opening session	Concerned partners ICARDA
09:30 – 10:00	Indigenous rangeland/ silvopastoral seeds and seedling challenges and opportunities in MENA region	Dr. Mounir Louhaichi Dr. Azaiez Ouled Belgacem
10:00– 10:30	Indigenous rangeland/ silvopastoral seeds and seedlings in Tunisia: challenges and constraints	Mr. Jamel Kailene
10:30 – 11:00	Group Photo & Coffee Break	
11:00 – 12:00	Lecture: Importance and viability of seeds and techniques of germination	Dr. Azaiez Ouled Belgacem
12:00 – 13:00	Exercise: Factors affecting seed viability and germination	Dr. Azaiez Ouled Belgacem Dr. Sawsan Hassan
13:00 – 14:30	Lunch	
14:30 – 16:00	Working group on seeds: Indigenous plants seed sector in Tunisia: challenges and constraints (SWOT analysis) Group presentation	All

Wednesday 25 October 2023

09:00 – 09:30	Principles of establishing and managing mother collections and rangeland / silvopastoral botanical garden Soil seed bank	Dr. Azaiez Ouled Belgacem Dr. Sawsan Hassan
09:30 – 10:30	Techniques of collecting and conserving seeds	Dr. Azaiez Ouled Belgacem
10:30 – 11:00	Coffee break	
11:00 – 13:00	Establishment and management of silvopastoral nurseries (propagation techniques)	Dr. Sawsan Hassan DGF
13:00 – 14:30	Lunch	
14:30 – 16:00	Working group on seedlings: Indigenous plants seed sector in Tunisia: challenges and constraints (SWOT analysis) Presentation per group	All

Thursday 26 October 2023

All day	Field trip: - DGF nursery in Chebika (Kairouan), - OEP seed cleaning unit at El Grine (Kairouan) - Acacia plantation in Kandar (Sousse)	All
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Friday 27 October 2023

8:30 – 10:00	Interactive session: Critical date for seed collection and suitable propagation techniques of key rangeland/ silvopastoral species	All
10:00 – 10:30	Coffee break	
10:30 – 11:30	Interactive session: Mapping selected rangeland/ silvopastoral species to agroecological zone in Tunisia	All
11:30 – 13:00	General discussion and recommendations Course evaluation, certificates and closing	All
13:00	Lunch and departure	



Annex-2: List of participants

Training Course
Seed Collection & Conservation and Nursery Management of
Indigenous Silvopastoral Species
Le Royal Hotel, Hammamet, 24 – 27 October 2023

دورة تكوينية
حول جمع وحفظ بذور النباتات الرعوية الغابية وإدارة المناكب
فندق رويال الحمامات – تونس
2023 27-24 أكتوبر

الرقم	Name / الاسم	Institute / المؤسسة	Email / البريد الالكتروني	Signature / التوقيع	*
1	المصطفى السون	مدرسة الفلاحة بظاوية			☒
2	نعمان مسعودي	مدرسة الفلاحة بظاوية			☒
3	مير جويحي	مدرسة الفلاحة بظاوية			☒
4	فرح بن سالم	معهد المناطق القاحلة			☒
5	عزالدين بالقي	ديوان تربية الماشية بطنجة			☒
6	أيمن البوصوي	ديوان تربية الماشية بطنجة			☒
7	حادر السني	ديوان تربية الماشية بطنجة			☒
8	هاثي	ديوان تربية الماشية بطنجة			☒
9	سني حنزولي	ديوان تربية الماشية بطنجة			☒
10	محمد عبد القادر	ديوان تربية الماشية بطنجة			☒

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فندق رويال الحمامات – تونس
2023 27-24 أكتوبر

* /Signature	Email / البريد الالكتروني	Institute / المؤسسة	Name / الاسم	الرقم
☒		المشورية لجمعية للتربية الغابية بالقيروان	ربيع الزايري	11
☒		جمع زحمات مزارعي الطماطم المستقبل دوق	هاك بن عبد الله	12
☒		المشورية لجمعية للتربية الغابية بقرين	ميروكة بن جلفا	13
☒		الادارة العامة للعلماء	معتيان حديدي	14
☒		المشورية لجمعية للتربية الغابية بسوسة	الأميني حصرمي	15
☒		المشورية لجمعية للتربية الغابية بتمبو	نزالدين تريب	16
☒		المشورية لجمعية للتربية الغابية بتمبو	عبد التبار بالجوخة	17
☒		صندوق الفلاحة زغوان	مصطفى السري	18
☒		INRGREF	إسمان حداثي	19
☒		INRGREF	وفاق محو الشفي	20

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حول جمع وحفظ بذور النباتات الرعوية الغابية وإدارة المنابت
فندق رويال الحمامات – تونس
27-24 أكتوبر 2023

* / التوقيع / Signature	البريد الإلكتروني / Email	المؤسسة / Institute	الاسم / Name	الرقم
☒		INRGREF	لمياء الصمروني	21
☒		INRGREF	فاذية الدربالي	22
☒		INRGREF	مريم الرزقي	23
☒		ODESPANO	سوسن الكوكي	24
☒		ODA Dhaher	محمد كرادوي	25
☒		KAS	كمال خديجي	26
☒		Defont	عمار كعبان	27
☒		IOARDA	عزيز بلقاسم	28
☒		ICARDA	منير الوحيشي	29
☒		ICARDA	سوسن حسن	30

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فندق رويال الحمامات – تونس
27-24 أكتوبر 2023

* /Signature	Email / البريد الالكتروني	Institute / المؤسسة	Name / الاسم	الرقم
☒		CRDA Béja A. Forêt	مراد كواله	31
☒		CRDA Sousse	فواز شال	32
☐				33
☐				34
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