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Characterization of cropping systems in the oasis of Boussemghoun (El-Bayadh- Algeria)

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Abstract
This study aims to analyze the different characteristics of the oasis agro-system of Boussemghoun in the Oranian Saharan Atlas (south-west of El-Bayadh). The oasis agro-system of Boussemghoun is considered a pillar of employment and a source of income and self-sufficiency for the Ksourian society in the commune of Boussemghoun. Investigations and a series of field surveys were carried out during the year 2022 with oasis farmers to identify the different farming systems practiced and to designate the factors limiting farming practices and to propose solutions and techniques adapted to the oasis environment. Through this diagnosis, the identification of existing cropping systems showed a diversity of production systems with traditional techniques in the oasis agro-system of Boussemghoun. This oasis agro-system presents a particular richness of agro-biodiversity (31 cultivated species) in a Saharan climate, by hundreds of cultivars of the date palm species, the most abundant of which are Feggous, Agharass, Ami Mohammed and Tardbit) dominates in the tree stratum, it is accompanied by 9 fruit species (olive, pomegranate, apple, vine, apricot, quince, pear, peach, fig tree) in the shrub stratum, and by many annual crops (21 market garden and 5 fodder species) in a herbaceous layer in association with family breeding.
Keywords: Agro-system, oasis farmers, Saharan Atlas, traditional techniques, date palm, agro-biodiversity.

Introduction

Agro-systems are artificial systems created by humans since the invention of agriculture, with a view to satisfying their needs for food products and other products of the earth. They are also deprived of self-regulation, which obliges man to intervene frequently in their functioning through fertilization, tillage, disease control, etc. (Nahal, 1998).

The agro-ecosystem is a product of the modification of the ecosystem by man and constitutes a space of interaction between man, his knowledge and his practices and the diversity of natural resources (Tassin, 2012). The agro-ecosystem is the basic unit for studying the relationships between a human community, its environment and the services that ecosystems provide for its subsistence. The agro-ecosystem is therefore a dynamic association comprising crops, pastures, livestock, other species of flora and fauna, the atmosphere, soils and water in

interaction with the uses made of them by men on the basis of their value systems and traditions (Tassin, 2012).

The agro-system, made up of physico-chemical and bio-ecological components, more or less modified or developed by man, therefore corresponds to the replacement of natural balances by natural balances by more unstable secondary balances. These components in interaction with socio-cultural and economic components evolve at various spatio-temporal scales, with very heterogeneous intensities and speeds (Khene, 2007).

The Saharan oases have experienced particularly profound changes, accompanied by social, economic, agricultural and environmental transformations. In addition to the classic stepped date palm oases, there are new extensions of agricultural perimeters through state or local initiatives (Bouaziz *et al*., 2018).

Worldwide, date palm oases cover an area of 800,000 ha (Toutain *et al*., 1988). The oases are intensively cultivated spaces, scattered over 30% of the territories of the emerged lands along the arid belt from Africa to Asia, linking the Sahara to Mongolia and sheltering 150 million people, in environments generally hostile lifestyles (Lacoste, 1992; RADDO, 2002; Khène, 2007). They play a preponderant socio-economic and ecological role in the collective management of water and the development of arid and hyper-arid regions by maintaining, at the strategic borders of the countries north and south of the Sahara, sedentary population's guardians of the space (Dolle, 1990; Sghaier, 1994; Hadidi, 2019). They are structured in multi-strata vegetation composed of wild and cultivated plant species, and dominated by a canopy, below which a large animal and plant biodiversity occurs in the lower vegetation stratum (Gebauer *et al*., 2007; Guezoul *et al*., 2013).

Algeria is a date-growing country ranked sixth in the world and first in the Maghreb for its large areas of cultivation with 160,000 ha and more than 2 million gardens and its average annual production of dates of 500,000 tons. The date palm Constitutes the first stratum of culture and the dominant culture in the oases, it is rich with its rustic varieties such as *Deglet Nour, Degla Bayda, Ghars,* for self-consumption and sale (Frédérique, 2010).

The Algerian oases are located in 14 provinces ranging from the north of the Sahara to the extreme south: Khenchela, M'sila (Bousaada), Batna (E'Mdoukal), Biskra, El Oued, Tébessa, Ouargla, Laghouat, Ghardaïa, Naâma (Asla, Tiout, Moghrar), Béchar, Adrar, Illizi, and Tamanrasset. The provinces with the largest number of date palm trees are in order: Biskra, Adrar, El Oued, Ouargla, Béchar, Ghardaïa and Tamanrasset for a total of 15,860,000 palm trees or 93.27% of palm trees at the level national. These regions naturally provide the vast majority of the country's date production (Blama, 2014; Moulai and Yahaya, 2019; Benaradj *et al*., 2020; Faci, 2021).

