Integrated Crop-Livestock Conservation Agriculture For Sustainable Intensification of Cereal-based Systems In North Africa and Central Asia

Strategic Practical Options for Integrating Conservation Agriculture Cropping and Livestock Systems

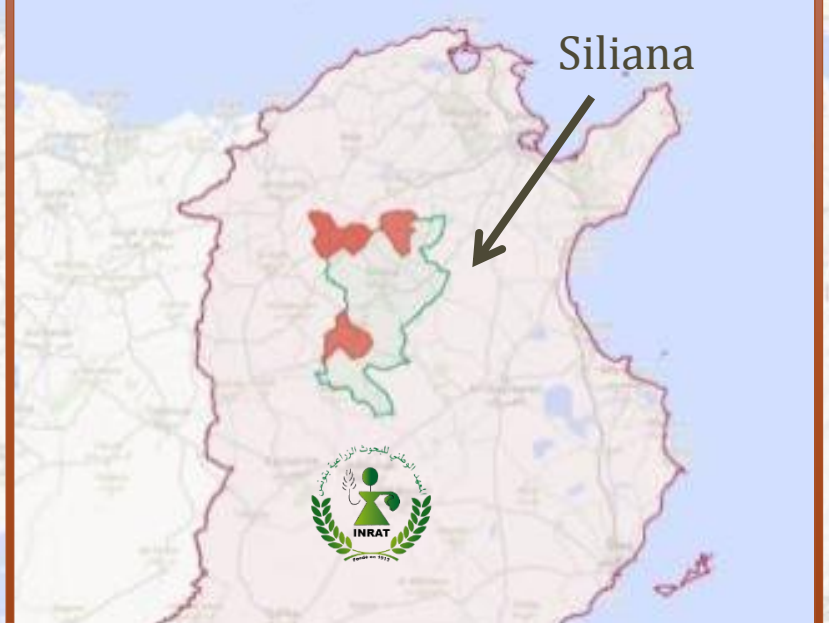
IFAD
INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT

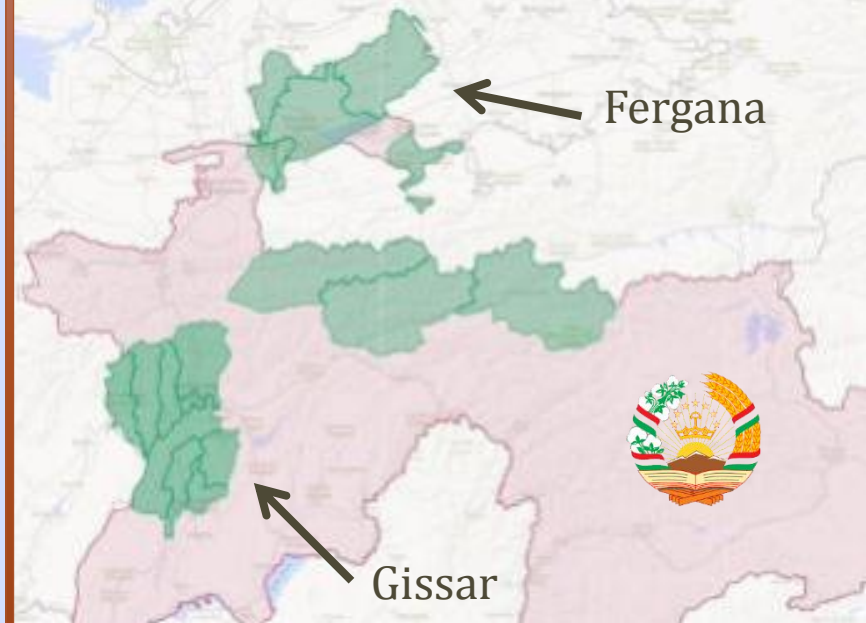
ICARDA
Science for Better Livelihoods in Dry Areas

A truly integrated production system based upon long term agricultural sustainability

Where?
Tajikistan, Algeria and Tunisia

Rewarding Partnership Involving 2 different Geographic Areas and Promoting a South – South





Challenges in introducing conservation agriculture into crop-livestock systems: trade-offs between CA cropping and sheep

- Need for locally manufactured zero till seeders,
- Adoption of crop residue retention in resource-poor and vulnerable smallholder farming systems because of demand for crop residues as livestock feed,
- Finding the right balance to meet the sheep nutrients requirements and retaining crop residues/stubbles
- Identifying the farmers who are more likely to become early adopter and will lead the way,
- Ensuring the engagement of NARES, service providers and farmers in testing sustainable options,
- Tailoring livestock management practices and forage production to fit into conservation agriculture cropping systems.

Development of non-rigid CLCA systems, adoption and spillover

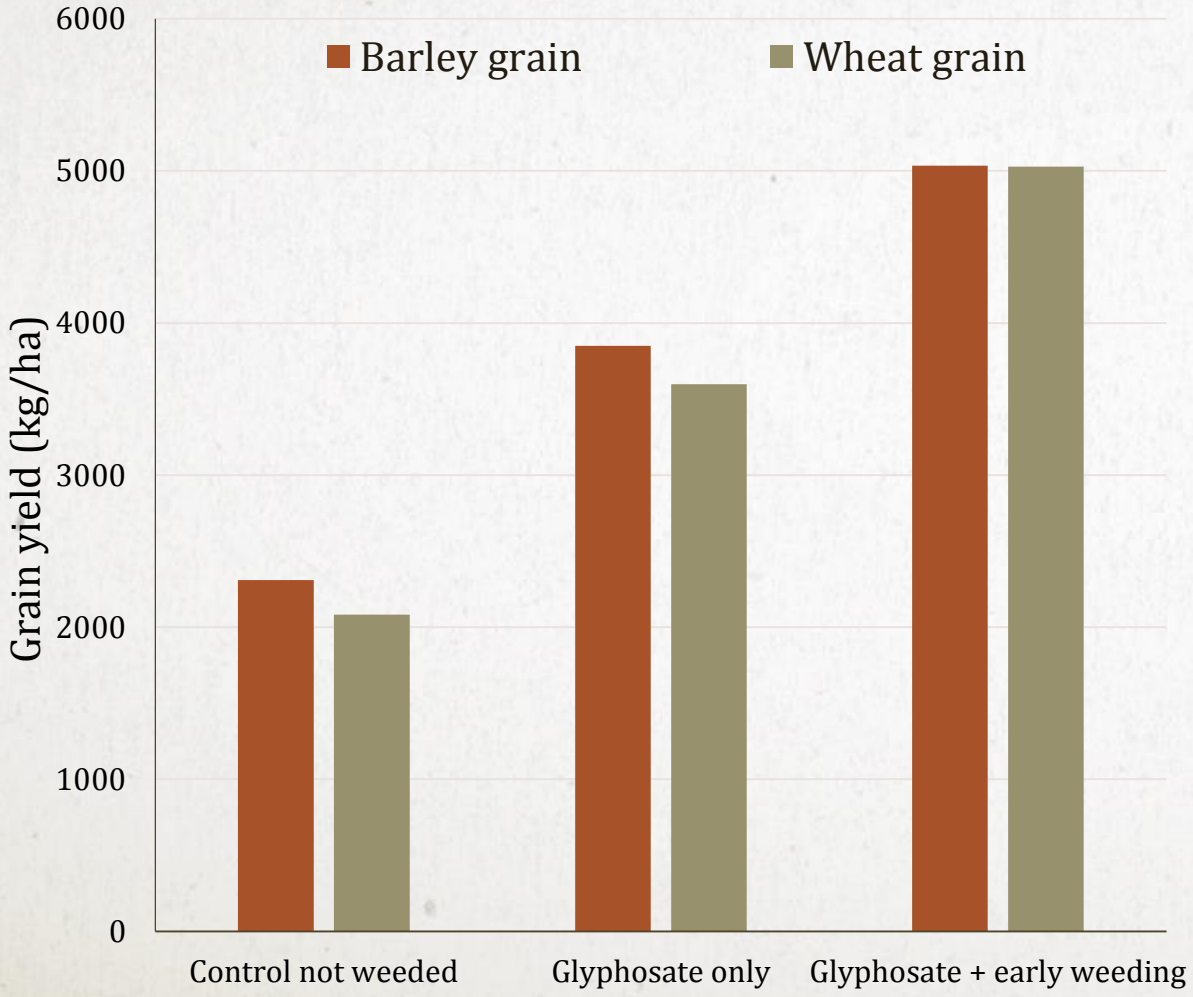
The project has created opportunities for the development of low-cost zero-till (ZT) seed drills

