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Title: Cultivating Sulla for Silvopastoral Restoration the Mediterranean Basin

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Summary

This innovation employs *Hedysarum coronarium*, a drought-resistant native forage legume, to enhance soil quality by providing soil cover, nitrogen fixation, biodiversity enhancement, and improved water infiltration. Simultaneously, it also enhances the quality and availability of fodder.

Description

In the semi-arid regions of Tunisia, drylands endure a challenging environment marked by high temperatures and limited annual rainfall. Despite these harsh conditions, many marginal farmers rely on these drylands to generate income through livestock grazing. Unfortunately, due to worsening climatic conditions and mismanagement, these lands are experiencing severe degradation, creating a vicious cycle: overgrazing diminishes available grazing land, leading to accelerated degradation in those areas. To break free from this cycle, an innovative approach is imperative.

Recognizing this problem, the International Centre of Agricultural Research in Dry Areas (ICARDA), in collaboration with national partners such as the Office de l'Elevage et des Pâturages (OEP) and the Direction Générale des Forêts (DGF), devised a strategy focusing on native plant species adapted to the challenging environmental conditions. They specifically chose leguminous species for their ability to enhance soil nutrient content through nitrogen fixation, as well as their positive impact on livestock diets. One such perennial species, *Hedysarum coronarium*, commonly known as "Sulla," not only provides soil cover to reduce erosion but also enhances water infiltration. The vegetation cover intercepts rainfall, reducing runoff, while the shade it provides reduces evaporation. Additionally, the plant's roots improve soil porosity, enhancing soil infiltration capacity. All these advantages contribute to bolstering biophysical and socio-economic resilience.

This technology has yielded several positive impacts in the area. Productivity can increase from approximately 0.9 TDM (ton of dry matter: TDM) per hectare to around 10.4 TDM kg per hectare in good years (with more than average rainfall). Under average conditions, the productivity is around 5 TDM per hectare. *Hedysarum coronarium* has significantly improved the quality of fodder, benefiting local land users. Furthermore, the soil is now less susceptible to erosion, with improved water retention properties. Land users have reported reduced costs for imported feed due to enhanced fodder availability. Additionally, since Sulla is well-suited to the local climate, it demands minimal inputs, resulting in cost and labour savings.

Figure 1. Field of Sulla

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1. Technicality

In 2017, a degraded field underwent Sulla planting. Prior to manual seeding, the land was plowed, a process that required 45 minutes for a plough to cover 1 hectare at a cost of 11.25 USD per hectare. Manual seeding, which involved 10 person-hours per hectare, followed this plowing. To prevent overgrazing, grazing management adhered to guidelines developed by ICARDA and national partners.

In the first year, twenty-five sheep and goats grazed one hectare for a period of thirty days. In subsequent years, when the vegetation had become more rooted and developed, forty animals grazed one hectare for a similar duration.

For optimal production, reseeding of the field is required every three years. This makes the activities and associated costs detailed in this document a recurring event every three years. To kickstart this process, approximately 30 kg of Sulla seed, costing a total of 45 USD, were utilized. This resulted in an average of around 120 plants per square meter.

Figure 2. Natural pollination in a Sulla field

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2. Benefits and Weaknesses

2.1 Benefits

Sulla has several benefits, such as:

- Decreased feed imports.
- Better year-round availability of fodder.
- Less risk of drought damage.
- Enhanced soil condition due to improved soil moisture and fixed nitrogen.
- Improved economic situation.
- Restoration of degraded land.

2.2 Weaknesses

The primary challenge associated with cultivating Sulla lies in effectively managing livestock grazing to support its sustainability. During the establishment year, Sulla should be lightly grazed to ensure good root development and plant numbers for the second year. Sulla does not tolerate heavy grazing as the relatively high soft crowns and succulent stems are preferentially grazed and easily damaged. Rotational grazing is to be preferred, depending on moisture, day-length and soil temperature. After grazing, at least 10 cm of stubble should remain to avoid delay in regrowth.

Figure 3. Sampling of Sulla

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Figure 4. Overview of the restored site using *Hedysarum coronarium*

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Figure 5. Sheep grazing *Hedysarum coronarium*

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Figure 6. Soil preparation for sulla reseeding

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3. Validation of the practice

A well-documented case study is available from a 40-hectare field in the Zaghouan governate in Tunisia. It has been tested and validated since 2017.

4. Minimum requirements for the successful implementation of the practice

The most important bio-physical factor for successful implementation is that rainfall should be between 250 and 500 mm per year. Furthermore, Sulla generates most impact on degraded areas that would otherwise be unproductive.

5. Related/associated technologies

- Conservation agriculture for smallholder farmers in dryland areas: ID 4674.

6. Further reading

- WOCAT Factsheet Native Drought-Tolerant Forage Species for Enhanced Dryland Pasture Restoration [Tunisia] by Joren Verbist, Mounir Louhaichi, Slim Slim, available from https://qcat.wocat.net/en/wocat/technologies/view/technologies_5919/
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- Mounir Louhaichi: Research Team Leader of Rangeland Ecology and Forages – ICARDA.
- Slim Slim: Associate Professor - School of Higher Education in Agriculture of Mateur Tunisia.
- Sawsan Hassan: Research Associate Coordinator of Forage Systems – ICARDA.
- Joren Verbist: Technologies Systemization Officer - ICARDA.