Among the existing oases in Algeria according to the geographical position, the mountain and altitude oases (pre-Saharan Oasis of Naama, El-Bayadh). They are at the limit of the Saharan and mountainous space, in deep valleys. They are located essentially, in the form of localized oases all along the wadis, in the vicinity

of water sources and in places where the levels of the water tables are shallow. This oasis agro-system exists at the level of the pre-Saharan space, often marked by an agro-sylvo-pastoral activity due to its geographical location which forms an intermediate zone between the steppe plains, the mountainous regions of the Saharan Atlas from West to East and the northern Sahara (Benaradj *et al*., 2020). The objective of this study is to characterize and analyze the different cropping systems existing in the oasis of Boussemghoun, an oasis that requires an analysis centered on the technical, socio-economic and ecological aspects. The study of cropping systems is fundamental in our work because it is a set of decision and organization of cultivation and breeding practices and space management.

Materials and methods

Study area

Geographic localization of the Oasis of Boussemghoun: The study area belongs to the daïra of Boussemghoun, province of El Bayadh (Western Algeria). It is located at the extreme south of El Bayadh towards the provinces of Naama, Béchar, Adrar isolated between a mountain range of the Ksour Mountains of Algeria 190 km south-west of El Bayadh in the western part of the High steppe plains. It is bounded to the north by the commune of Chellala, to the south by the commune of Abiodh Sidi Cheikh, to the south/east by the commune of El Bnoud and to the west and southwest by the province of Naama. It covers an area of 586.10 km² or 3% of the territory of El-Bayadh (DPSB, 2020; Benaradj *et al*., 2021). It is located at the following geographical coordinates: 32°51’53’’N and 0°01’07’’E and average altitude of 1000 m.

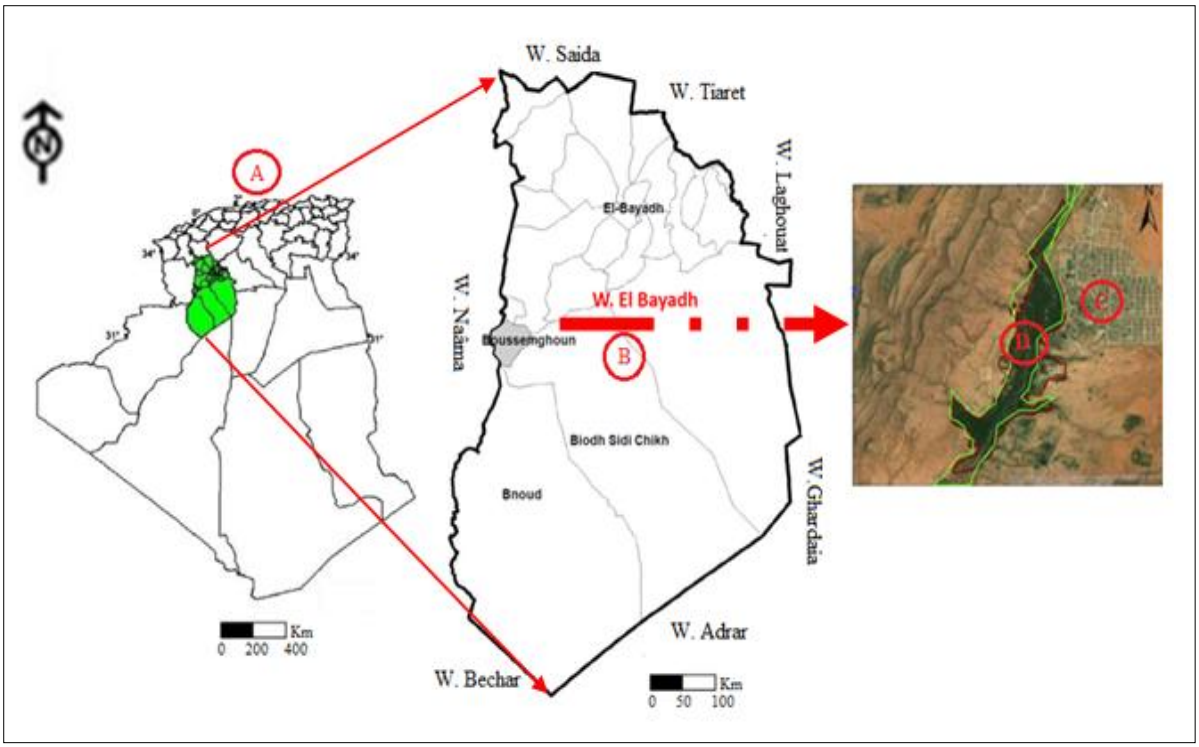

Figure 1. Map of Algeria (A), the wilaya of El Bayadh (B), the municipality of

Boussemghoun (C), the oasis (D)

Climate framework: The Boussemghoun region has an arid Mediterranean climate of the Saharan type with a very cold winter and a hot and dry summer with temperatures that can reach 48°C. Over the year, the average temperature is 18°C with temperatures that can reach 48°C and rainfall is very irregular during the year with an average of 180 mm/year. The prevailing winds are from the southwest. They are frequent and variable throughout the year (Ait Saadi *et al*., 2017; Benaradj *et al*., 2021). Due to the geographical location of the Boussemghoun region (400 km from the coast), the action of the Mediterranean is blurred while the Saharan influences assert themselves (Hadidi, 2019).