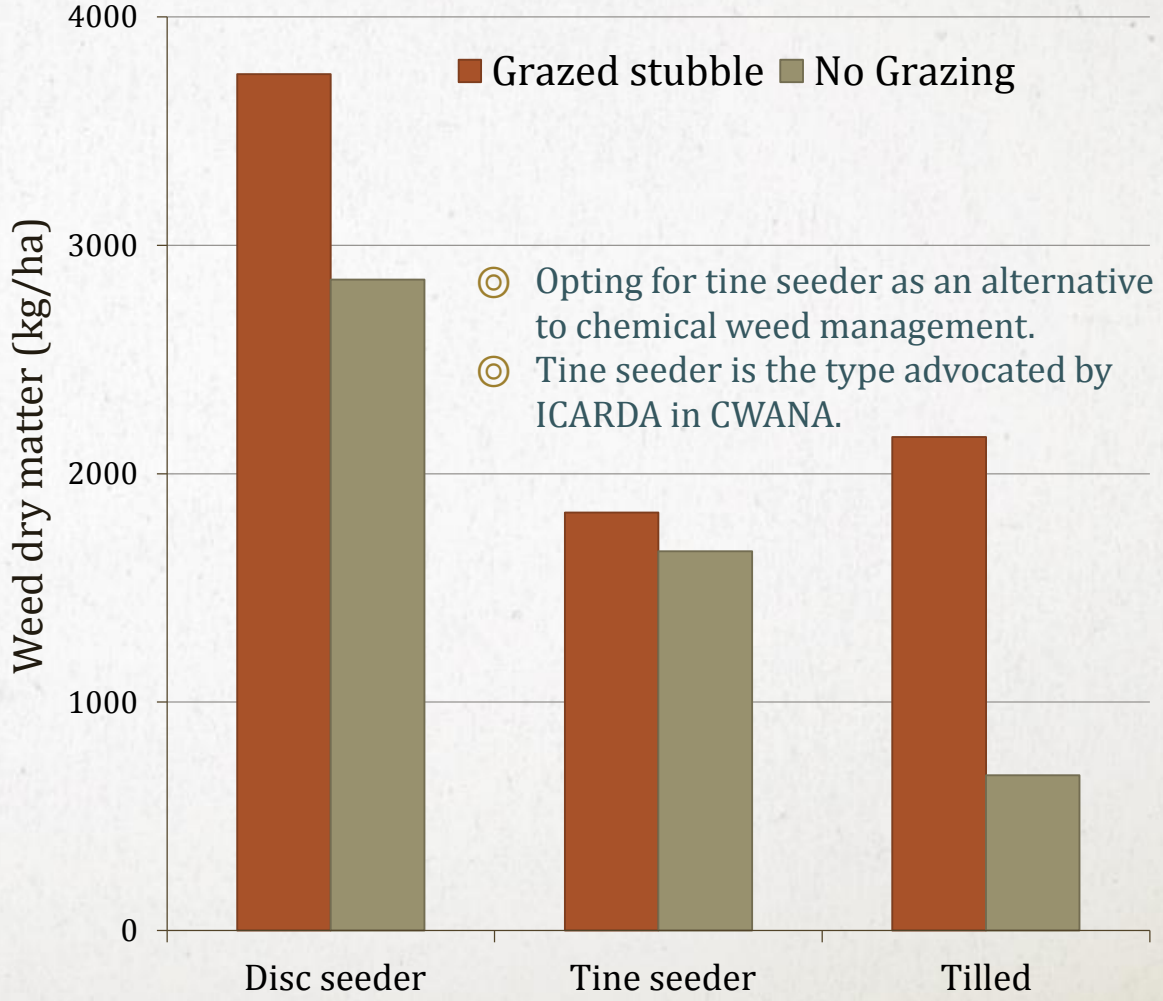
- Currently a major barrier to adoption,
- Local adaptation of ZT seeders are required to suit local farming systems.
- The project opened up venues for farmers in each country to access low-cost ZT seed drills to replace imported drills. Each of the participating countries has developed its own strategy:
  - local manufacturer in Setif, Algeria,
  - low-cost ZT seeders manufactured in Uzbekistan are easily accessible to Tajik farmers,
  - development of a business model for the INGC (Institut National de Grandes Cultures) prototype in Tunisia,

Algerian prototype ZT seeder

Building conservation agriculture packages and optimizing stubble management

Increased barley and wheat yields through effective weed control demonstrated on-farm in Algeria

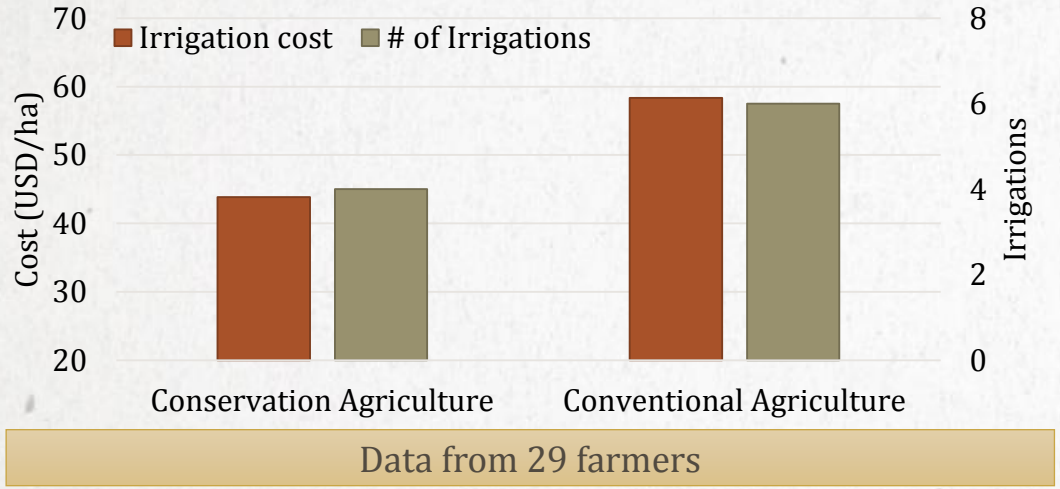




- Opting for tine seeder as an alternative to chemical weed management.
- Tine seeder is the type advocated by ICARDA in CWANA.

Achieving significant reductions in irrigation water: a key future research opportunity

- On-farm results from M'Sila (Algeria) showed significant reduction (30 to 40%) in water requirements for irrigated crops where zero tillage has been adopted,



