



INITIATIVE ON
Livestock and Climate



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Scaling the technology for producing livestock feed pellets using agricultural byproducts in Tunisia

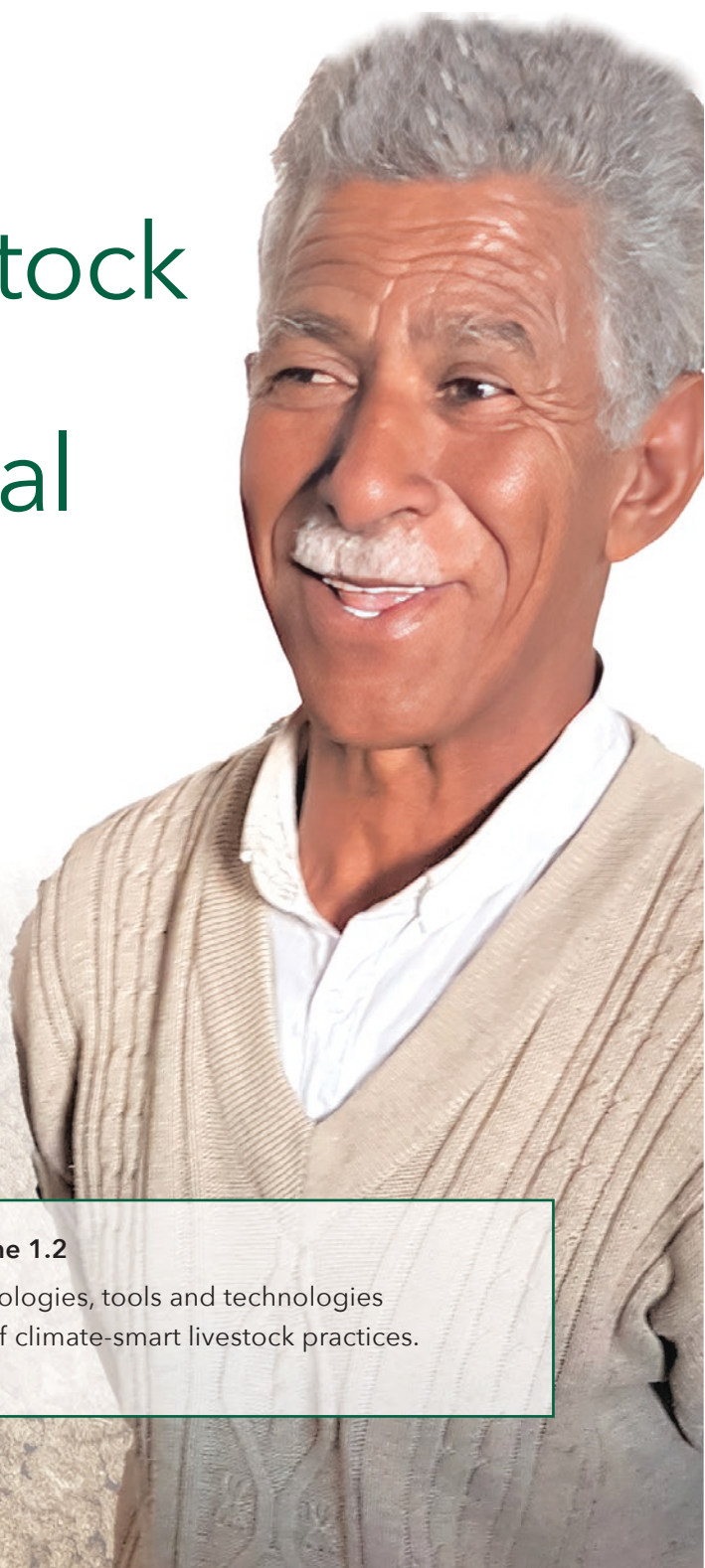
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Contributing to Livestock and Climate Initiative Outcome 1.2

Research, extension and farmers have access to methodologies, tools and technologies supporting socially inclusive development and scaling of climate-smart livestock practices. Where appropriate, training will be provided.



Innovation development and uptake is not only about the innovation i.e. the technology or process itself, it is also about developing an appropriate scaling methodology. Developing appropriate scaling methodologies has been a key focus of the CGIAR Research Initiative on Livestock and Climate.