Socio-economic framework: The ksar, of a trapezoidal shape, occupies an area of 3.04 ha. It is protected from gusts of wind and sun by the palm grove which extends over 39 Ha (Benali, 2004). The inhabitants of the ksar of Boussemghoun descend from the Berber tribes of "Zenata and speak the Amazigh language (native language of the local population of the ksour). The population of the ksar depends on the oasis, since the agricultural environment formed a basic source for life and an important resource for the supply of local building materials in wood and adobe (Ait Saadi, 2017).

The population of Boussemghoun is 4605 inhabitants in 2020, i.e. a population density of 7.86 Hab/km² (Tab.1). We have seen a significant change in the population, it has almost tripled in 85 years; it went from 1,407 to 4,605 between 1936 and 2020 (DPSB, 2020). In addition, the bioclimatic conditions which are more advantageous compared to those of the pre-Saharan part have favored the installation and development of a human settlement (Ait Saadi *et al*., 2017).

The Boussemghoun region has significant agricultural potential, the Useful Agricultural Area (U.A.A) is estimated at 2648 ha, of which 844 ha is irrigated. The courses in the esparto zones occupy an area of 1280 ha. This geographical location favors oasis agriculture on hills between Jebel Tanout and Jebel Tameda. The area of 30 to 39 ha of palm grove in association with other crops, namely arboriculture and market gardening and fodder crops (Youcef and Rachedine, 2017, Benali M, 2004). Regarding animal production, the region has an agro-pastoral vocation and the livestock is estimated at 30,515 head.

Methodological approach

The strategy adopted is based on the exploration of the study area and contact with the different categories of farmers to better understand the farming systems practiced and more particularly at the level of the Boussemghoun study area located south of the province of El Bayadh.

Choice of the "Oasis de Boussemghoun" as study area : To achieve the purpose of this work, the oasis of Boussemghoun was chosen, taking into account the following criteria (seniority of the palm groves, the structure of the population and agricultural production and virgin land little exploited in the field of pre-Saharan agriculture).

People's choice : In our case, the population is made up of the section active in the field of agriculture; the study sample is made up of a total of 30 farmers. The farmers surveyed were approached with the collaboration of the staff of the Directorate of Agricultural Services (DAS) of El-Bayadh and the guide in order to obtain as much information as possible related to our subject.

The methodology adopted requires the use of appropriate observation or survey methods. It focuses on the following points:

- Bibliographic research was carried out to become familiar with the subject. It consisted in reviewing various sources, such as scientific publications, theses, books and other documents concerning the subject.
- Collect the necessary information from the various organizations (DSA of El-Bayadh, agricultural subdivision of Boussemghoun, DBSB of El-Bayadh).
- Completion of the operator survey. This step consists of collecting the necessary information dealing with socio-economic aspects and direct observation. The development of a sheet in the form of a questionnaire is relevant to identify the various points relating to oasis agriculture. The sheet developed is based on three key points (date palms, arboriculture and market gardening) which are essential to oasis agriculture. The surveys were carried out in the form of interviews with farmers and visual observations of the farms. We also leave the respondent the possibility of adding other alternatives. Among the survey questions:

• Identification of the operator (age – level of education ……)
• Identification of the farm. (Size -mode of asserting)
• Means of production
• Types of crops
• Management and maintenance (irrigation, fertilization, etc.)
• Phytosanitary state
• Existing varieties
• Animal production
• Open questions

d) Counting, processing of data collected and statistical analysis.

RESULTS

For the characterization of the production system in the oasis of Boussemghoun, we also proceeded to a classification of the oasis farms according to the cropping systems and their importance.

Information relating to the surface area of the holdings, the surface areas of the various crops, the size of the livestock, as well as indications relating to the products sold according to the cropping systems.

Demographic characterization

Juridical nature

The farms that were the subject of the survey were obtained by inheritance from generation to generation and they are small areas not exceeding 1.5 hectares (small plot) divided into plots between the heirs (Fig.2). However, no farm is acquired

under the Accession to Agricultural Land Ownership program.