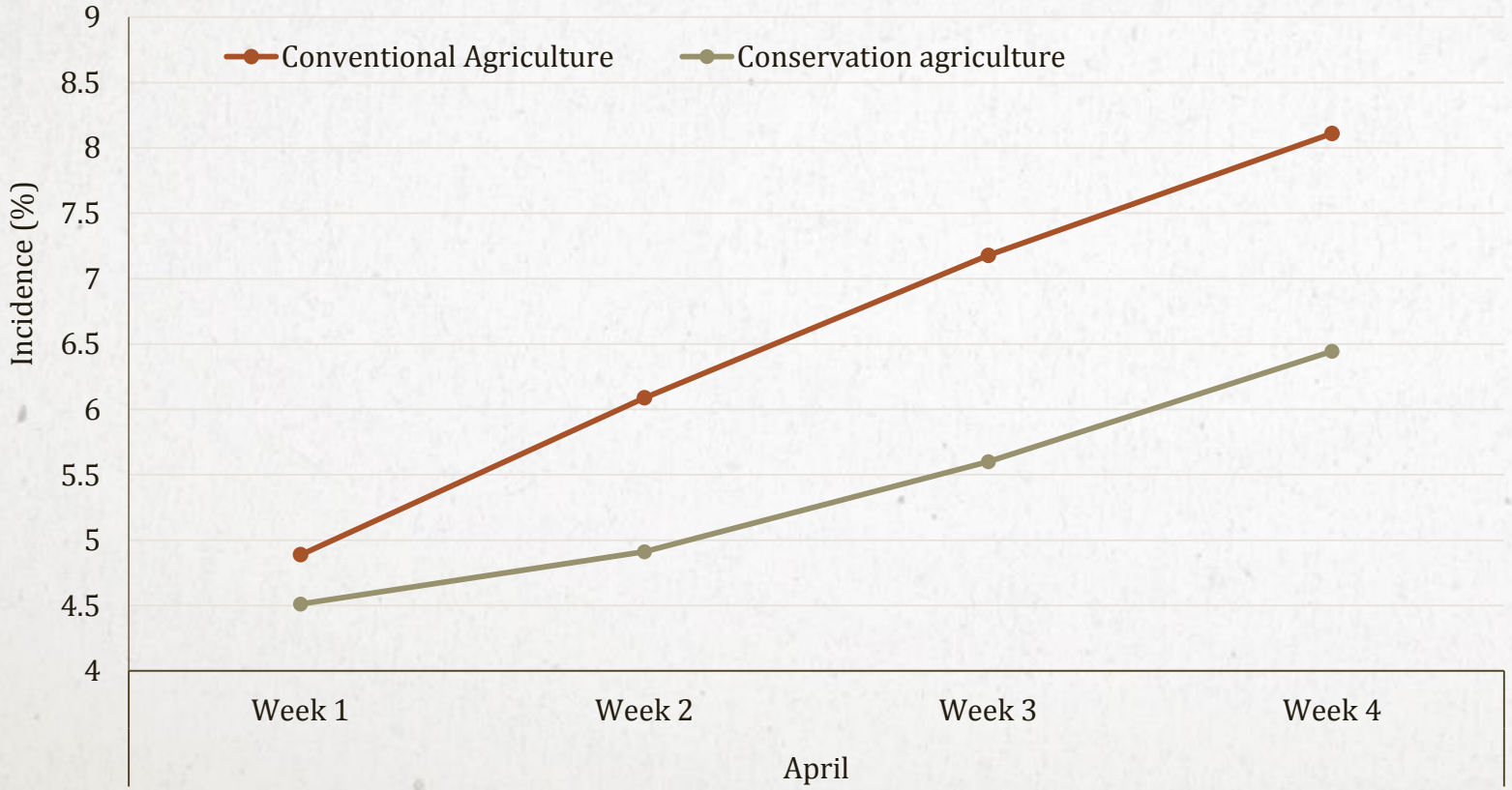
Data from 29 farmers

- Under flood irrigation the time the water takes to travel the distance of the irrigation bays is reduced by as much as 50% for the first initial irrigation under zero tillage compared to conventionally sown crops (reflecting a net decrease in total volume of water pumped onto the cropland)

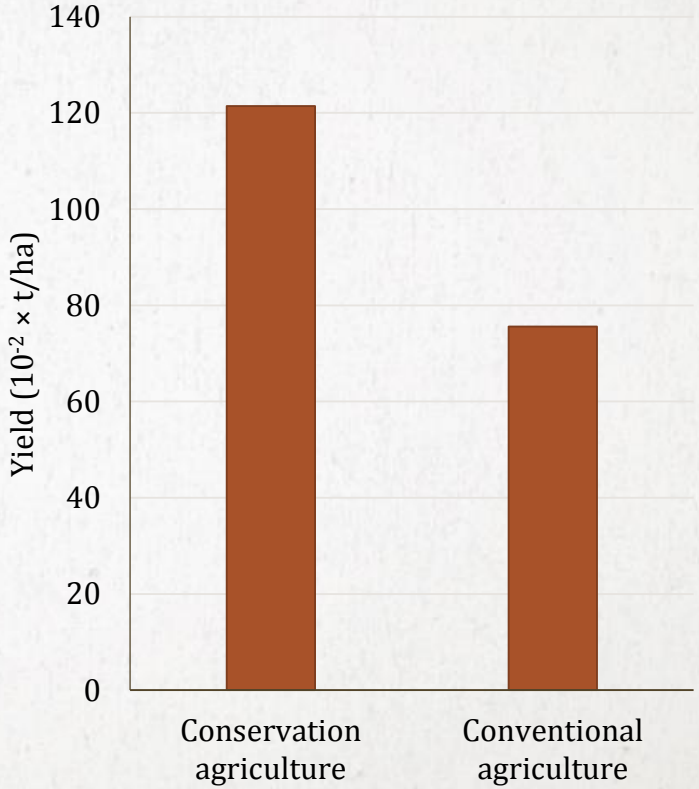
- The combination of introduction of sprinklers and zero tillage seeding systems present enormous opportunities for improving water use efficiency.

Towards higher yields and disease reduction through conservation agriculture

In Tunisia, losses due to wheat helmintosporiosis can reach 1 t ha^{-1} for susceptible varieties when winters are wet and cold

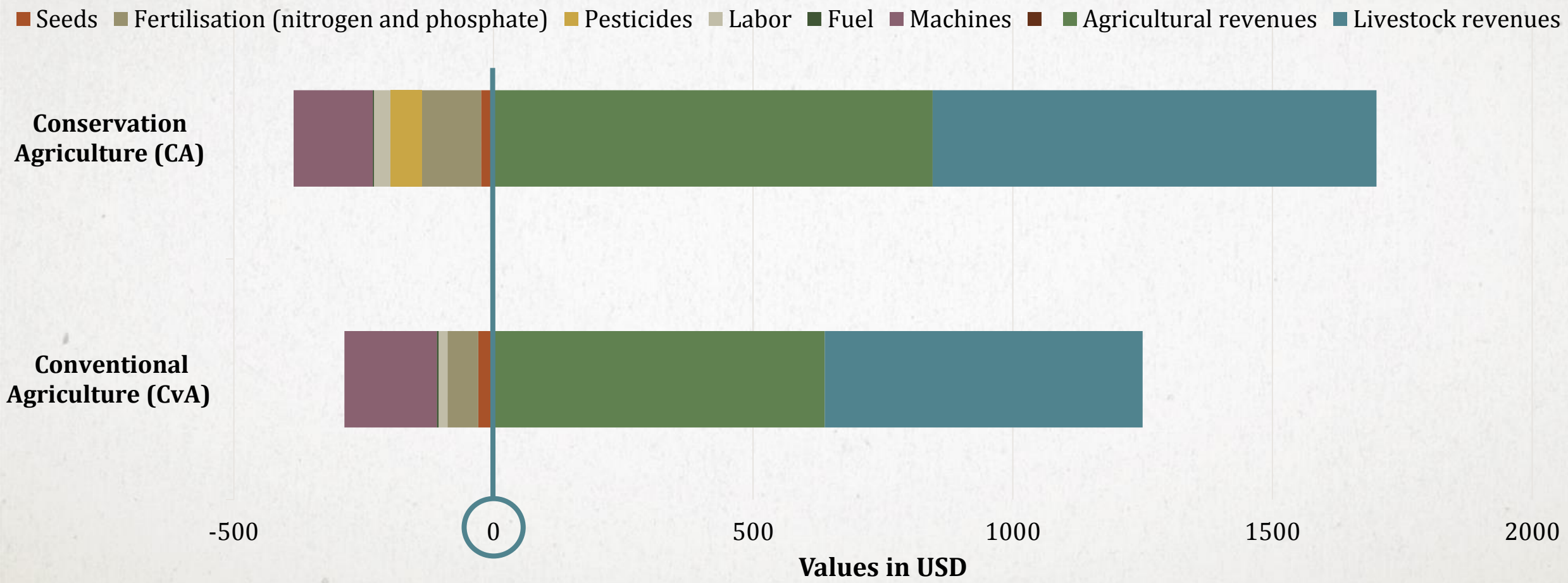


Lower disease spread of Tan spot for durum wheat grown under conservation agriculture



Greater wheat yields after Conservation Agriculture vs Conventional agriculture

Economic evaluation of conservation agriculture technologies and trade-offs in North Africa

