



RESEARCH
PROGRAM ON
Dryland Systems

JULY 2015

Six month-progress report

AS Beni Kedache-Sidi Bouzid, Tunisia

Activity 8 - Setting up a Community based flock management
programs

Introduction

Integration is based on the principle of the interactions between two or more components of the production system. Interactive research based on interdisciplinary approach involving NARS and ICARDA's scientists is important to develop integrated crop-livestock systems in the low rainfall areas. The site of Sidi-Bouزيد is characterized by a large and rapidly increasing food and feed shortage, highly variable income levels, and limited natural resources, particularly arable land and water. Inhabitants are poor, most socially disadvantaged, and disfavored in terms of infrastructural and institutional support. A large number of the small farmers in the region are deriving most of their family income from barley/livestock based systems particularly and because sheep fattening is quite profitable in the region. In fact, Sidi-Bouزيد region is implemented produced in 2014, 325,000 lambs for the Eid festivity, which represent 38% of the total national lamb production.

The CRP Dryland Systems implemented in Zoghmar community (Governorate of Sidi Bouزيد) is focusing on Community-based flock management, identification of sheep practices to meet lamb market demand, determination of nutrient deficiencies in small ruminant flocks, seasonal characterization of small ruminant feeding systems, and determination of water footprints and the water productivity of animal products in the action site. In addition, and in order to increase feed availability, (i) agroforestry practices (alley cropping) were introduced to farmers to reduce pressure on rangelands, fill gaps in feed resources, reduce soil erosion, enhance infiltration, and boost carbon sequestration and (ii) Conservation Agriculture (CA) practices has been proposed as an adapted set of management principles and as a viable and feasible option toward farm which can also contribute to make agricultural systems more resilient to climate change.

Livestock component

The aim is to improve livestock productivity by empowering small farmers through a suitable flock management practices, an organization and a sustainable lamb value chain under low input production systems in harsh conditions. Based on a survey made for 120 farmers to characterize the livestock production systems and to identify fattening practices, flock management and market. Three major sheep practices were identified: the first group was the lamb producers (LP) only and they represent 21% , the second cluster was the lamb producers-fatteners at the same time (LPF) which represent 55% and the third one was the fatteners only (F) representing 24% of the total sheep practices in Zoghmar community (Bedhief and *al.*, 2015).

For each group, there is a dominant genotype: the (LP) raised mainly the Barbarine breed (native one with fat tail) under low input production system (which means that farmers rely mainly on rangeland for feed resources with little supplementation when needed). The (LPF) category, have half and half Barbarine and Ouled jlel (Algerian thin tail) breeds, this group is encountered in semi-intensive system which means they rely beside the rangeland on purchased concentrate. For (F), they fatten mainly Algerian thin tail lambs, this breed is a trans-boundary breed between Tunisia and Algeria which used to be only at the border but it's now gaining more and more regions in Tunisia, and this group is mainly intensive (which means they rely mainly on purchased feed and concentrate). For

the two last clusters that practice fattening, three fattening periods were followed in Zoghmar community: a short fattening period where fatteners sell their lambs at less than three months after weaning. A second group of fatteners that have an average of 3-6 months of fattening after weaning and a third group of long fattening period with more than six months after weaning and those animals were mainly for religious holiday (Aid el Edha) (Bedhiaf and *al.*, 2015).

The strategy followed by CRP-DS program is to reduce the cost of production by reducing the concentrates used in the animal feed, and by relying more on on-farm feed production and other alternative feed sources that are cheap and locally available. Diagnosis of flock management in Zoghmar community showed that feeding calendar, we identified 4 types of diets in year round and diets includes 30 to 70 % of concentrates feeds (barley, wheat bran and commercial concentrate). In summer and autumn season, farmers rely on cactus to replace part of concentrate feeds and gross feedstuffs (stubbles, hay, and straw). Sheep and goat raised in that region are generally grazing on degraded rangelands (Ibidhi and Ben Salem, 2015).