Age of farmers

The age of the farmers surveyed in our study is between 30 and 90 years old. The results show that more than half of this population (53%) is between 51 and 70 years old, i.e. 16 farmers; more than a third (37%) are between 30 and 50 years old, i.e. 11 farmers; nearly (10%) are from 71 to 90, i.e. 3 farmers.

According to these results, it is concluded that the farmers proportionally the most active seniors aged 51 to 70 thus constitute, by far, the socio-professional group of the oasis agriculture of Boussemghoun and the young people are less interested in this type of activity (Fig.2).

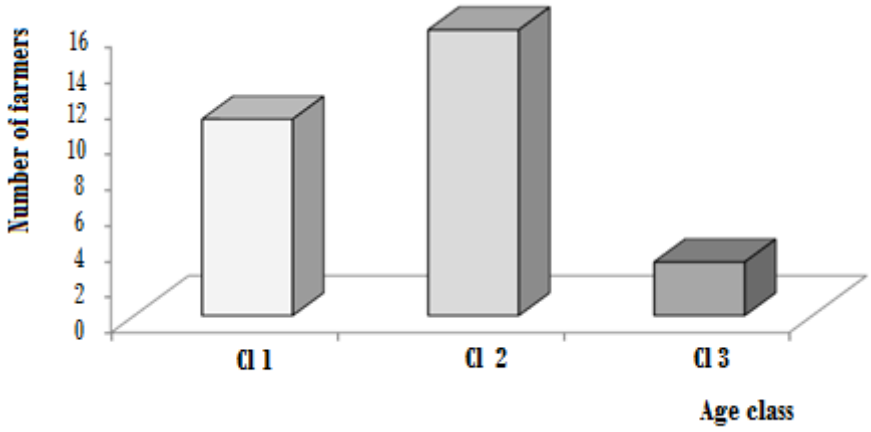

Figure 2. Distribution of operators farmers by class age: Cl 1:30-50 years; Cl 2: 51-70 years; Cl 3: 71-90 years

Educational level of farmers

According to the data in the graph which represents the education level of farmers, we see that 33% of them have a primary level. 40% have a secondary level. The illiteracy rate of farmers is estimated at 27%, which constitutes a limiting factor in the dynamics of agricultural production (Fig.3).

It is concluded that the farmers have a modest level of education enabling them to be able to communicate and translate their thoughts into writing. The farmers interviewed said they had no qualifying training in agricultural production to enable them to better manage their farms.

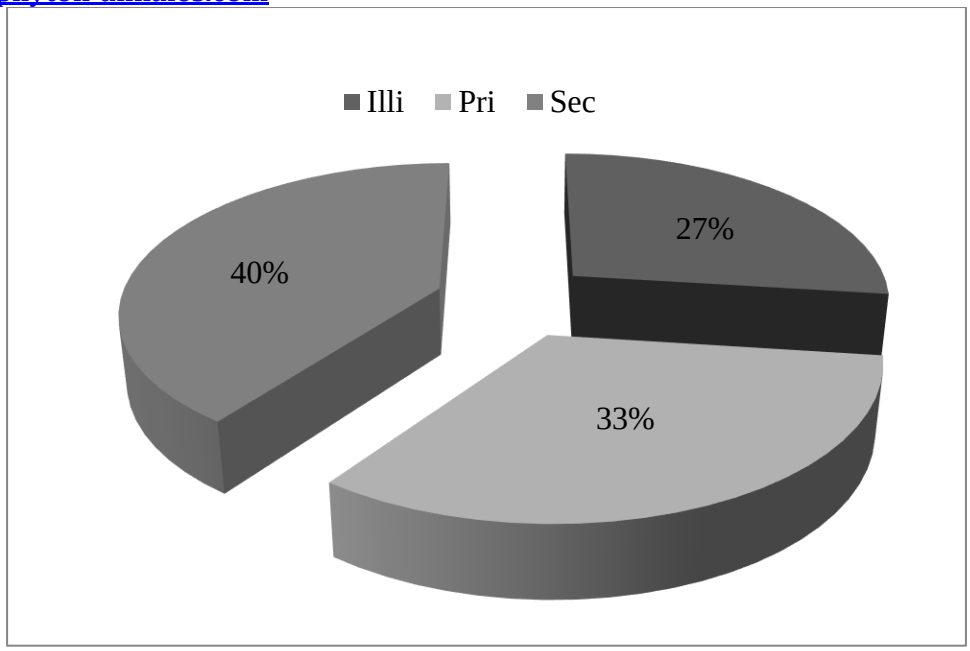

Figure 3. Distribution of operators according to level of education :Illi : illiteracy;Pri: primary level; Sec: secondary level

Workforce

Because the farms are very small and acquired by inheritance, the farmers do not employ any employees, the farmers use family labor.

Therefore, the responses of the respondents show great stability in the family workforce.