In Tunisia, with the support from Livestock and Climate and the Initiative on Agroecology, ICARDA developed a technology and scaling methodology for the co-production of a more resilient, low-emission livestock feed system. Working with national government partner Office de l'élevage et des pâturages (OEP) and private sector partner Juhaina, the technology is a small-scale compressor that produces pellets. Pellets allow nutritious agricultural byproducts to be combined with grains and forage crops to produce cost-efficient, preservable feed pellets. After refining the formula with farmers to develop appropriate and qualitatively sufficient feed pellets using locally available inputs, the scaling methodology focused on farmer cooperatives in the south of Tunisia, where there is high demand for supplementary feeds. This innovation and its scaling will help alleviate grazing pressure on rangelands.

The issue

The rangeland areas in the south of Tunisia receive less than 200 mm of rainfall annually. A significant proportion (40–50%) of this area has declining soil organic carbon content, and grazing resources are increasingly scarce. Livestock owners rely on expensive imported concentrates during certain periods of the year due to feed shortages that are likely to increase due to climate change-induced drought. Higher daytime temperatures now make grazing less efficient, further increasing demand for supplementary feeding, particularly for the camels, sheep and goats owned by the communities living in the oases.

Using existing agricultural byproducts, it is possible to help livestock owners by making nutrient-dense and cost-effective feed available for small and large ruminants. Localising feed production also reduces the use of imported ingredients, like soybeans and maize, helping Tunisia save foreign exchange currency. Tunisia has many discarded byproducts from local agri-food supply chains—particularly olive cakes, date kernels, and downgraded dates—which still contain useful nutrients. The processing of these as animal feed represents a sustainable solution for increasing livestock nutrition for mixed crops-livestock farmers.

To establish a livestock feed pellet technology using agricultural byproducts in a way that could be valorised and scalable, ICARDA learned from its previous research and stakeholder engagement experience with value chain development as part of CGIAR's Consortium Research Project on Livestock. In that project, the feed block technology failed due to low farmer uptake, resulting in dosing difficulties and blocks quickly breaking up and rotting. To resolve this, the new compressor combines ground-up agro-industrial byproducts to make a feed for small ruminants in pellet form. This makes dosing and preservation easier and ensures resistance to rotting.

The scaling pathway

To encourage feed pellet technology scaling, ICARDA with national partners followed four strategic pathways:

- ▶ Establishing a public-private partnership;
- ▶ Validating the technology and valorising agricultural byproducts;
- ▶ Beneficiary targeting and sustainable management; and
- ▶ Training and demonstrations.

Establishing a public-private partnership.

ICARDA worked with national partner OEP, which has an office in each of the 24 governorates in Tunisia—including the six arid governorates of the south classified as rangelands. Other partners included the research institute specialising in the south, Institut Des Régions Arides, and the National Institute of Agronomic Research of Tunisia (INRAT). However, for scaling, a private sector partner was needed and OEP facilitated an introduction to Juhaina, a new Chinese private sector company that was planning to import the small-scale pelletizer machines that would enable scaling. A partnership was established with Juhaina who provides two types of pelletizers, one with a production capacity of approximately 110 kg per hour for 2,200 dinars (TND) (approximately US\$700) and one of 500 kg per hour (for 9,000 TND (approximately US\$2,870). The company assures after-sales service with spare parts and repairs.

Validating the technology and valorising agricultural byproducts.

We first purchased the smaller pelletizer and tested it at the OEP research station to find the best combination of ingredients. Our experiments focused on agricultural byproducts and residues widely available in Tunisia, mainly the wheat bran and barley grain that livestock owners receive with government subsidies, and local forage crops such as lucerne.¹ The publication brief *Profitability of Manufactured Feed Pellets for Small-Scale Crop-Livestock Farmers in Tunisia* explains these experiments with feed pellet formulas and models a business case for the pelletizer.

Pellet formulas can be adapted by farmers according to their animals' nutritional needs, as explained in the brief: *Nutrient-dense livestock feed pellets manufactured in Tunisia can compete with imported feed concentrates.*

The Innovation Profile *Feed pellet production with locally available products* illustrates the process we followed to achieve innovation readiness, including collaboration with lead farmers. ICARDA financially subsidised the pelletizers at 90% with 10% contribution from farmers to ensure their ownership of the technology. GIZ ProSol (SWC@ scale) project also learned about the technology and purchased some machines from Juhaina, which they distributed freely to their beneficiaries.