In fact for lamb producers (LP) category, less concentrate was used in spring and in summer compared to the other seasons because they rely on rangeland, cactus and/or cereal stubble. For lamb producers and fatteners at the same time (LPF), they used 20% of rangeland and 60% of concentrate for feeding their sheep flocks and for the category of fatteners only (F), more than 70% of concentrates, 10% of hay and cactus were used. Cactus must be well used in this community to help farmers to a least cost ration using available by products, alternative feed resources (spineless cactus with high WUE), also known for its anthelmintic activity and on meat quality of small ruminant (Bedhiaf *et al.*, 2015).

Improving the nutrition of small ruminants by using alternative feed sources and feed supplements was an important objective in this program. Spineless cactus has been introduced in the target site many years ago and has been used as animal feed to fill the gap during drought years and dry seasons and in 2015, the OEP (livestock and pasture agency) has planted 200 ha in Zoghmar community. Cactus is a good and cheap source of energy; it is an excellent supplement to poor roughages like straw. Cactus is well adapted to harsh environment and has a high biomass yielding (200 to 100 tons of pads/ha under a rainfall of 200 to 350 mm without any input). A combined diet including barley straw, cactus and Atriplex is able to maintain sheep and ensure a moderate production during the frequent drought years.

Research conducted within this program showed the important role of barley (grain and straw) and cactus importance in the feeding calendar all year around. Also, direct grazing of dual purpose barley and vetches is one aspect of crop/livestock integration tested in Zoghmar community (Benyoussef *et al.*, unpublished).

For market trend, we noticed at the same age and lamb weight, the prices payed by butchers for Algerian thin tail breed are 40 TD higher compared to fat tail lambs, this is dictated by butchers and this confirm a previous study (Bedhiaf *et al.*, 2008) within this acitivity it has been shown that (i) Consumers still prefer the fat-tail Barbarine breed, (ii) Barbarine lambs tend to be superior in flavour and juiciness, (iii) Lambs from Sidi-Bouzid tend to have better juiciness and flavour than lambs in urban area (iv) Butchers are an

important force dictating a shift to thin tail breeds because they don't want to have problem in selling the fat. The result now in Sidi- Bouzid, we have 50% Barbarine breed and 50% Algerian thin tail, two decades ago, there was only the Barbarine breed.

The nutritional status results of sheep flocks, based on the determination of blood metabolites were approximately 42.13 g/l \pm 18.27 for the total protein, 2.26 mmol/l \pm 1.36 for glucose, and 5.06 mmol/l \pm 2.95 for urea. Those values reflected the malnutrition status of sheep due to the unbalanced diet distributed. The work will continue on the importance of different minerals diet content (from 0.1 mg Cu/ day to 1 mg Cu/ day during 3 months) and the effect of its deficiency on metabolic and digestive functions, the performances of production and reproduction, the health and the immune response of sheep breeds (Chérif, 2015).

Chopped cactus olives leaves, stubbles and range vegetation were the animal feeds with low total WF compared to the other feeds used (Figure 1). Feed produced from cereals has the highest WF in the studied region. The green WF has the biggest share of the total WF of feed products. For the blue WF, Commercial concentrate has the highest blue WF, while range vegetation, stubbles and chopped cactus were mainly rainfed. Concerning the water footprint and water productivity assessment of small ruminant products under Zoghmar environment, the average water footprint (WF) values were 4521 liters/Kg of carcass and 6222 liters/kg for goat and sheep, respectively (Ibidhi and Ben Salem, 2015). For sheep and goat meat production, a total of 94% of the water used is a green water, 5% is of blue water and 1% is of a grey water (figure 2). Also, summer WF was lowest due to the water efficiency of ingredients of diets distributed to sheep and goat such as cactus (Figure 3). In order to reduce the WF of meat it is suggested to use high water efficiency animal feeds such as cactus which is a drought tolerant plant species and energy feed source for livestock. Therefore, cactus can promote livestock sector in dry areas and improve farmers' income by increasing the economic water productivity.