Farmers practice agriculture which covers the following areas:

• Cultivation in three strata: date palm, arboriculture and low fodder cultivation and market gardening.

• Mixed farming: The superposition of the three levels of cultivation and breeding.

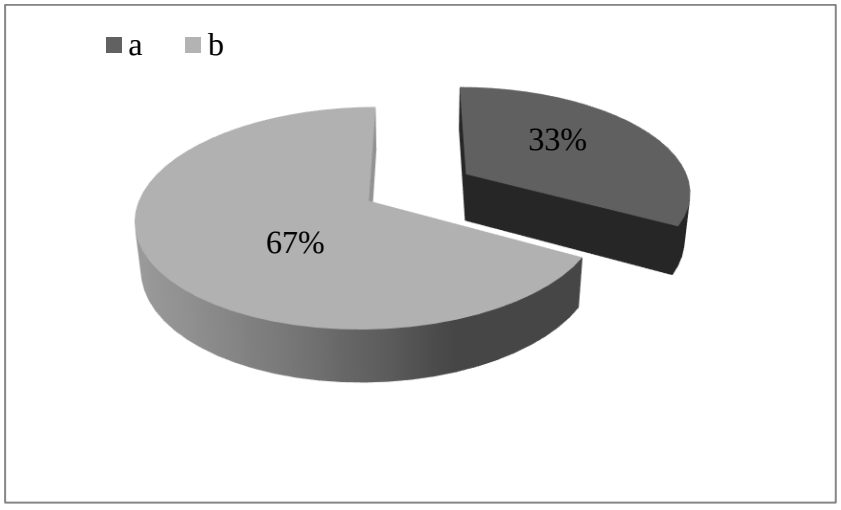

Figure 4. Breakdown of operators by activity: a: Cultivation in strata; b: Cultivation and breeding

Irrigation system

Water is essential for agricultural and socio-economic development, it requires techniques to preserve it and use it well. The Boussemgoun oasis is known for its traditional system, i.e. 99% (foggara) and 1% by sprinkling (Fig.5).

Figure 5. Crop Irrigation System (a) Foggara flooding, (b) sprinkling

Equipment and Cultivates crops

Equipment

The small size of farms, the expensive price of agricultural machinery, the financial incapacity of farmers and the unavailability of skilled labor do not encourage farmers to invest in the means of production. We find simple agricultural equipment such as: the shovel, the pickaxe, the pincers, the pruning shears. Based on farm-level surveys; it should be noted the absence of appropriate agricultural equipment.

Amendment and fertilization

In order to improve the fertility of the plots, the farmers of the oasis use organic manure (slurry from sheep, goats and poultry) and, to a lesser degree, mineral fertilizers.

Windbreaks

The majority of farmers use dry palms, fences and trees to protect crops. The effectiveness of a windbreak lies in the creation of a protective zone where the air circulates in the exploitation and the elimination of the fight against silting.

Weeding

Weeds are herbaceous or woody plants that are undesirable where it is located; they are both competitive and complementary at the same time.

Figure 6. Windbreaks in the Boussemghoun oasis: a: ground wall; b: stone; c: dry palms

Cropping systems and Livestock

The oasis of Boussemghoun is structured by small traditional oasis farms in deep valleys or along the wadis of Boussemghoun. It is characterized by crops in the under storey of palm trees, fruit trees and rustic trees, as well as market gardening. The majority of farms were classified in the intensive production system group. The agro-system practiced in the oasis of Boussemghoun forms one to three floors:

- First floor of date palm
- Second floor of arboriculture
- Third stage of herbaceous market gardening and fodder cultivation.

Figure 7. Three-stage oasis cropping system in the Boussemghoun oasis: 1: Date palm; 2: Arboriculture; 3: Herbaceous market

On both banks of the valley that passes west of Boussemghoun, the palm grove extends for about seven (7) kilometers in length while its width remains narrow in line with the abundance of water, the quality of the soil and terrain. There are more than 10,000 palm trees, the oldest palm trees produce 20 to 30 kg per foot, young palm trees produce up to 100 kg.

Arboriculture represents the second layer and benefits from a micro-climate created by date palms. The study made it possible to inventory 9 fruit species belonging to 5 botanical families (5 species of Rosaceae and 1 species for each of the families of Oleaceae, Punicaceae, Ampelidaceae and Moraceae), essentially are the pomegranate olive tree, apple tree, olive vine, apricot, quince, pear, peach, fig. These hardy fruit trees adapted to the oasis environment are intended for self-consumption and sale in local markets. Pomegranates from the oasis are harvested and brought to towns in the north, which are renowned throughout the region for their unique high quality.

