ICARDA

Science for resilient livelihoods in dry areas

Use of conservation agriculture in crop-livestock systems (CLCA) in the drylands for enhanced water use efficiency, soil fertility and productivity in NEN and LAC countries

April 2018 – December 2022

Traveling workshop: Integration of the livestock component

Tunisia, 1-4 July 2019

icarda.org

International Center for Agricultural Research in the Dry Areas

Second phase of the project

First phase of the project: Integrated Crop-Livestock Conservation Agriculture For Sustainable Intensification of Cereal-based Systems In North Africa and Central Asia: 2013 - 2016

Project Outcomes

- **Outcome 1)**

2,100 (70% of beneficiaries) farmers have adopted CLCA farming systems with increased production and improved cost-benefits compared to conventional systems;

- **Outcome 2)**

Locally adapted guidelines for CLCA technologies and practices are used by at least 8 participating NARES and IFAD investment project partners in their advisory services or promoted in their outreach to private input and service providers;

- **Outcome 3)**

At least 4 effective agricultural innovation systems - 1 in each implementation area of the 4 target countries - are coalesced in order to foster broad uptake of conservation agriculture practices within integrated semi arid crop-livestock production systems.

Target Numbers

The direct target group will be an estimated 3,000 (at least 50% women and 30% youth (below 35 years)) small crop-livestock farmers in drylands in LAC and NA participating in trials, action research, training and extension for the development and adoption of local adapted technologies and practices for CLCA systems;

Through the IFAD investment projects and project partners it is estimated that the training and adoption of technologies and practices for CLCA systems will reach an additional 10,000 small crop-livestock farmers;

In North Africa and over the four years, the grant will aim to target directly and indirectly 2,000 mixed cereal-sheep farmers whose farming practices stretch to over 50,000 – 60,000 ha.

2 Regions, 2 CG Centers, Multi national partners, Different production systems, Various commodities, Multidisciplinary approach

North Africa: Algeria - Tunisia

- Cereal – Livestock belt (barley – wheat – sheep)
- Mixed small to medium-scale holders
- Rainfall 200 - 450 mm, very irregular
- Poor soils, extremely low soil organic matter
- very high erosion risks
- Extended practice of fallow
- Supplementary irrigation of wheat in Algeria

Latin America: Bolivia - Nicaragua

- Maize-red beans-based systems in the rain-fed dry corridor of Nicaragua
- Low integration of livestock mainly dual purpose cattle
- High impacts of drought on crop losses and livestock mortality
- Maize, and Andean cereals that include quinoa or amaranth in Bolivia
- High pressure on the land, extension of quinoa and competition with camelid production



Significant Challenges

- Moving to no-till;
- Local machinery supply;
- Co-existence conservation agriculture and livestock;
- Livestock sector encompasses feed production, animal production, and in some cases, a manure management chain all of which require high integration with crop production systems;
- Balance to meet the livestock nutrients requirements and stubble retention;
- Adoption of retention of crop residues by resource-poor mixed smallholder farmers due to strong competition for residues by livestock;
- Forage inclusion tailored to fit conservation agriculture cropping systems and livestock feeding.

Trade-offs are complex and diverse

Benefits from CA and challenges for smallholders

Pittelkow et al. (2015)

Global meta-analysis using **5,463 paired** yield observations to compare CA, with conventional tillage practices across **48 crops** and **63 countries.**

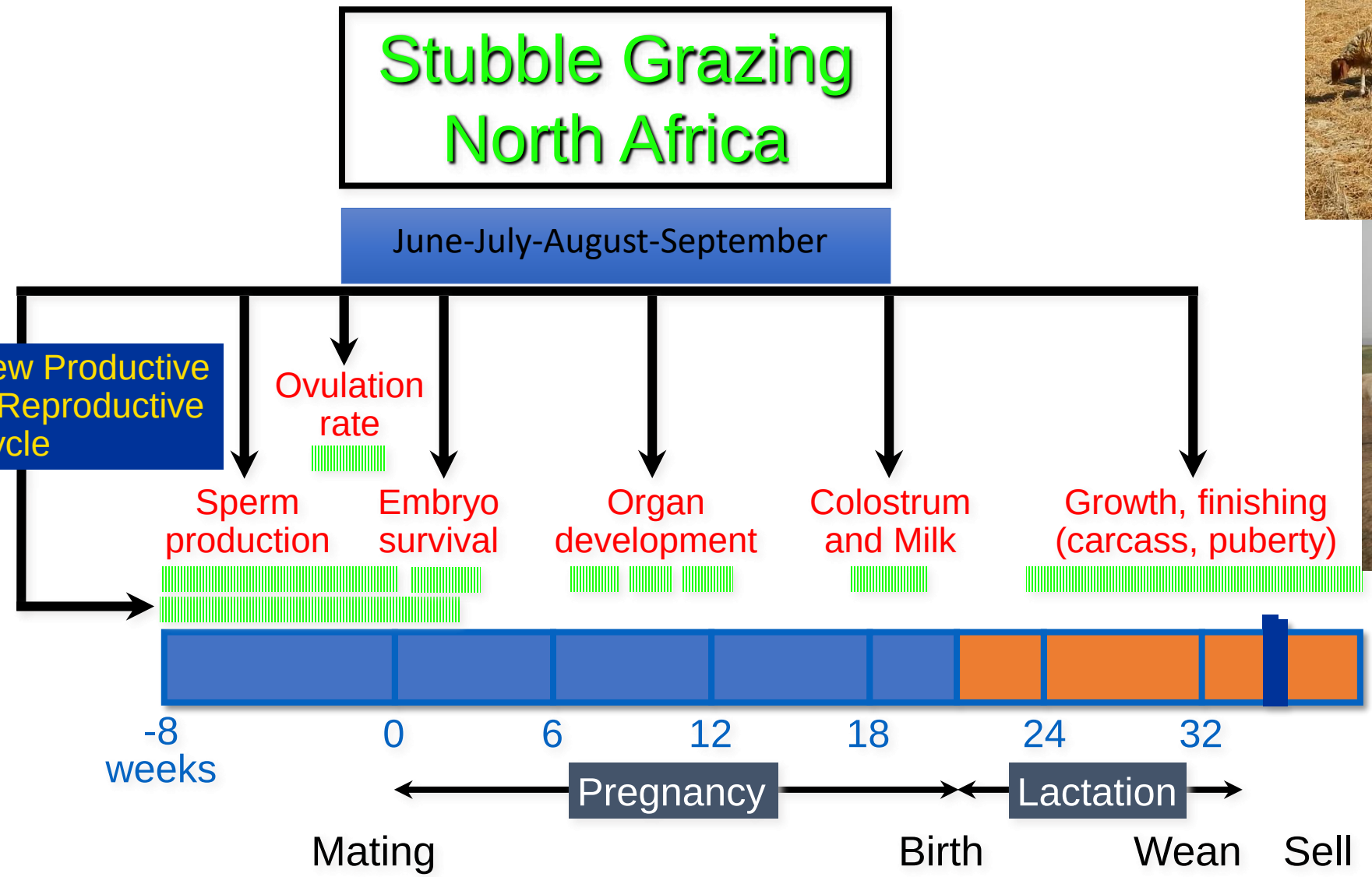
- CA in combination with residue retention and crop rotation significantly increases rainfed crop productivity in dry climates;
- It may become an important climate-change adaptation strategy for ever-drier regions of the world ***(COP 22)***;
- Resource-poor and vulnerable smallholder farming systems will have the greatest challenges adopting retention of crop residues due to strong competition for residues by livestock.

- Smallholders dominate both crop production and livestock systems in the NENA region
- Most of the poor residing in rural areas raise livestock:
- 70 percent in Tunisia,
- 78 percent in Algeria

Major lessons from Phase I

- Stubble grazing tools developed and validated in both countries;
- Forage alternatives and forage associations tested in both countries;
- On-station and on-farm pilot levels.

When is it important?