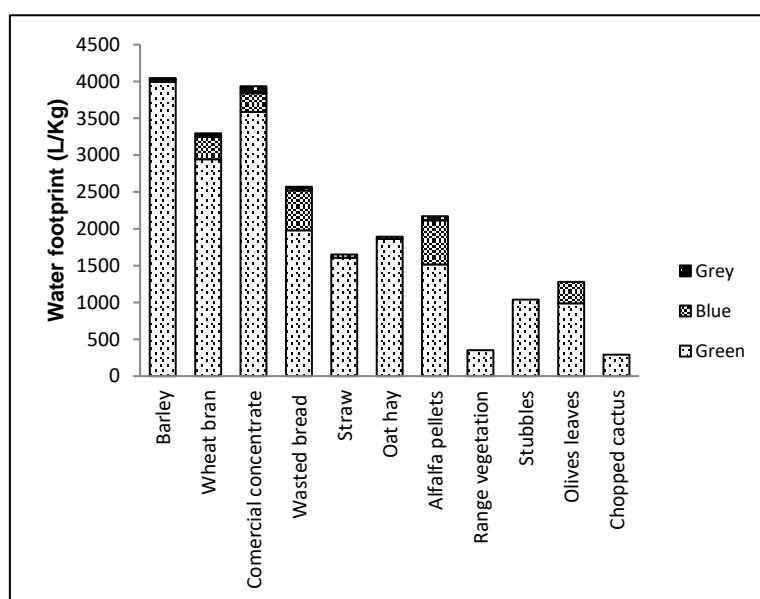


Figure 1. Average water footprint of animal feed (liter /kg).

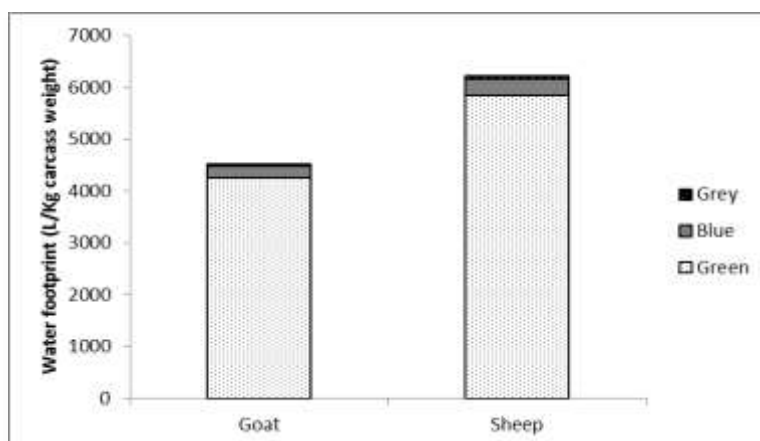


Figure 2. Average water footprint of sheep and goat meat produced in Zoghmar community.

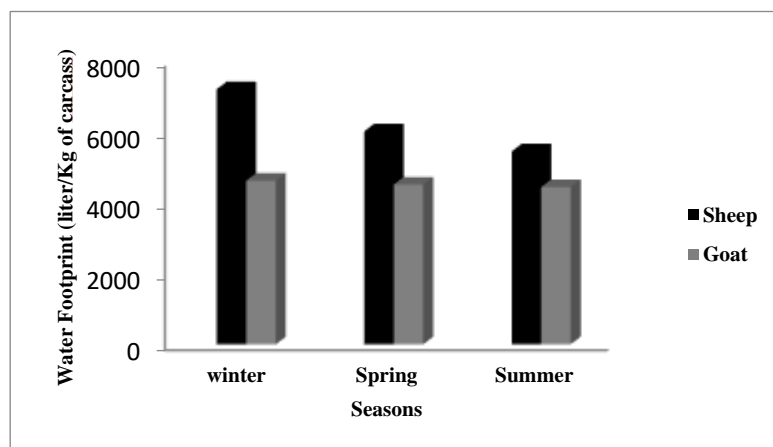


Figure 3. Water Footprint of Sheep and Goat among Seasons in Zoghmar Community

In alley cropping cactus areas, an inventory for *in situ* agro-biodiversity was conducted. Associated species are: *Artemisia sp* and *Lotus edulis*. Dominant species (density>6) encountered in the quadrates during two following years were *Plantago albicans*, *Tesium*, *Crepis*, *Poacea*, *Medicago littoralis* in 2014 and *Plantago*, *Stipa*, *Asteriscus*, *Atractylis*, *Poacea*, *Panorychia*, *M. littoralis*, *Cynodon dactylon* in 2015. We proceed to the multiplication of germoplasm (Table 1) underutilized forage and pasture legumes to be used for animal feeding, soil improvement and rangeland rehabilitation at zoghmar site.