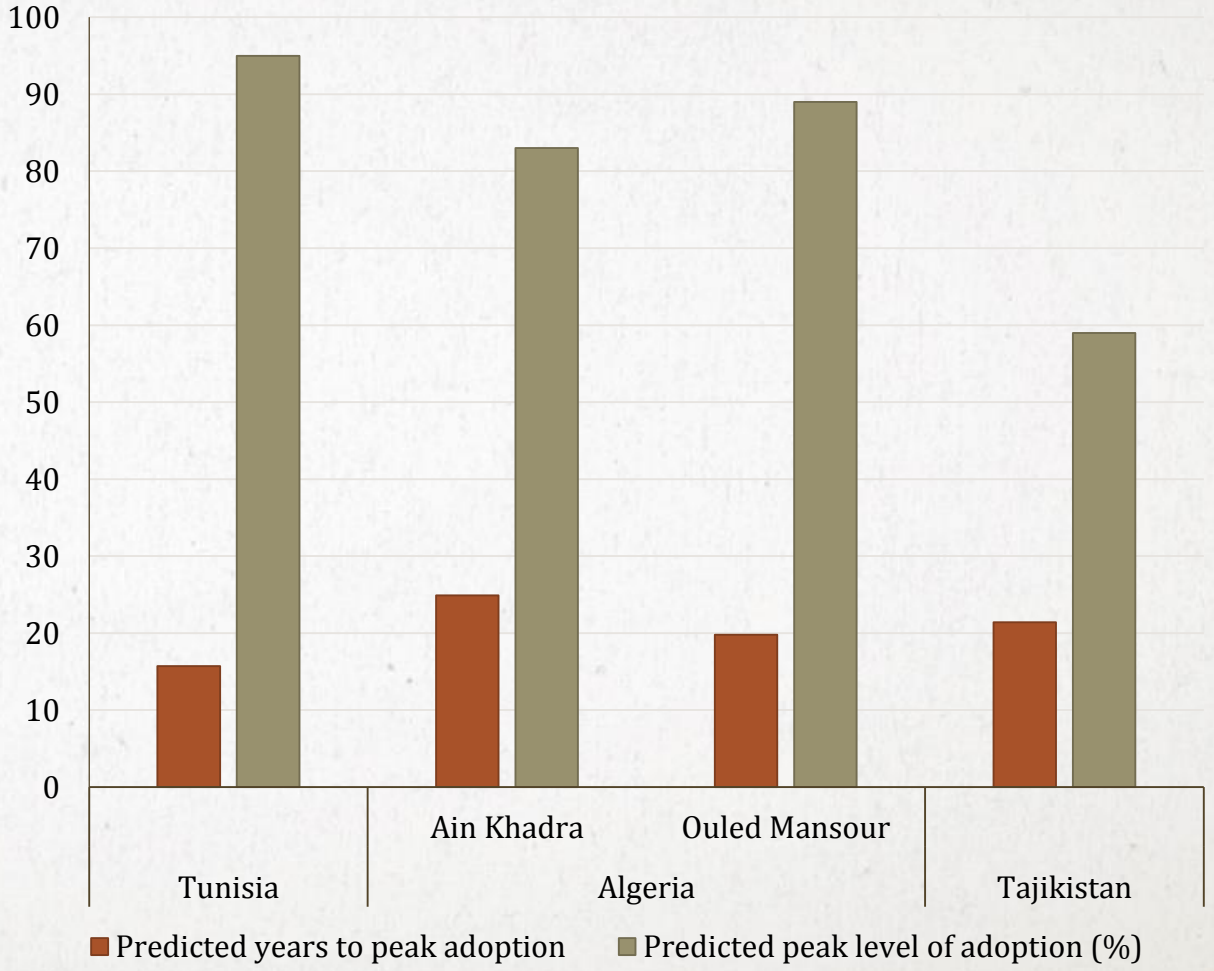


Benefit Cost Analysis (Average for 1 ha of Durum Wheat)

Determinants of adoption of Conservation Agriculture in CWANA

Factors negatively affecting adoption of conservation agriculture:

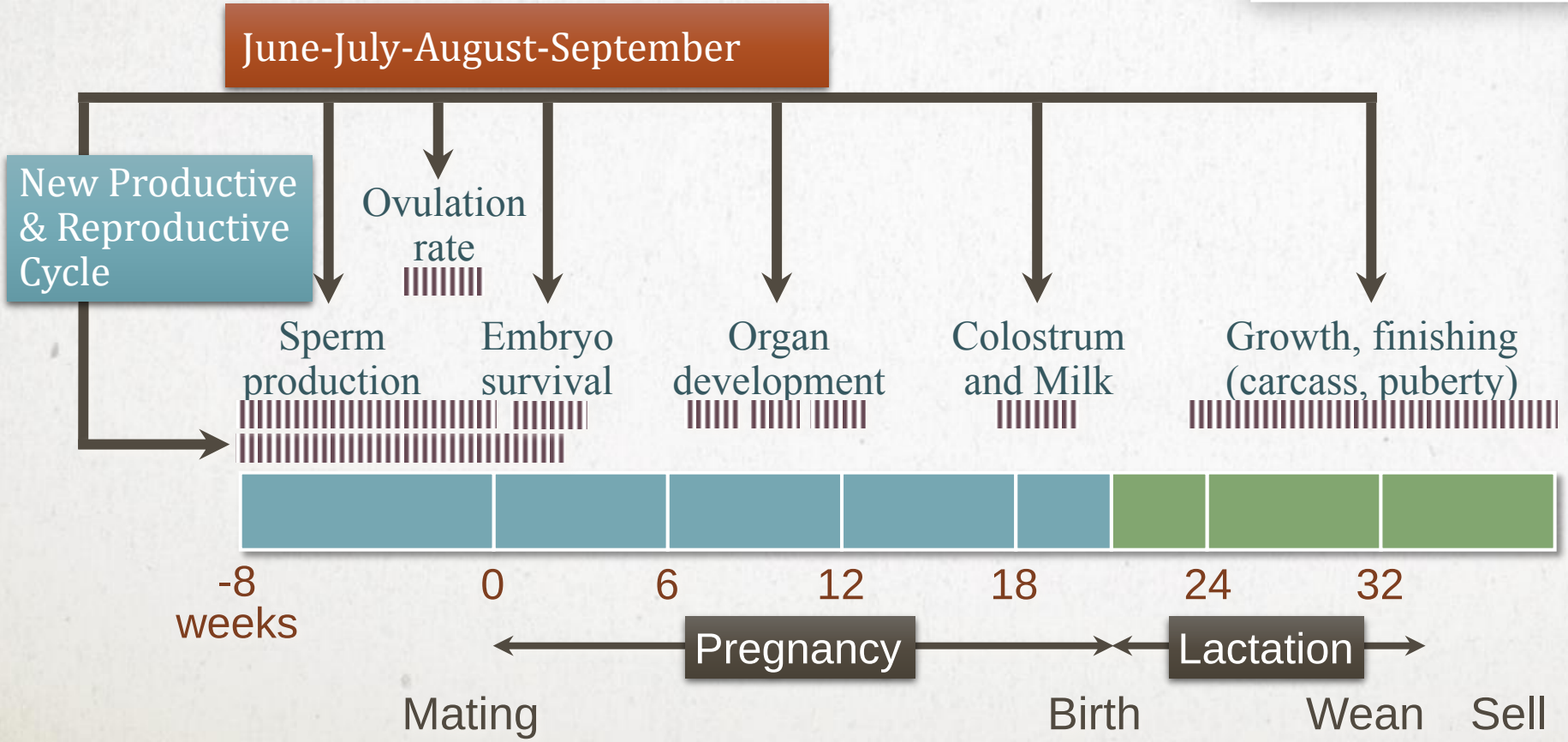
- Small farm sizes,
- Lack of information and extension services on conservation agriculture,
- The importance (in terms of profitability) of livestock activity for farmers compared to cereal crops production,
- Lower production risk of livestock than cropping activities,
- High up-front cost of the investment (seeder),
- Missing availability of financial support to farmers,
- Complexity of the technology.



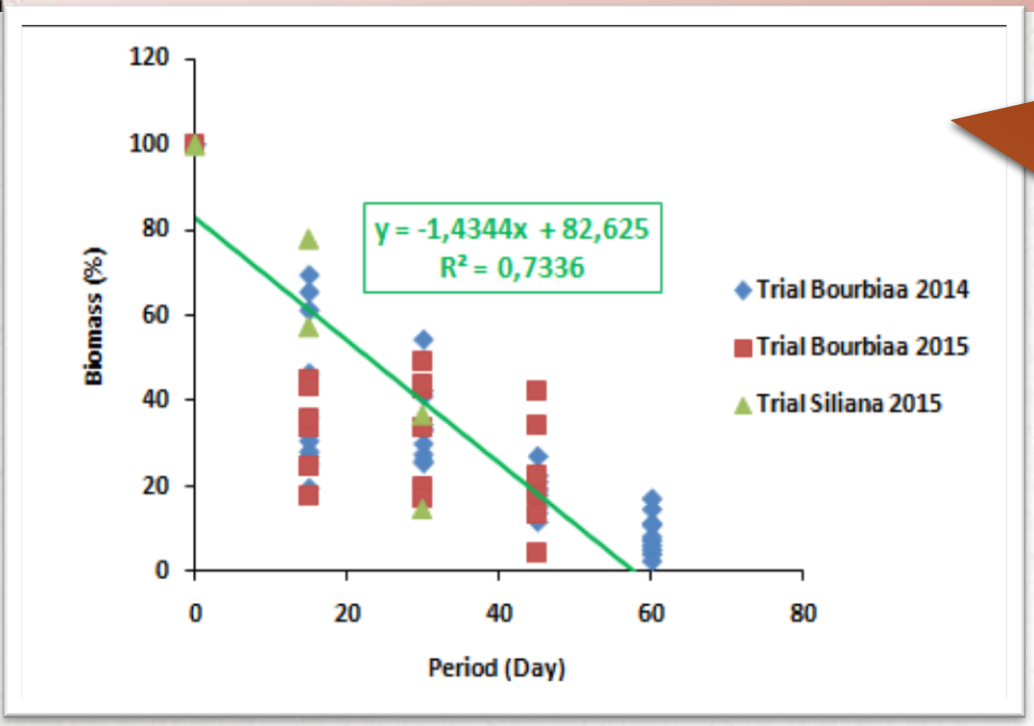
Local solutions relying on grazing strategies and fodder production to compensate for stubble retention

Why is it important?

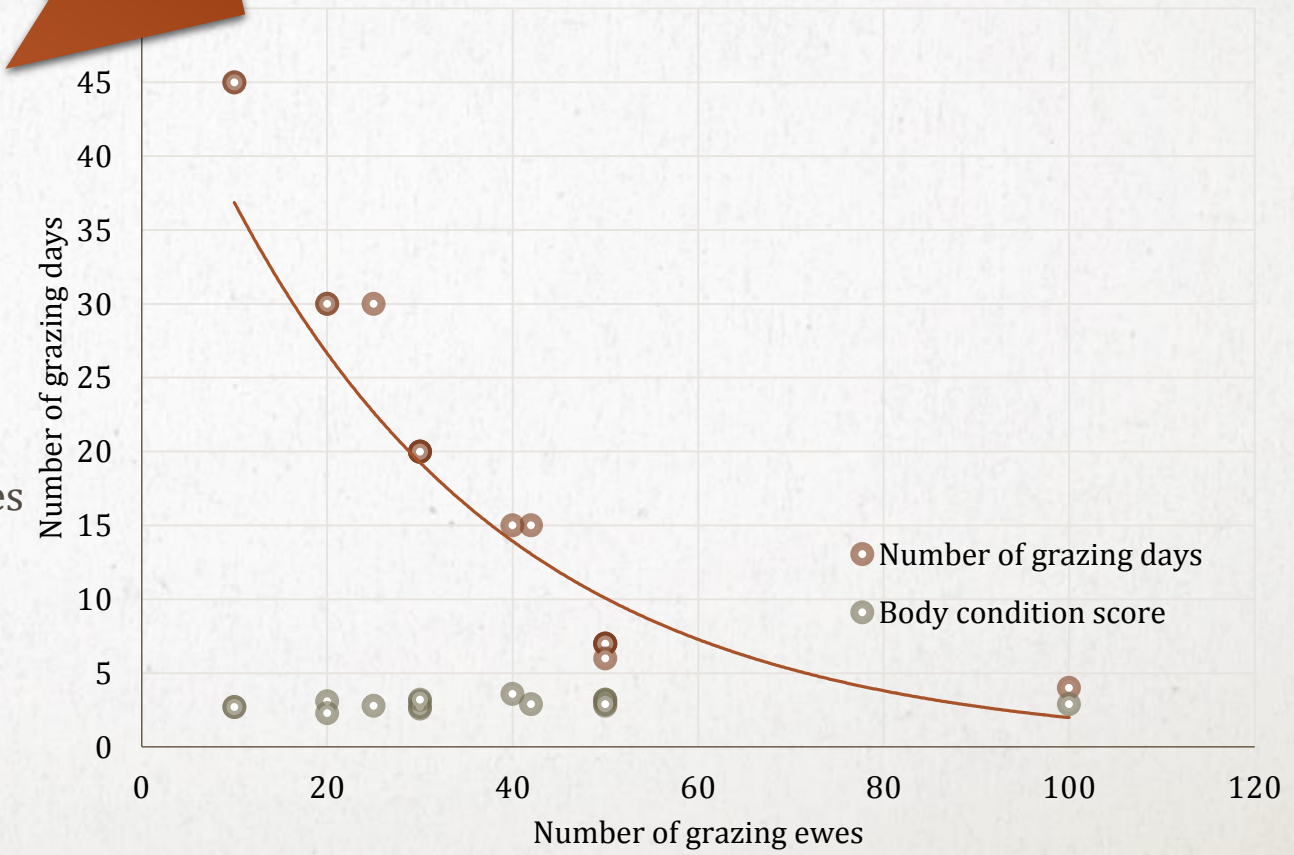
In North Africa stubble grazing provides 70-80% of the sheep diets during the first 2 months of grazing



Optimizing on-farm stubble grazing in M'Sila-Setif-Siliana: scalable to the rain-fed cereal belt in North Africa



from on-station to on-farm research



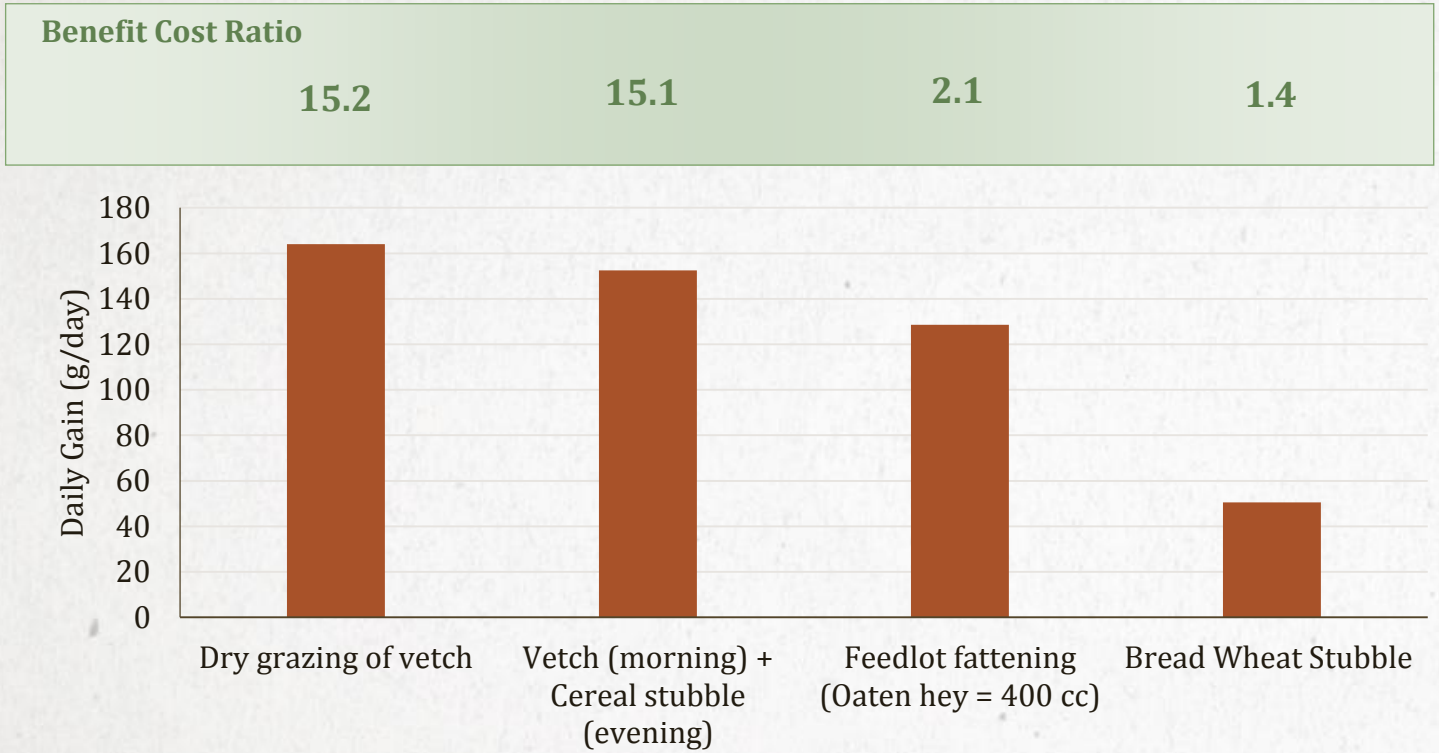
Emerging recommendations

- Lambs in post-weaning stage (growing at 30-70 g/day) or ewes during mating or 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
- Pull out animals if residual stubble biomass is near 0.6 t ha^{-1}

CA cropping and keeping sheep in the system: results from 17 on-farm trials in Algeria suggest a light grazing model

Residue level:	2 t/ha	0.45 t/ha	0.57 t/ha

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:

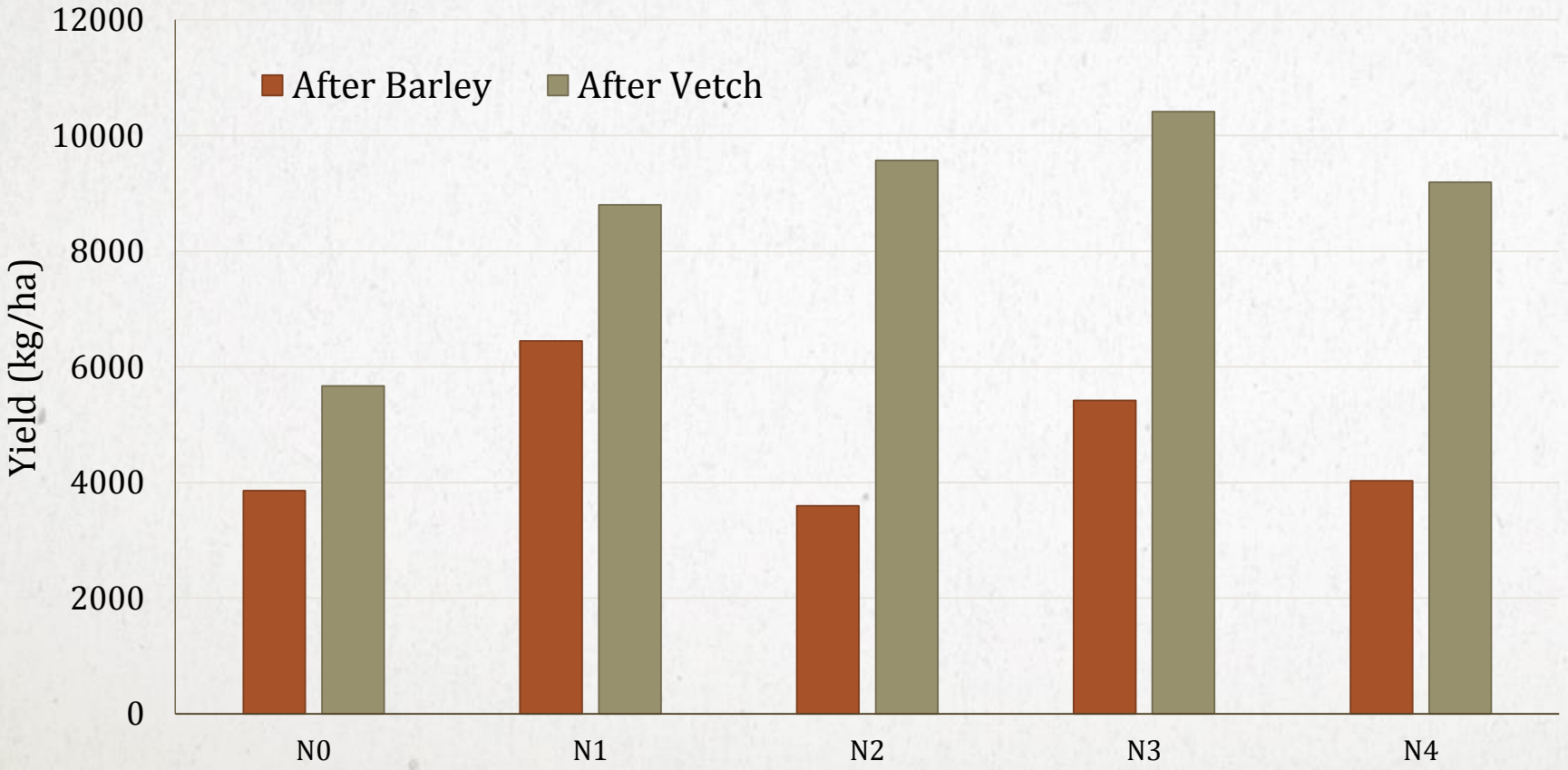
- Can be grazed while green in spring,
- can be cut as hay and used to bridge the fallow feeding gap,
- can be left to reach maturity in the field and grazed during the summer as an alternative to cereal stubbles.

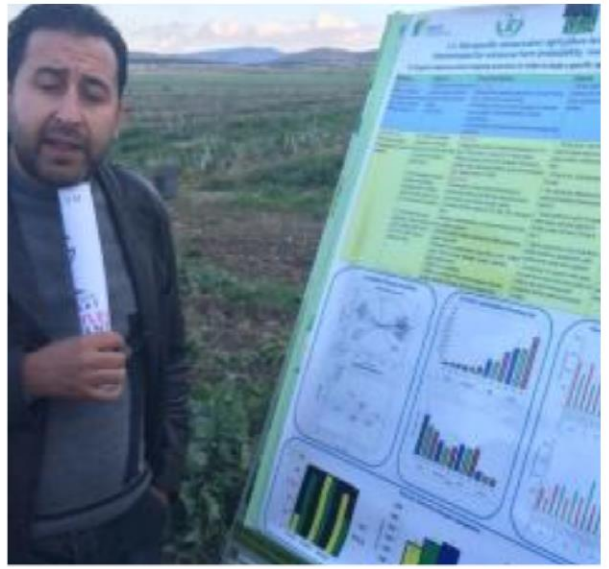
Making the most of vetch in semi-arid Tunisia

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

Towards an integrated CLCA system through including vetch in the crop rotation: opportunity for increasing crop yields

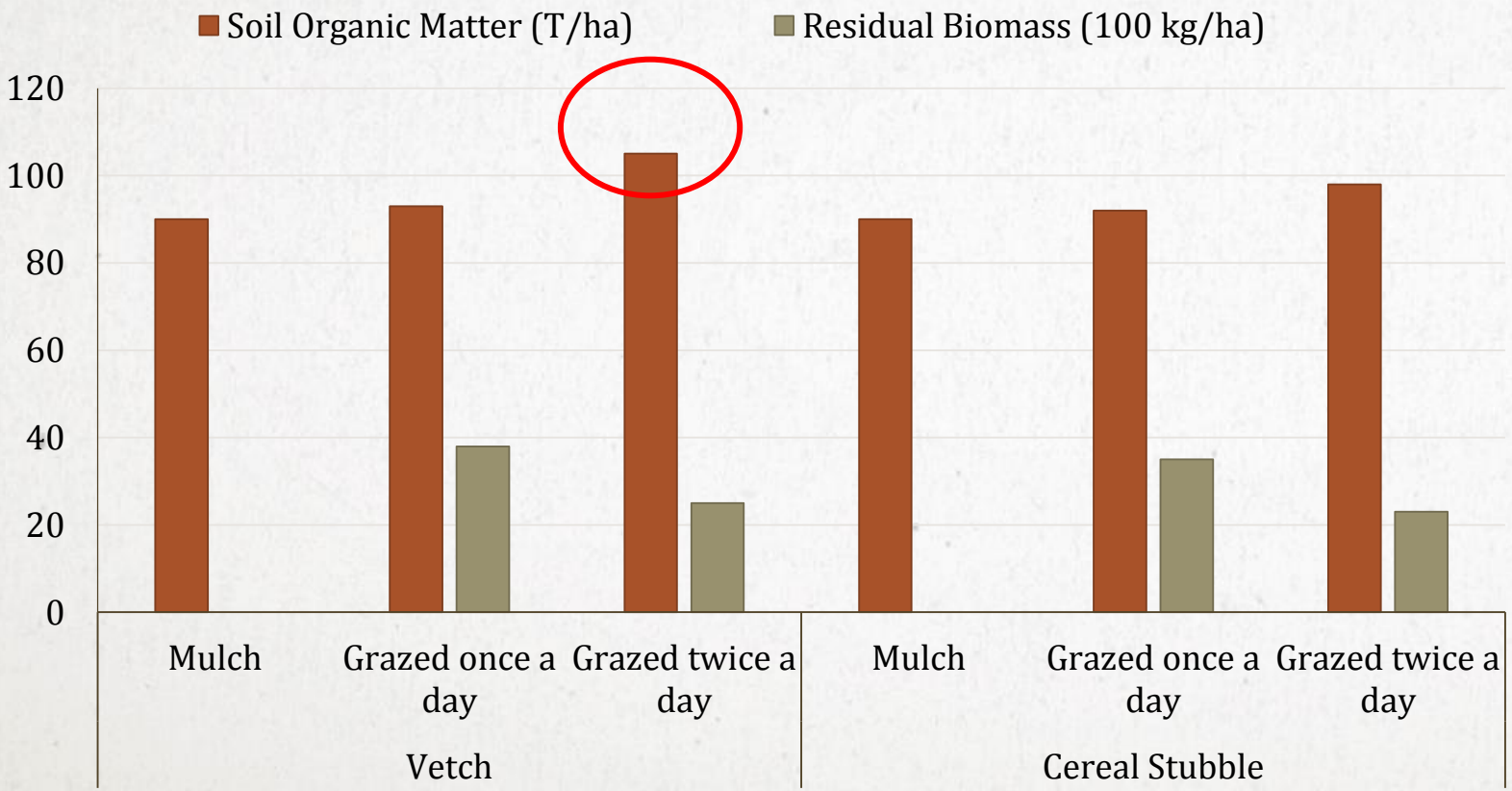
Greater response of durum wheat to N fertilization after vetch *vs.* barley





Significant opportunity to positively impact natural resources

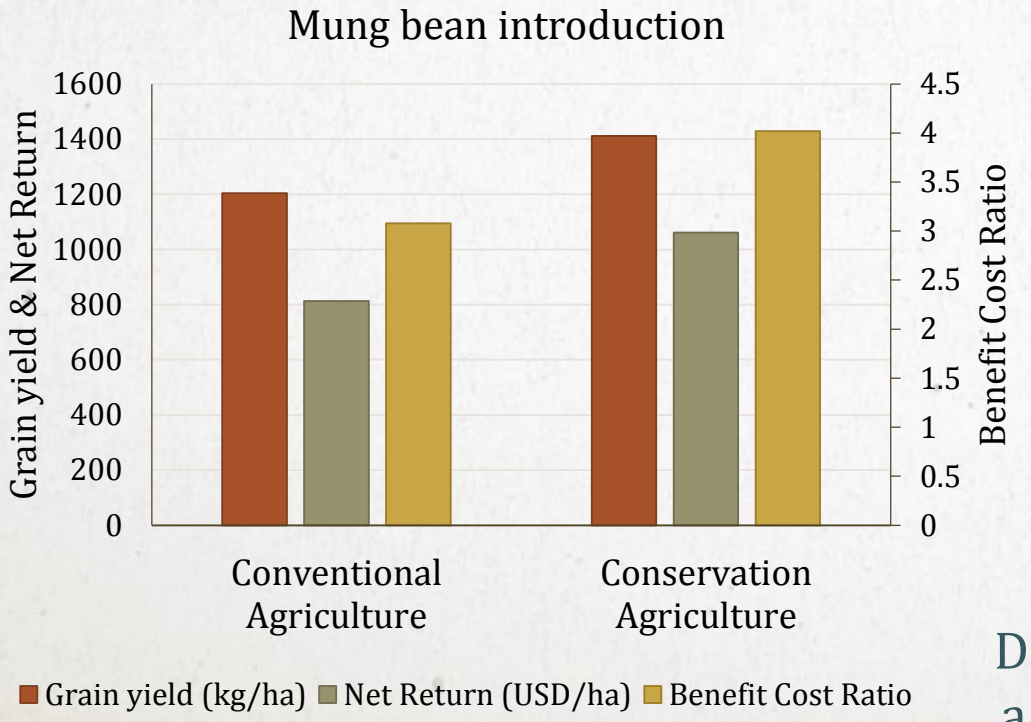
Need to monitoring the long-term impact of practice change in soil structure and fertility and organic carbon



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

Conservation agriculture as a promising option for sustainable crop intensification in Tajikistan

Double cropping made possible with no-till seeders in Tajikistan where conservation agriculture is in a relatively early stage

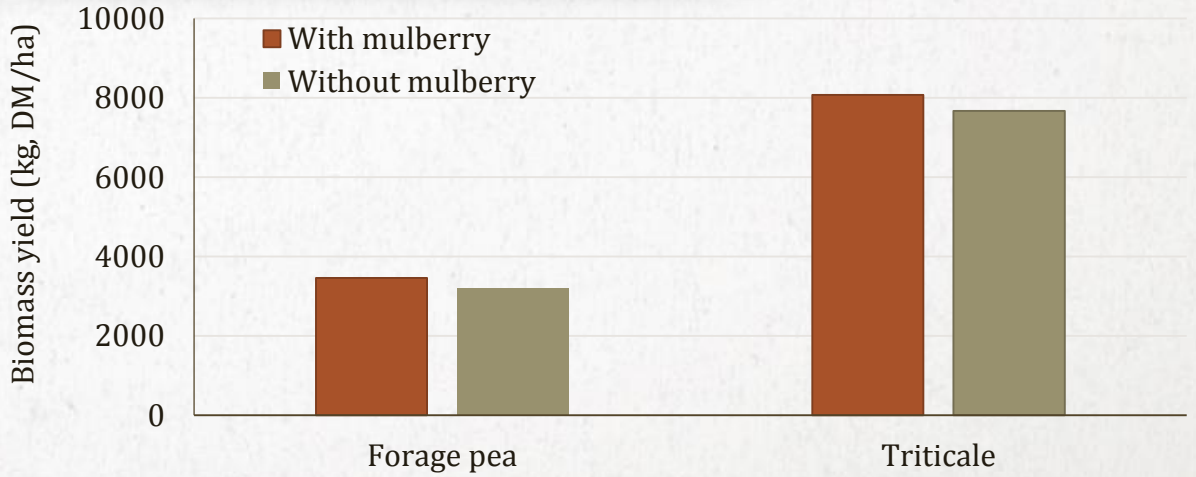


Direct seeded Mung bean after wheat: two crops in one year and a substantial extra feed biomass to bridge the feeding gap in the extremely harsh winter

Alley cropping where erosion is high reduces pressure on stubbles and helps meeting the sheep nutrient requirements

Alley cropping, planting arable crops in rows between shrubs, is a valid method to provide green fodder for livestock as an alternative to crop stubbles while preventing soil from erosion under conservation agriculture.