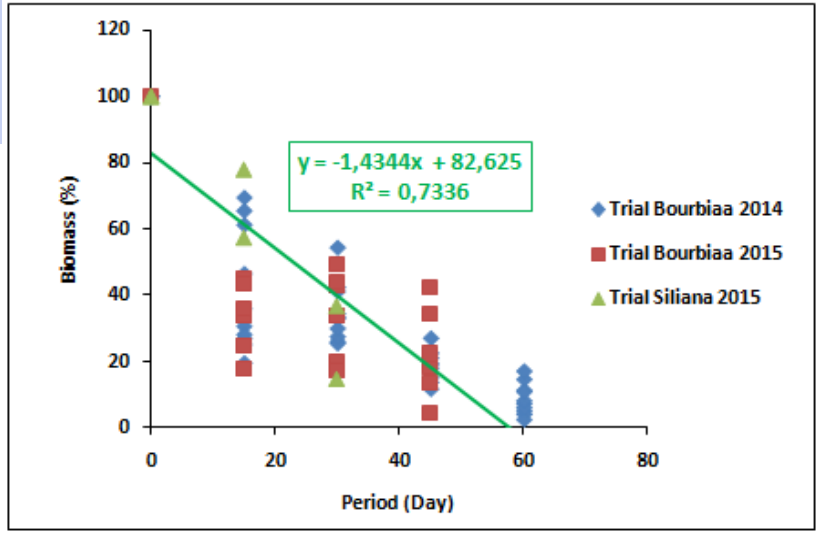


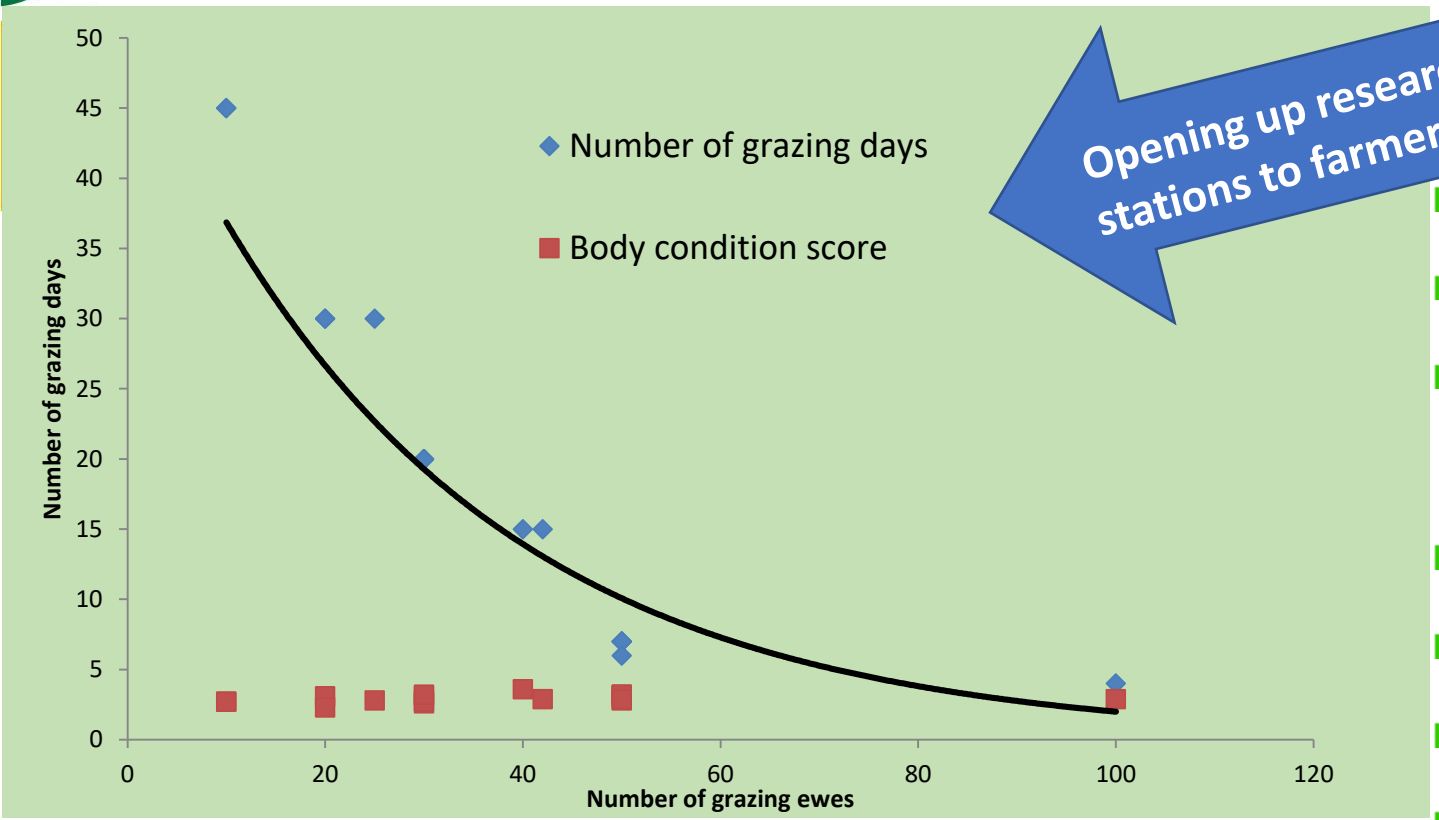
Optimizing on-farm stubble grazing: scalable model in M'Sila-Setif-Siliana