Beneficiary targeting and sustainable management.

To scale the technology, we focused on the south of Tunisia, where there is a high demand for alternatives to rangeland grazing and an ample supply of dates that are not good enough quality for human consumption, plus residues like date kernels and palm leaves. In this region, lucerne is grown between the date palms, and livestock owners receive barley grain and wheat bran subsidies from the government as supplementary animal feed. The objective of the scaling effort was to promote the use of the larger pelletizers by farmer cooperatives, known as 'farmer organisations.' Unlike individual farmers, these organisations have the capacity to access reliable quantities of agricultural byproducts. As members of farmer organisations, livestock owners supply their grain and bran quotas to the organisation, which then provides the lucerne and olive cake residue for pelleting. Farmers pay a service fee.

At least ten of the larger pelletizers have already been purchased by farmer organisations in the south of Tunisia, with Juhaina reporting it has sold sixty machines to farmers, cooperatives and small feed companies across Tunisia.

¹ Lucerne or alfalfa (*Medicago sativa*) is a deep-rooted, temperate, perennial pasture legume which is well adapted to mixed farming systems.

Training and demonstrations.

Training and demonstration days organised for farmer organisations that have shown interest in the technology have been an important part of the scaling process. With OEP support, demonstrations are led by a farmer organisation already using the technology, with explanations given on the composition of the feed pellets. As part of the demonstration, small ruminants were given pellets to demonstrate their palatability. To ensure long-term local viability, interested livestock owners are offered training and support to develop a basic business plan that involves investing in knowledge and skills related to pellet ingredients and fostering partnerships with fellow farmer organisations and local private sector actors.

Mr Hedi, the El Maarai Farmer Organisation manager in Zaafran, Governorate of Kebili, South Tunisia said, *"ICARDA provided us with a grinder, a pelletizer and a feed mixer. Thanks to this complete feed processing unit, we produced over 40 tonnes of feed pellets in 2023 composed of date palm byproducts, barley grains and lucerne. This balanced feed improves the growth rate of our ruminants and reduces labour."*

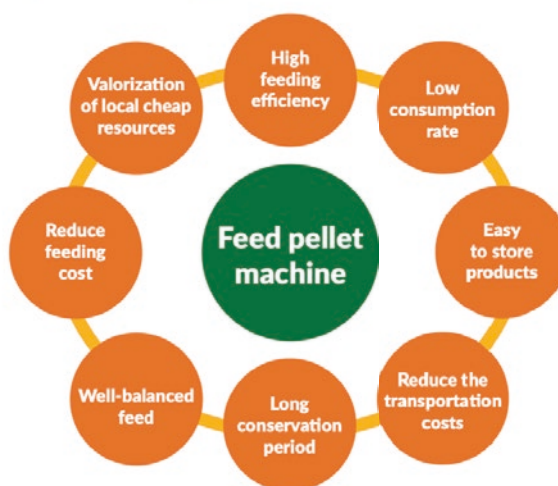
Lessons learned

on the scaling methodology

Several factors combined were instrumental to the success of our scaling efforts. The public-private partnership was key, with OEP support helping to identify and establish links with farmer organisations and private sector suppliers. This improved the commercial viability of the imported pelletizers. The subsidies provided were critical for purchasing the first set of machines. The Tunisian Agence de Promotion des Investissements Agricoles agreed that the machines could continue to be eligible for a 50% subsidy, but this may take some time to roll out.

In October 2023, a delegation of CIAT scientists visited Tunisia to learn more about **addressing feed gaps using resilient forage-based feed options and densification** and its applicability to other contexts. CIAT now plans to introduce pelletizers in Ethiopia and Kenya. The pelleting technology has been presented at several meetings in Tunisia as well as to CGIAR's feed and forage research community during online workshops and to a wider audience at the Tropentag conference in Prague in 2022. This increases the opportunities for further scaling.

Figure 1 Pellet machine usage opportunities



Source: Our elaboration based on several resources (2022).

The **CGIAR Research Initiative on Livestock and Climate 2022-24** aimed to build the capacity of stakeholders to adapt to climate change whilst mitigating livestock's negative climate impact. This series of outcome briefs shows how we have achieved this.

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