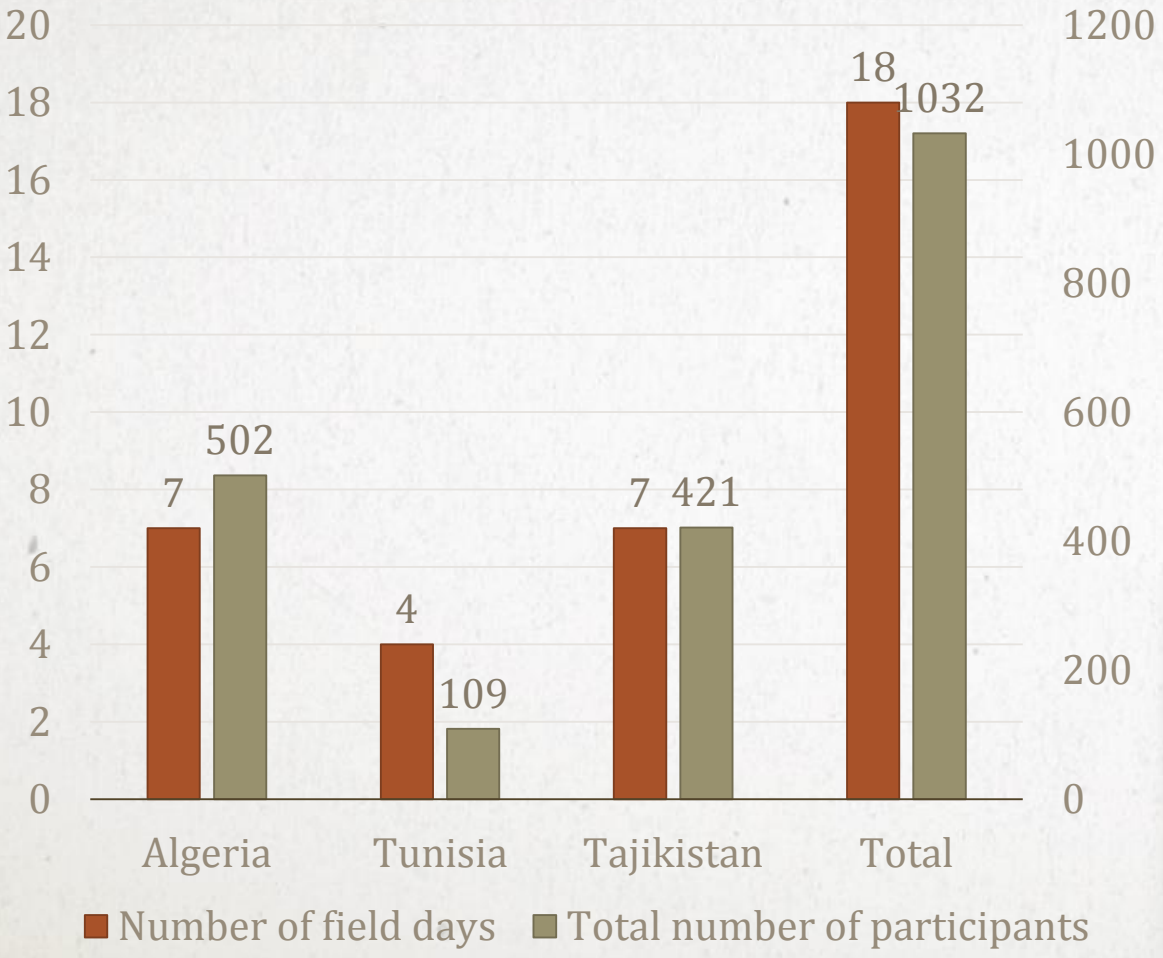
- *Atriplex halimus* and to a lesser extent *Atriplex nummularia* had the highest survival rates (> 70% in North Africa),
- Cactus is not an option in the continental areas of the Algerian Steppe because of frost,
- Average live weight gain of sheep was 1.68 ± 0.81 kg when grazed for 15 days on wheat stubble and atriplex planted in alley cropping,
- Mulberry is a promising shrub for alley cropping in eroded areas of Tajikistan; potential area for adoption is around 0.5 million ha where soil erosion is a threat,
- Availability of healthy seedlings in public nurseries remains a challenge,
- Supplementary irrigation during the first summer is needed.



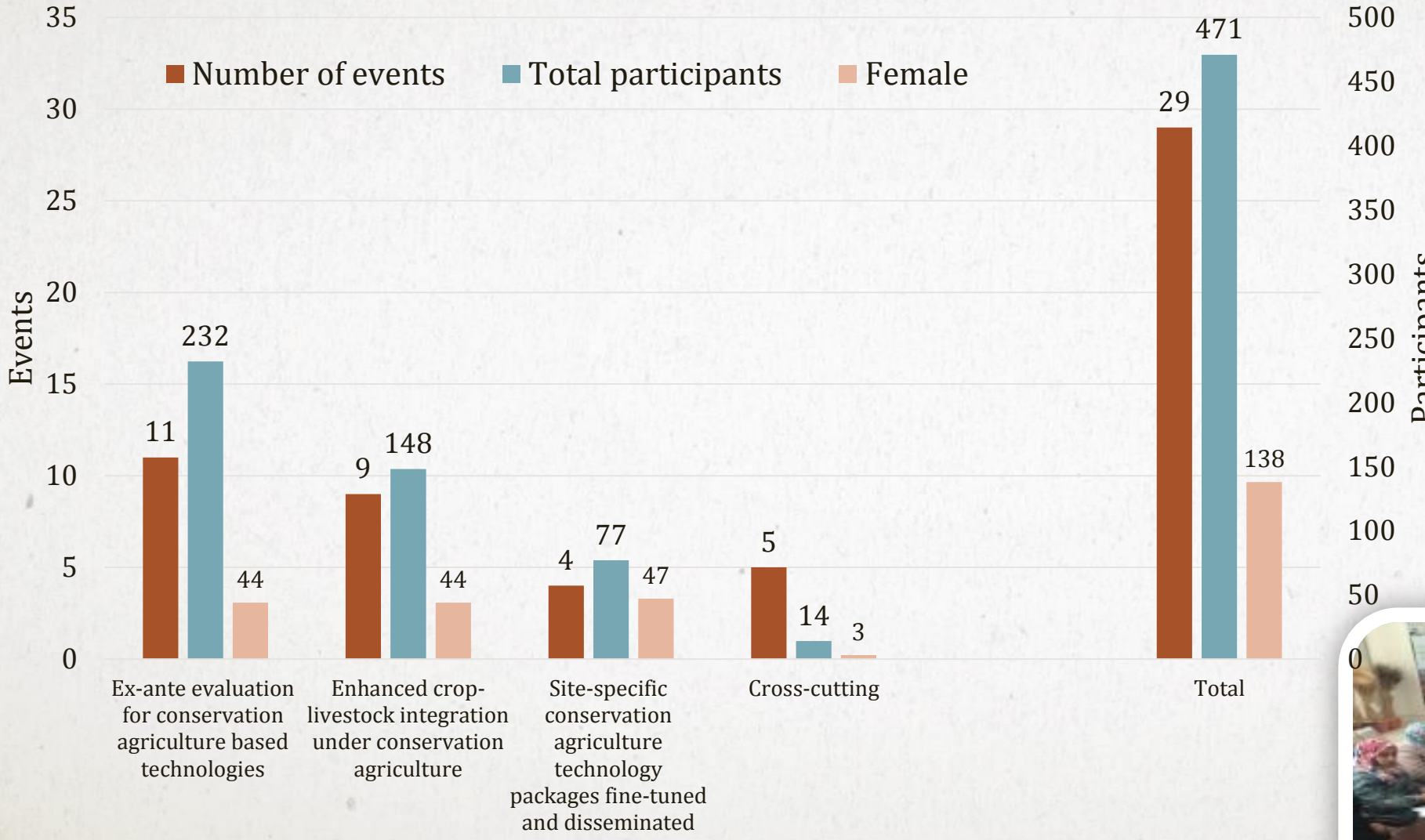
No reduction in crop yield occurred during the establishment year of the shrubs/trees. Once fully established, the extra forage production and agro-ecological benefits of shrubs will be realized.

The project generated, enabled and ensured firm farmer engagement and capacity generation in the field

Inducing changes in knowledge, attitudes, skills, aspirations and practices amongst farmers



Capacity generation in the field to further expand crop-livestock under conservation agriculture system



Strong linkages with outreach research & development initiatives and knowledge sharing

Linkages with other Projects

- **IFAD** funded project in Siliana (Tunisia),
- CANA Project (**ACIAR** funded project) (Maghreb),
- **DFID/BMZ funded project**: Grows for Rural Economy and Agriculture of Tajikistan,
- **FAO project GCP/RER/030/TUR**: Conservation Agriculture for Irrigated Areas in Azerbaijan, Kazakhstan and Uzbekistan,
- **CGIAR** Research Program on dryland systems,
- Project de développement rural des zones montagneuses du nord de la Wilaya de M'Sila; General Direction of Forestry – Algeria,
- Fallow resorption program in Algeria.

Videos

- English: http://www.cac-program.org/news/detail/416
- Russian: http://www.cac-program.org/ru/news/detail/417
- Videos section: http://www.cac-program.org/video
- Arabic: https://www.youtube.com/watch?v=xI254EcfDzs