Table 3. Fruit species grown in the oasis of Boussemghoun

No.	**Common name**	**Scientific name**	**Botanical family**
1	**Olive tree**	*Olea europaea*	Oleaceae
2	**Pomegranate tree**	*Punica granatum*	Punicaceae
3	**Vine**	*Vitis vinifera*	Ampelidaceae

4	**Apple tree**	*Malus domestica*	Rosaceae
5	**Quince**	*Cydonia oblonga*	Rosaceae
6	**Pear tree**	*Pyrus communis*	Rosaceae
7	**To fish**	*Amygdalus persica*	Rosaceae
8	**Apricot tree**	*Prunus armeniaca*	Rosaceae
9	**Fig tree**	*Ficus carica*	Moraceae

Figure 8. Arboriculture in the Boussemghoun oasis (a: Pomegranate tree; b:Olive tree)

The third floor of herbaceous crops (fodder and market gardening) was benefits from the microclimate created by the 2 upper floors phoenicicole and arboreal. Several species adapt to these cultures in the oases. Fodder crops are mainly represented by alfalfa, barley and wheat, they occupy small areas ranging from 0.2 to 0.4 ha per farm, and they are intended to meet the needs of the herd integrated into the farm.

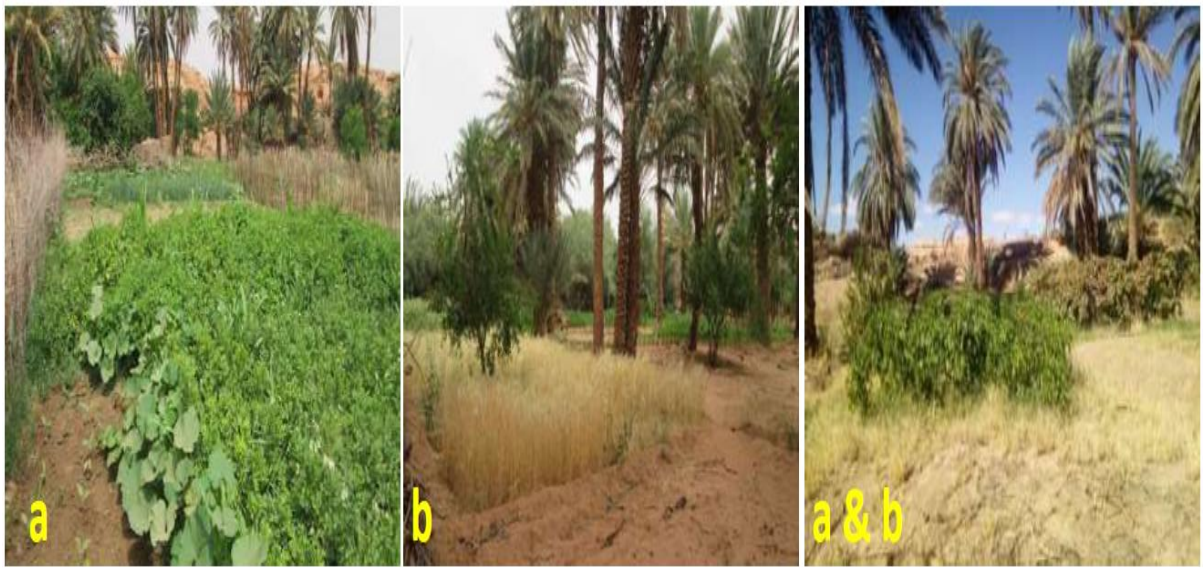

Figure 9. Herbaceous crops (a) Market gardening; (b) Fodder

Table 4. Forage species cultivated in the oasis of Boussemghoun

No.	**Common name**	**Scientific name**	**Botanical family**
1	**Barley**	*Hordeum vulgare*	Poaceae
2	**Wheat**	*Triticum aestivum*	Poaceae
3	**Alfalfa**	*Medicago sativa*	Fabaceae
4	**But**	*Zea mays*	Poaceae
5	**Oats**	*Avena sativa*	Poaceae

The cultures established are not very varied. The areas are small; they vary from 0.5 to 0.7 hectare per farm, the majority of farmers practice market gardening for self-consumption and are only intended for secondarily for sale in the markets. Among the cultivated species are: Potato, Onion, Tomato, Bean, Shuttle bus, Carrot …

Table 5. Vegetable species cultivated in the oasis of Boussemghoun

No.	**Common name**	**Scientific name**	**Botanical family**
1	**Potato**	*Solanum tuberosum*	Solanaceae
2	**Onion**	*Allium cepa*	Amaryllidaceae
3	**Tomato**	*Solanumlycopersicum*	Solanaceae
4	**Bean**	*Vicia faba*	Fabaceae
5	**Shuttle bus**	*Brassica rapa*	Brassicaceae
6	**Pumpkin**	*Cucurbita maxima*	Cucurbitacées
7	**Squash**	*Cucurbitapepo*	Cucurbitaceae
8	**Carrot**	*Daucus carota*	Apiaceae
9	**Parsley**	*Petroselinumcrispum*	Apiaceae
10	**Mint**	*Mentha mentha*	Lamiaceae

11	**Melon**	*Cucumismelo*	Cucurbitaceae
12	**Watermelon**	*Citrullus lanatus*	Cucurbitaceae
13	**Green bean**	*Phaseolus vulgaris*	Fabaceae
14	**Pepper**	*Capsicum annuum*	Solanaceae
15	**Garlic**	*Allium sativum*	Amaryllidaceae
16	**Eggplant**	*Solanum melongena*	Solanaceae
17	**Coriander**	*Coriandrum sativum*	Apiacées
18	**Celery**	*Apium graveolens*	Apiaceae
19	**Cucumber**	*Cucumis sativus*	Cucurbitaceae
20	**Lettuce**	*Lactuca sativa*	Asteraceae
21	**Pepper**	*Capsicumannuum*	Solanaceae

Livestock

The oasis of Boussemghoun is known for the diversification of production systems that combine livestock and agriculture, which allows oasis dwellers to obtain means of subsistence in food, health and education. Part of the food needs of the herd is covered by the production of the oasis. Breeding makes it possible to valorize crop by-products (straw, date waste, etc.), input and manure which improves soil fertility, The animals raised by the families are intended for self-consumption or sale, it partly ensures the supply of meat, milk, eggs.

Table 6. Types of farming practiced in the oasis of Boussemghoun

Type of breeding	Number of heads	Number of farmers
Sheep alone	3 to 60	10
Goat alone	0	-
Cattle alone	0	-
Mixed breeding	3 to 55	10
Poultry farming	5 to 20	5
Rabbit farming	0	3
Beekeeping	6 to 30	0

The survey results on 30 farms show that 20 farms practice the breeding of small ruminants; this is sheep farming alone or in association with goats. The size of the herd varies from 3 to 60 heads with a dominance of sheep whose number of ewes varies from 4 to 40 heads. Cattle breeding is absent in the oasis production system. This herd of small ruminants is exploited for the production of meat and milk.

Ruminants are traditionally kept in stalls and pastured in bordering rangelands. As soon as they return, the herd receives supplementation based on concentrate, crop weeds, alfalfa, dates or scrap dates, crop residues or various by-products from the oasis. For the conduct of the reproduction of ruminants, the males remain permanently

with the females, the natural mounting is practiced.
For the breeding of small animals, no case of beekeeping has been recorded. In addition, rabbits and poultry are small in size. Farmers are conducted traditionally without significant investment. They recycle household waste and by-products. This type of farming is carried out mainly by women in a traditional and sedentary way.
For rabbit breeding, only three farmers practice it with a workforce ranging from 3 to 30 rabbits per farm. For housing, rabbits are raised in the courtyard of houses in a place dedicated to them. They are driven to the ground in the open air surrounded by a fence or they dig underground galleries.
Poultry farming is practiced by five farmers. Rustic breeds of poultry are raised. The size of the poultry varies from 5 to 20 heads per farm. Rudimentary poultry houses are used.

Figure 10. Types of farming: A: poultry; B: rabbit; C; goats; D: sheep

DISCUSSION

Irrigation system

The Irrigation water is mainly of underground origin and is mobilized by wells and boreholes. Farmers generally own their basic irrigation equipment; as for agricultural equipment, its less frequent possession is positively correlated with the size of the farm (Hadidi, 2019).
The foggara is an ancestral technique of capturing and sharing groundwater, it is composed of aeration wells, pipes and underground galleries to supply the ksar and irrigate the oases (Remini and Achour, 2008).
The needs of crops in water vary according to the species, market gardening,

requiring some watering in the spring; alfalfa and date palm require water all year round. The apricot and olive trees can be satisfied with occasional watering, while citrus fruits require continuous irrigation (Hadidi, 2019).

The distribution of irrigation water in the plots is carried out by the "Nouba" method, that is to say in turn, except that the duration of irrigation depends on the contribution of the individual. From the dam a network of seguia (chanel) has been designed inside the palm grove to transport water to the farmers one by one. Irrigation of the farm will start from midnight until sunrise, depending on the order and the size of the plots. For each owner, the duration of flow varies from two to four hours; the latter is named (*takharobt*).

The different surface irrigation techniques used in the oasis of Boussemghoun are:

- Submersion irrigation (Fig.16): In the oasis of Boussemghoun, the most exploited mode of irrigation is submersion irrigation with seguias systems for palm crops. This technique consists of rapidly introducing water into basins suitably delimited by small dikes leveled horizontally, then letting this water infiltrate into the soil (Pommeret, 1971). This technique has its advantages in destroying weeds, frost protection. It is a gravity irrigation system is among the systems used in the oasis. This mode of gravity irrigation generates a huge waste of water and consequently the reduction of the level of the water table. However, it causes soil compaction, reduced permeability and porosity, and water loss. The drying up of water tables and the salinization of the soil.
- Runoff irrigation: the water runs off in a thin layer over the entire surface to be irrigated and gradually infiltrates (Pommeret, 1971)
- Irrigation by infiltration channels: the water runs off only on part of the ground, in previously arranged furrows, and infiltrates laterally and vertically. Furrow irrigation is particularly suitable for row crops. Corrugated irrigation (micro-furrows) is a variant adapted to cover crops (Pommeret, 1971).

Equipment and Cultivates crops

The same findings are described by several authors in oases (Bouzeria and Mecif, 2018; Benaradj *et al*., 2020).

Fertilization is the supply of nutrients to the soil to improve the physicochemical and biological characteristics of the soil and thus to optimize the development and significant yield of plants (Benamara and Djotni, 2018).

The windbreak is an inert or plant barrier that protects cultivated land against wind erosion and the unfavorable effect of the wind. In arid areas, windbreaks improve the microclimate, reduce potential evapotranspiration, reduce wind erosion and optimize crop yield (Boualem, 2006; Benaradj *et al*., 2022).

Weeds are herbaceous or woody plants that are undesirable where it is located; they are both competitive and complementary at the same time. Depending on the palm groves, the weeds differ; we most commonly encounter: wild oats, lamb's-quarters, sowthistle, knotweed, mercuriales, orach, houlques, phragmites, quackgrass, false diss, cyperus, etc. (Ferry and Toutain, 1990).

Weeds are often cited as one of the major problems in different cropping systems, particularly in market gardening and cereal growing (Mahmoudi, 2014).

Cropping systems and Livestock

The oasis production system is based on layered cultivation associated with livestock. It is very intensive (palm trees, fruit growing, market gardening, cereals, fodder). According to the results presented, it is noted that the most practiced crops are Phoeniciculture and fruit arboriculture and market gardening and, in the second degree, followed by cereal crops and legumes (Bouzeria and Mecif, 2018; Boucherit *et al*., 2020, Benaradj *et al*., 2020; Boucherit *et al*., 2024).

The date palm is the basis of agriculture in the oasis of Boussemghoun. In addition to human consumption, some poor quality date varieties and by-products are intended for livestock feed. The palm grove crossed by a wadi constantly supplied with water from numerous springs, excellent land for cultivation divided into an infinity of gardens According to Rahal-Bouziane (2006), the main crop in the oases is the date palm in the shade of which various crops grow (cereals, fodder, medicinal and condiment plants, market gardening and industrial crops).

According to our survey and the guide, the oasis of Bousemghoun has more than 100 date cultivars. The most abundant and best paying cultivars are Feggous, Agharass, Ami Mohammed and Tardbit which contain the best appearance and size. According to Ait Saadi, 2019, these dates are considered the most beautiful in the region and similar to those in western oases, but they cannot be stored for a long time.

Conclusions

The oasis agrosystem is considered a pillar of employment and a source of income and self-sufficiency for the Ksourian society of Boussemghoun. This work started with a series of surveys that allowed us to identify the different cropping systems and constraints.

The oasis agrosystem of Boussemghoun was characterized by the following particularities:

- It is geographically part of the Saharan Atlas with a diversity of cropping system, vegetation and animals and quality of production;
- The oasis constitutes a closed environment, which can accommodate original families having right of access to the land (owners of the land of the palm grove);
- The oasis is composed of three levels of cultivation; the first is the date palm which is distinguished by a varietal diversity. Arboriculture constitutes the second stratum; it presents hardy varieties adapted to the oasis environment. The last stratum includes market gardening and fodder crops intended for human and animal consumption. All these strata form a special microclimate adapted to an arid climate.
- A production system associated with the breeding of small ruminants and small family-type breeding intended essentially for self-consumption.
- This space is considered traditional where water and soil resources are limited.

Therefore, access to these resources is subject to social rules at the level of the Ksourian community.
- The identification of existing cropping systems showed a diversity of production systems with rudimentary techniques.
The oasis of Boussemghoun has been able to resist these constraints over the years. To ensure the sustainability of the oasis system, it is necessary to: - Manage water resources by minimizing water loss through the use of localized irrigation systems;
- Improve production systems for the satisfaction of the local population, and the flow of surplus to neighboring markets in bordering regions;
- Collaboration with technical services for the phytosanitary protection of crops and awareness, extension and training of a qualified workforce.
- raise specific problems through integration and cooperation with professionals. - Consolidate the socio-economic environment.
In perspective, knowledge of the oasis agro-system and its evolution with farming practices is an essential prerequisite for safeguarding agricultural potential and ensuring the improvement of the living conditions of the local population.
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