Table 1. Seed multiplication (kg/unit area) in alley cropping areas in 2015.

Species	Accession/ Variety	OEP station 2015
<i>Vicia sativa</i> (5)	Mghila	169 kg
	VS15	34.4kg
	Badr	24 kg
	VN1	32 kg
	Jerba	24.5kg
<i>Vicia narbonensis</i>	INRAT	34 kg

The CRP-DS has developed a genetic improvement strategy and proposed a community-based breeding program to improve sheep productivity at Zoghmar community level (Rebhi, 2015, Abbassi, 2015).

Conservation agriculture component

The specific objectives are: i) to evaluate the effect of CA based on no-till system compared to conventional agriculture (Cv) on soil fertility, Water Use Efficiency (WUE) and crops productivity (cereals and forages) under rainfed regime, and ii) to consolidate results and to enhance adoption of CA by small farmers. During the current cropping season, several on-farm demonstration trials in the framework of CRP-DS have been implemented: 32 on-farm trials at Zoghmar/Sidi Bouzid governorate (CRP-DS program), 30 on farm trials at Fernana/Jendouba governorate (CANA project), 22 on- farm trials at Chouarnia/Siliana governorate (CLCA project), 2 long term on-station trials implemented at Bourabia: the experimental station of INRAT, Zaghouan, Siliana, Kef, Beja, Bizerte governorates (National CA program through INGC program).

The assessments of some on-farm trials were made and several parameters were determined: i) Soil water balance and crop water uptake (soil moisture was measured under different soil depth using gravimetrically method each month) and Water Use Efficiency, ii) Total Dry Matter (TDM) and yields compound of durum wheat and barley, and iii) several agro-physiological parameters (chlorophyll index, chlorophyll content, grain protein content, nitrogen content....).

In 2015, the cropping season in Zoghmar was very dry, annual rainfall was 186 mm and was highly variable from month to month. Under semi-arid condition, grains yield and above ground biomass of barley was improved under conservation agriculture (CA) compared to conventional system (CV) by 24% and 18%, respectively. Grain WUE (WUE-g) and Dry Matter WUE (WUE-DM) of barley were increased compared to conventional system, respectively by 21 % and 8 % (figure 4).