No till and keeping sheep in the system

100 %

20 - 25 %

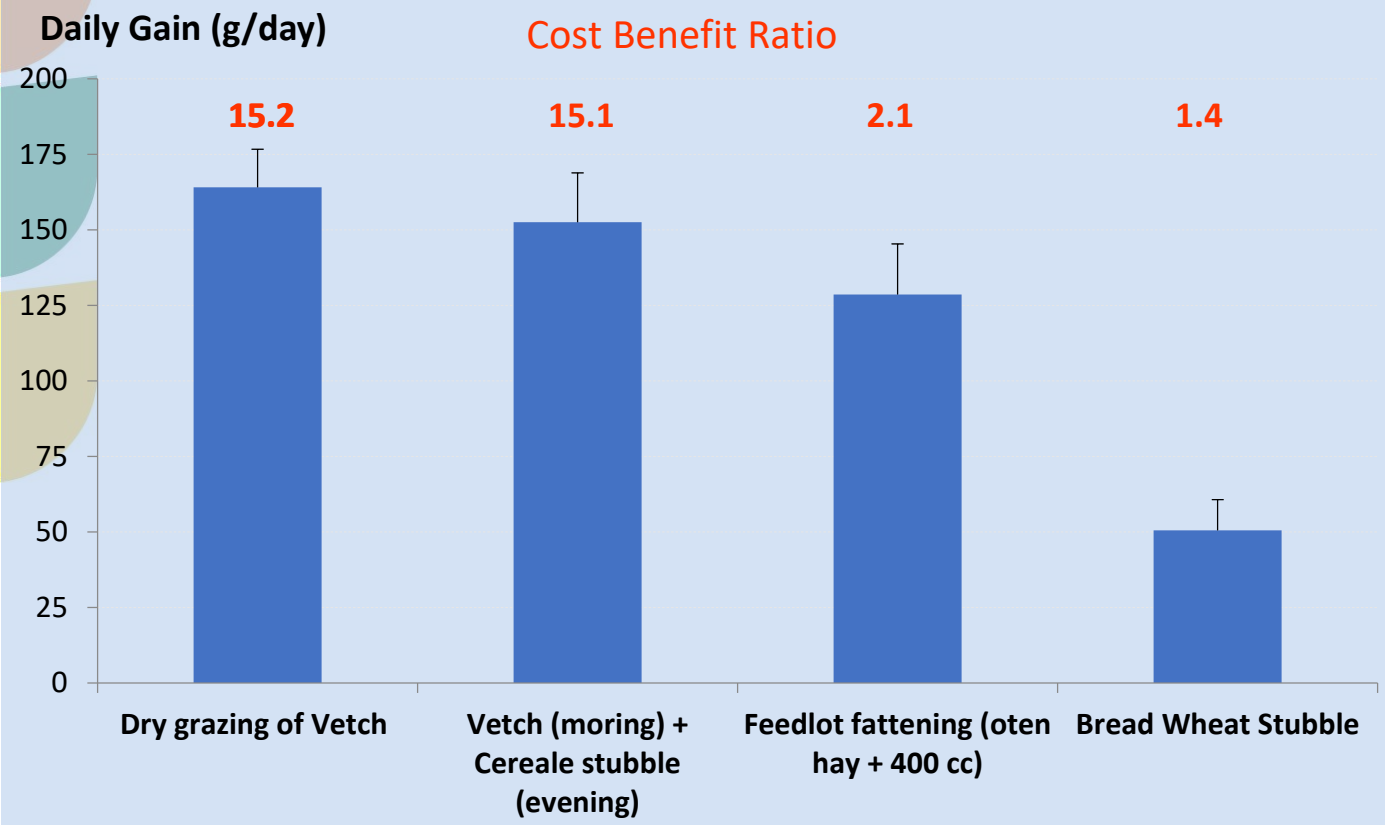




Opening up research from stations to farmers

- Residual wheat or barley stubbles: ≈ 0.6 to 1 ton/ha;
- Pull out animals if residual stubble biomass is near 0.6 T/ha
- Lambs in post-weaning stage (growing at 30-70 g/day)– Ewes during mating, mid pregnancy (slightly increasing weight – maintaining constant body condition score);
- Daily grazing time: 6-8 hours
- Stocking rate up to 30 heads/ha
- Number of grazing days 30-45 days
- If beyond 45 days, moderate supplementation from 250 to 300 g cc/head/day

Vetch is a profitable option to spare stubble, increase carrying capacity and productivity over mechanical fallow



Forage legumes such as vetch offer many options to cereal-livestock farmers:

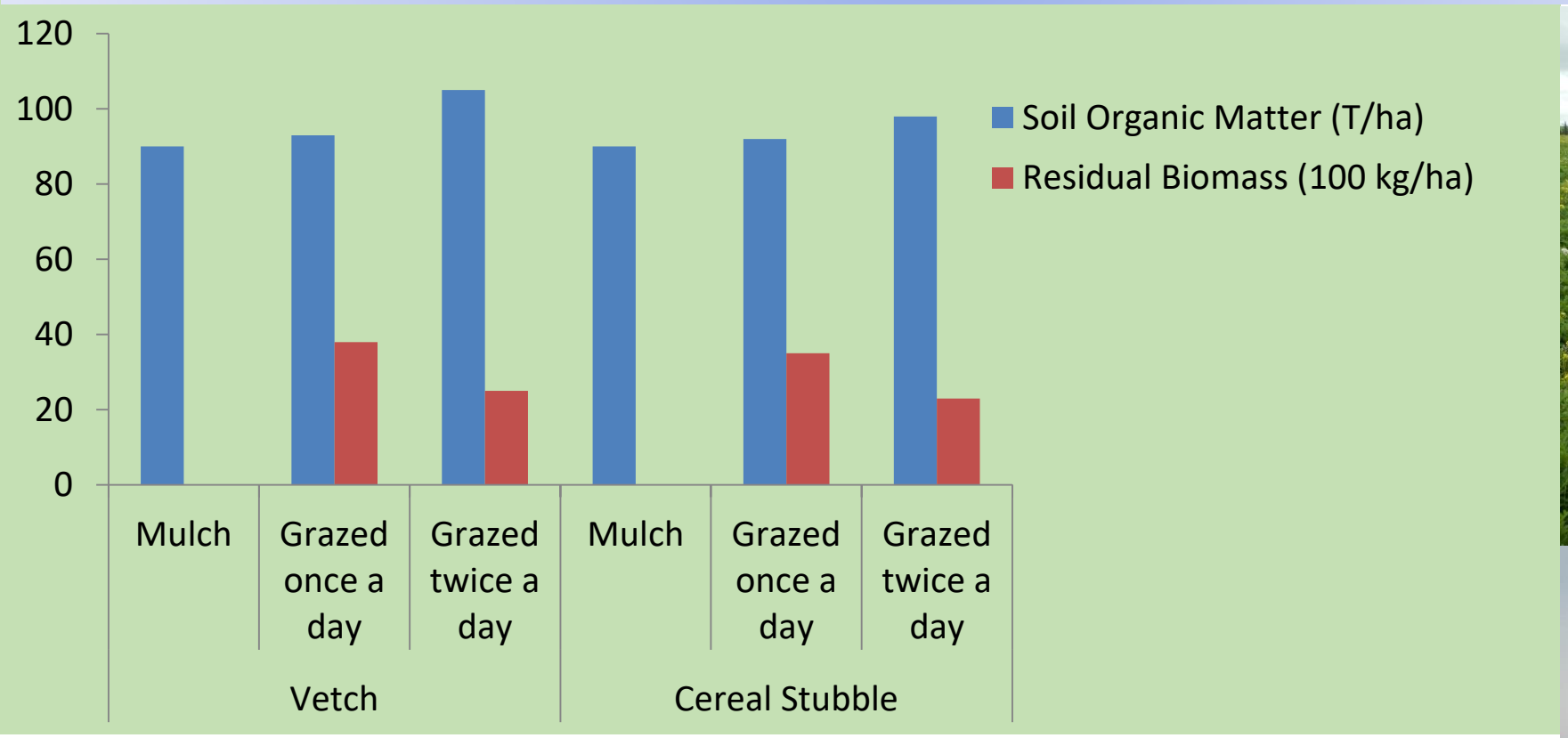
- Can be grazed while green in spring;
- can be cut as hay and used to bridge the fallow feeding gap;
- can be left to reach maturity in the field and grazed during the summer as an alternative to cereal stubbles.

Making the most of vetch

With an initial 16% (biomass 4.6 T DM/ha) and a final 8% (biomass 2.5 T DM/ha) crude protein content in June and August respectively, dried grazed vetch supports sheep nutrients requirements, promotes growth and farm profitability

Significant opportunity to positively impact natural resources

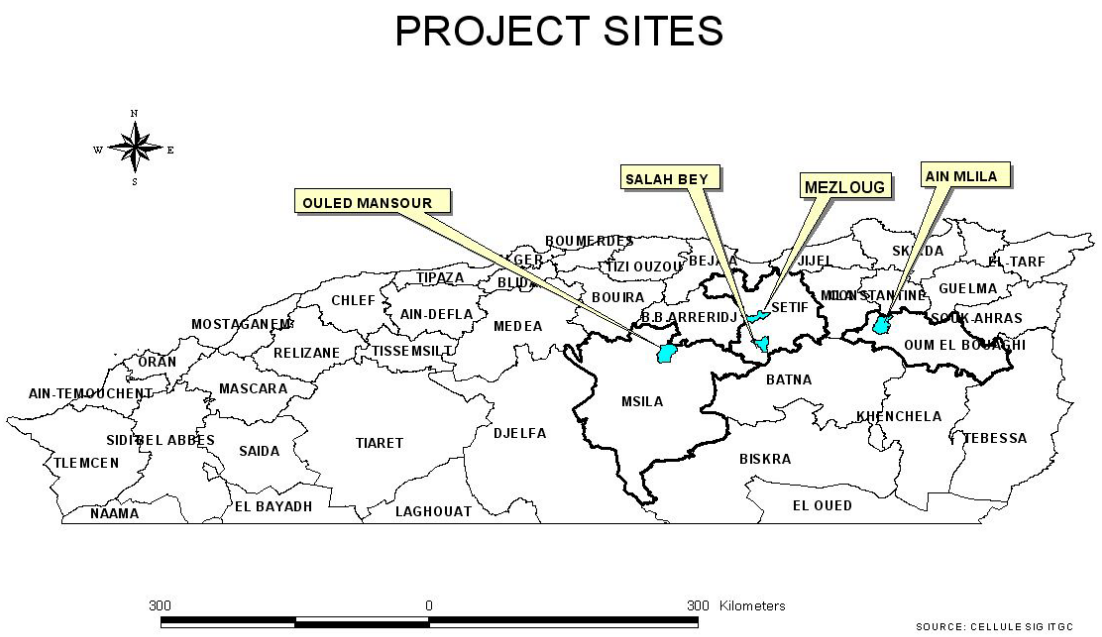
Need to monitoring the long-term impact of practice change

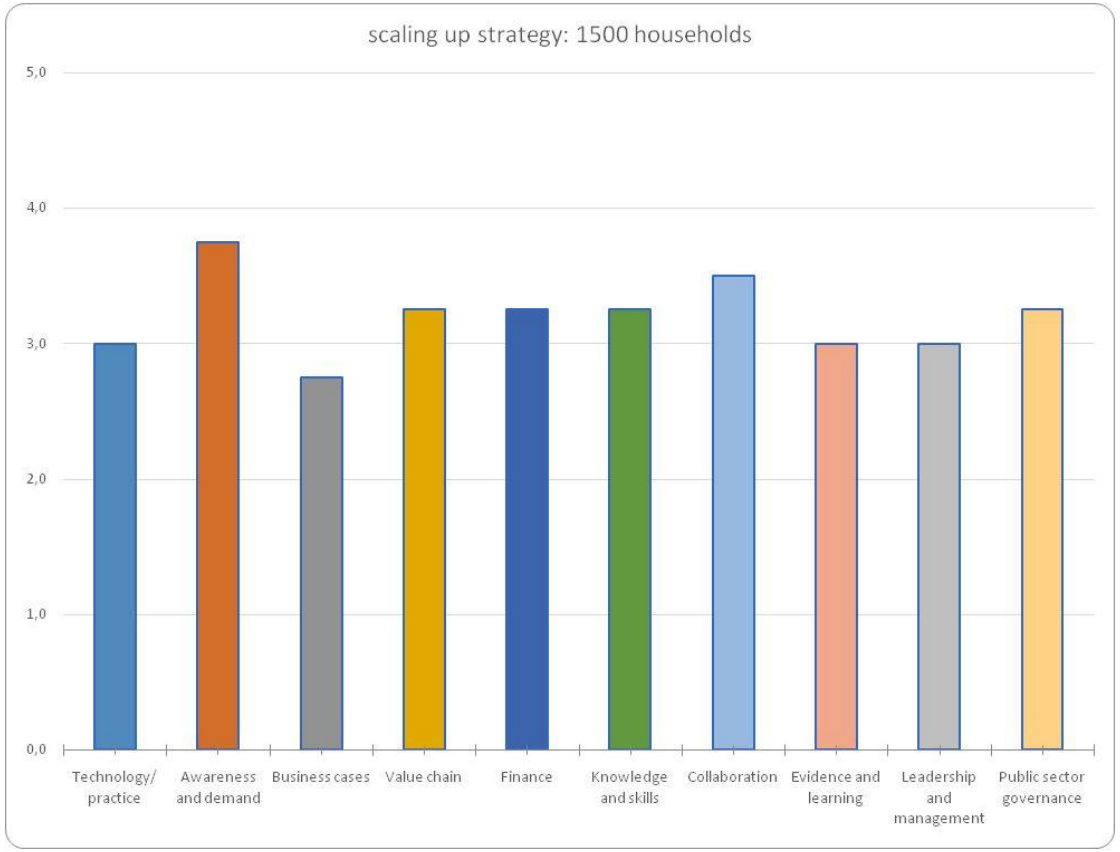


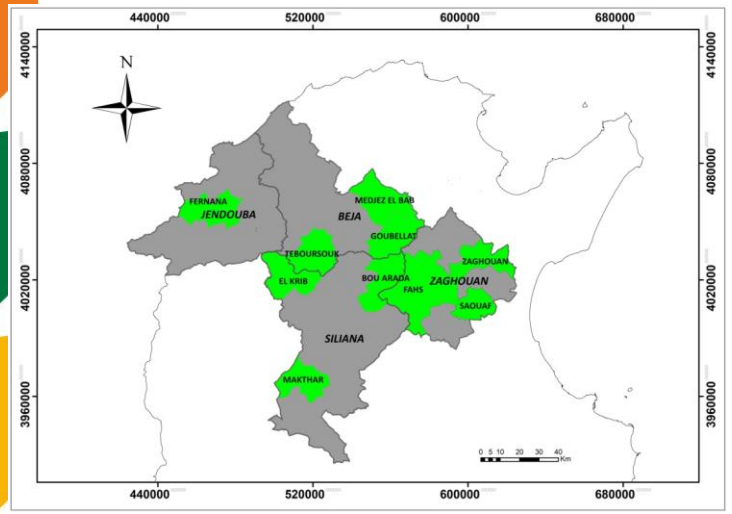
Results need to be demonstrated over an extended period of time, to take into consideration changes in soil fertility, physical soil properties, farm profitability and drought resilience

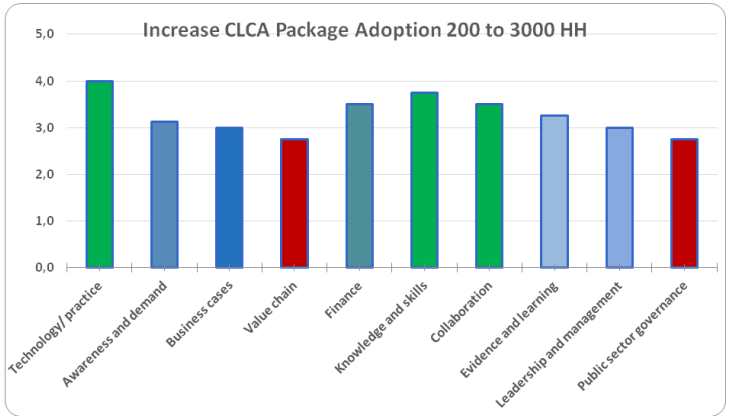
What are the challenges during Phase II?

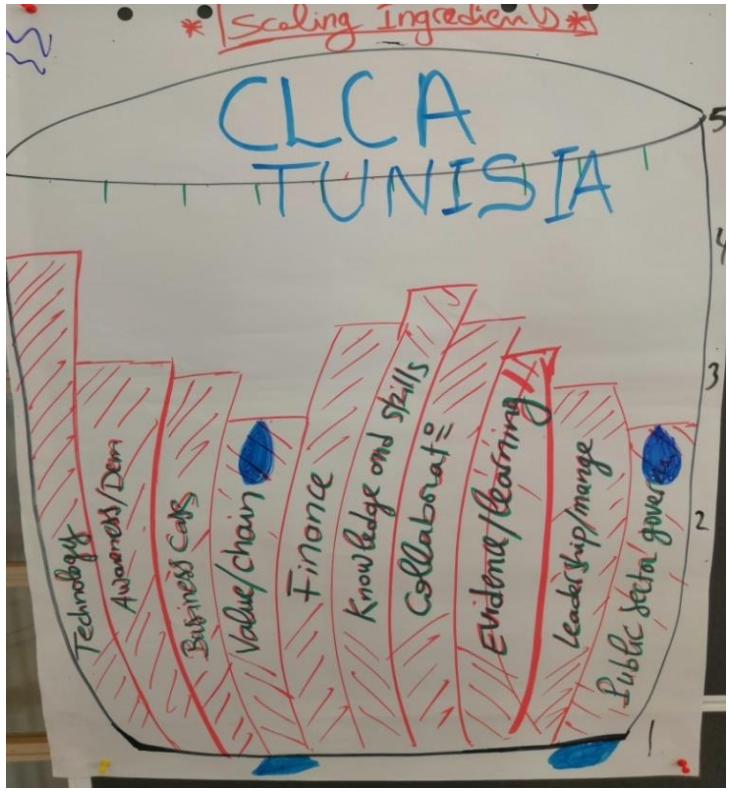
Algeria: Scaling ambition up to 1500 HH and scaling scan outputs







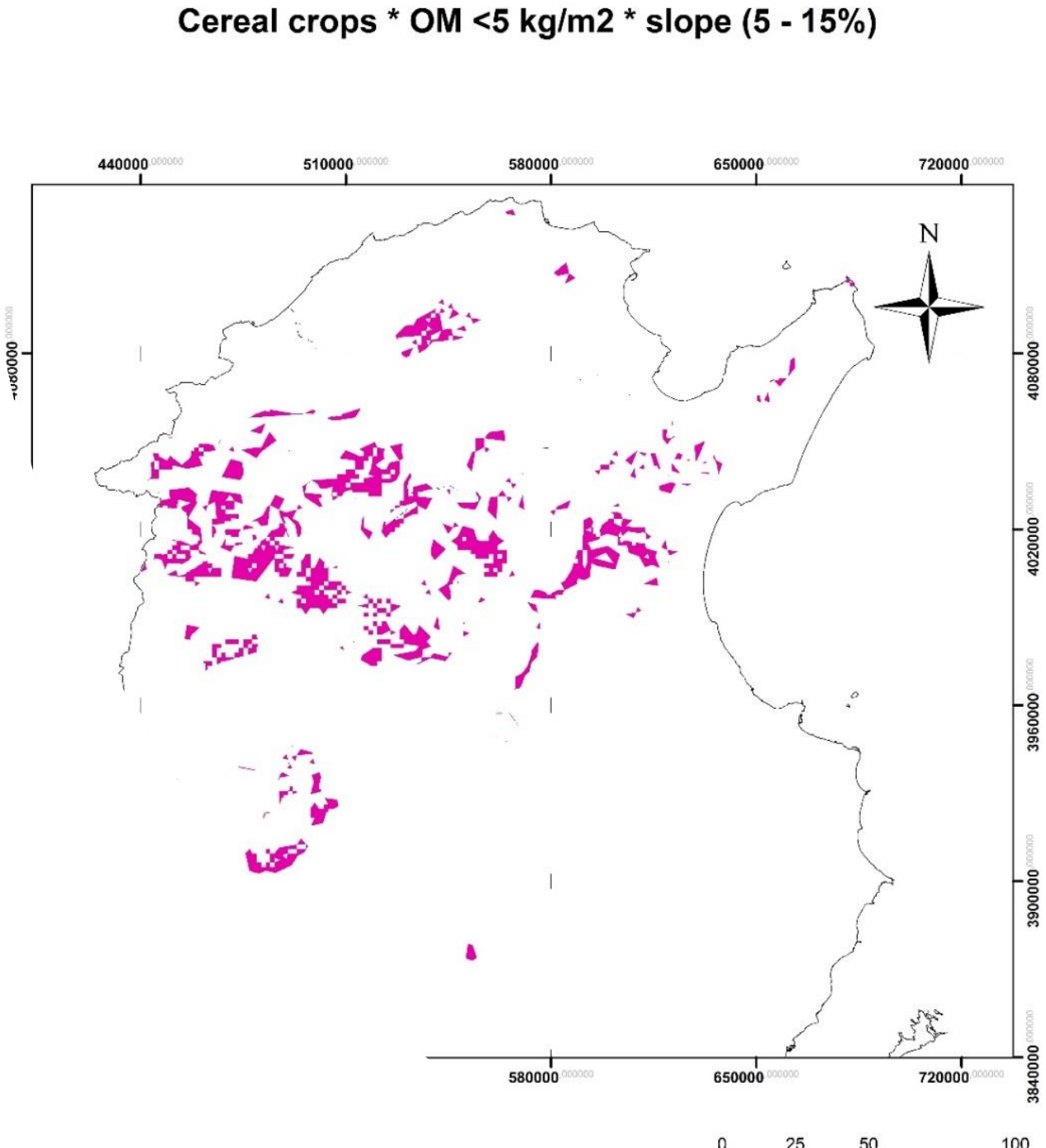




Tunisia: Scaling ambition up to 3000 HH and scaling scan outputs

Fragile areas where CA could generate maximum impacts and gain public support (foresight study).

- This map shows the areas where CA can be suitable for reducing land degradation and enhancing soil fertility.
- It combines three layers of: Cereal-livestock-based systems distribution x slope of soil (5 – 15 %) x soil organic matter (< 2 %)
- The resulting map shows that approximately **260 000 ha** of small holdings are favorable to CA adoption in Tunisia, offering a strategic opportunity to restore soil health and protect the country's vulnerable biophysical environment.



What are we supposed to do during Phase II?

- **Fine-tuning crop residue use in different geographies and socioeconomic environments**
- **Advocating alternative feeding systems and livestock enterprises**
- **Development and promotion of small-scale farm feedlots in support of residue retention**
- **Testing of effective service delivery mechanisms for machinery, agronomic and livestock services**

Fine-tuning crop residue use in different geographies and socioeconomic environments

- In all participating households where (i) ZT/CA plots have been established + presence of livestock (ii) minimum soil disturbance + presence of livestock (iii) forage associations are introduced + presence of livestock
- Flock structure and description; management bottlenecks (disease prevalence, high mortalities, depressed reproduction)
- Preventive health care
- Initial stubble biomass
- Type and number of grazing animals/variation in number of grazing animals
- Number of grazing days
- BCS variation
- Residual stubble biomass
- Overlap feedlot system/stubble use

- **ODK mobile data collection**

Advocating alternative feeding systems and livestock enterprises

Forage associations	Off-farm feeding resources	Alternative feeding resources
Area Type of association Rotation Forage yield Grazed/stored Forage use	What type (forest rangeland – communal grazing area…) Period of use Grazing period Grazing animals	What type Raw use/transformed Incorporation in the diet Period of use

Development and promotion of small-scale farm feedlots in support of residue retention

How important is the feedlot system

Feedlot diet composition

Period of use

Quantities distributed

Beneficiary animals

Criteria for efficiency

Testing of effective service delivery mechanisms for machinery, agronomic and livestock services

Animal feed grinders

Pelleting machines

Forage seed cleaner