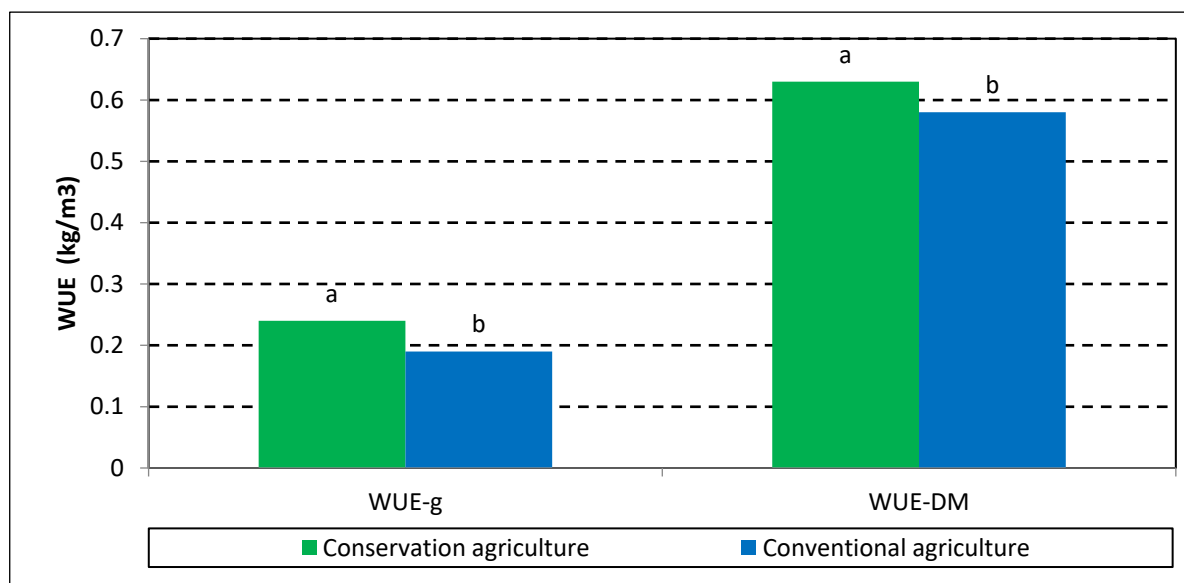


Figure 4. Water Use Efficiency of barley under conservation agriculture.

Up-scaling of conservation agriculture in the framework of CRP-DS

- 1000 ha in semi-arid regions were implemented under CA system at Siliana. Governorate in collaboration with FIDA development project (PDRAI), CLCA project and INGC.
- 250 ha in sub-humid region were implemented under CA system at Jendouba governorate in collaboration with CANA project and INGC.
- 150 farmers adopted CA system.
- 700 farmers and NGOs trained on conservation agriculture (farm field school, field days and training).
- Local farmers association created and 03 innovation platforms implemented.
- 15000 people (farmers, NGOs, students, researchers, extension service, policy makers, and private company) informed and targeted directly and indirectly by Radio broadcasts, Aired TV programs, leaflets, FFS, field days, training, web site.....

List of publications

- Bedhiac S., Daly H., Dhibi B., Dhraief Z., Oueslati M., Gamoudi A., Rebhi B. and Abbassi S., 2015. Innovation platform, farmers' organization and market to empower small farmers benefit from an autochthonous meat sheep value chain under low input production systems. FAO-CIHEAM, 2015, France.

Ibidhi, R and Ben Salem, H. 2015. Water Footprint Assessment of Sheep and Goat Raised Under the Agro-pastoral Production System in the CRP Dryland Systems Action Site of Beni Khedache-SidiBouzid in Tunisia. Mediterranean option, Montpellier.

Abbassi Seif Allah, 2015. Caractérisation des ateliers d'engraissement et comparaison phénotypiques et génétiques des races ovines dans la communauté de Zoghmar (Gouvernorat de Sidi-Bouzid). Mémoire de Mastère de l'INAT, soutenu Juin 2015.

Chérif Chirine, 2015. PhD (en cours)

Rebhi Besma, 2015. Caractérisation des écotypes génétiques des petits ruminants dans le gouvernorat de Sidi Bouzid en vue d'une caractérisation moléculaire. Mémoire de Mastère de l'INAT, soutenu en Juin 2015.



RESEARCH
PROGRAM ON
Dryland Systems

The CGIAR Research Program on Dryland Systems aims to improve the lives of 1.6 billion people and mitigate land and resource degradation in 3 billion hectares covering the world's dry areas.

Dryland Systems engages in integrated agricultural systems research to address key socioeconomic and biophysical constraints that affect food security, equitable and sustainable land and natural resource management, and the livelihoods of poor and marginalized dryland communities. The program unifies eight CGIAR Centers and uses unique partnership platforms to bind together scientific research results with the skills and capacities of national agricultural research systems (NARS), advanced research institutes (ARIs), non-governmental and civil society organizations, the private sector, and other actors to test and develop practical innovative solutions for rural dryland communities.

The program is led by the International Center for Agricultural Research in the Dry Areas (ICARDA), a member of the CGIAR Consortium. CGIAR is a global agriculture research partnership for a food secure future.

For more information, please visit
drylandsystems.cgiar.org

Led by:



In partnership with:

