



Project Number: 1567

Project Acronym: ISFERALDA

Project title: Improving Soil FERtility in Arid and semi-arid regions using Local organic
DATE palm residues

D3.2 AGRICULTURAL SURVEY OF THE STUDY SITES

Authors : Xavier Morvan¹, Vincent Miconnet¹, Salah Eddine Benziouche² and Mohamed Moussa³

1: University of Reims Champagne-Ardenne, 51100 REIMS, FRANCE

2: University Mohamed Khider of Biskra, BISKRA, ALGERIA

3: Laboratory of Eremology and Combating desertification, Institute of Arid Regions, Medenine 4100, Tunisia

Summary

Local field surveys, conducted with a representative sample of studied sites' farmers, were performed in the oases of study sites. These surveys aim at defining the initial state of study sites. The subjects covered by the surveys include the varieties of crop grown, the technical itineraries, soil work, amendments applied, irrigation... The surveys based on closed and open questions cover multiple topics such as socioeconomic and demographic conditions of the farmers, farmers' perception of the oasis degradation and potential barriers that may hamper the farmers to adopt sustainable management practices.

The dominant variety of date palm tree in the oases studied is Deglet Nour.

The main irrigation system used in the different farms of the oases is the submersion system.

Among the existing threats to soils in the oases, water scarcity and soil salinization are the best identified. Farmers believe that the fight against oasis degradation is beyond their capacities and that the methods they currently use, like fences to combat soil erosion or mineral amendment, do not represent radical long-term solutions to fight oasis degradation.

Very little use is made of the waste from the date palm trees. Most farmers burn this waste. Depending on the region studied, the use of date palm residues varies between 9 and 30%. Most farmers use date palm leaves as fences to combat wind erosion. Very few of them use this waste as compost, none of them use them to produce biochar. Instead, farmers use organic amendments, such as animal manure.

This shows the importance of the ISFERALDA project in changing farming practices and leading farmers to use more date palm residues as organic amendment (compost and biochar) to improve the fertility and properties of their soils.

1- Table des matières

1.	Tunisian study sites	5
1.1	Characteristics of interviewed farmers.....	5
1.2	Agricultural exploitation	5
1.3	Irrigation system in the Nefzaoua region and low frequency of water turns.....	6
1.4	Waste in the oasis	7
1.5	Amendments applied by farmers	8
1.6	Effect of the amendment on a fodder crop.....	9
1.7	Indicators of the degradation	10
2	Algerian study sites	10
2.1	Agricultural exploitations in Ziban and Oued Righ	11
2.1.1	Farm size	11
2.1.2	Varietal structure of the phoeniculture potential	11
2.1.3	Date palm density	12
2.1.4	The age of the plantations	12
2.2	Cultivation management	12
2.2.1	Agricultural operations	12
2.2.2	Mechanization.....	13
2.2.3	Pesticide use	13
2.3	Irrigation and drainage	13
2.4	Wastes in oasis.....	14
2.5	Organic and mineral amendment.....	14

List of Figures

Figure 1 : Distribution of respondents according to their age and literacy level	5
Figure 2 : A. Land distribution owned by the farmers, B. Work duration in the oasis	6
Figure 3 : Cultivation system in the oasis of Nefzaoua, A. Number of date palms owned by the farmer, B. Crops grown next to date palm	6
Figure 4 : Irrigation system in Nefzaoua oasis	7
Figure 5 : The drainage system in the oasis	7
Figure 6 : Palm tree waste in oasis system	8
Figure 7 : Effect of soil amendment in improvement of date palm production.....	10
Figure 8 : Farmer's perceptions on a set of common degradations signs of Nefzaoua oasis.....	10
Figure 9 : Farm size of the Algerian farmers interviewed.....	11
Figure 10 : Use of waste in the Algerian oases	14
Figure 11 : Type of manure used by date producers	15

List of Tables

Table 1 : Frequency of water delivery in Nefzaoua oasis	7
Table 2 : Amendments applied by farmers.....	8
Table 3 : Cost of oasis soil amendment	9

1. Introduction

Local field surveys have been performed with a representative sample of studied sites' farmers in the oases of study sites. These surveys aim at defining the initial state of study sites. The subjects covered by the surveys include the varieties of crop grown, the technical itineraries, soil work, amendments applied, irrigation (Annex 1) ... The surveys based on closed and open questions cover multiple topics such as socioeconomic and demographic conditions of the farmers, farmers' perception of the oasis degradation and potential barriers that may hamper the farmers to adopt sustainable management practices.

The analyses of the agricultural surveys were treated differently depending on the country of origin because the culture and some of the agricultural methods of the date producers differed somewhat in the 2 countries. Thus, this report is made up of two parts in which the Tunisian surveys are analysed first, and the Algerian surveys second.

2. Tunisian study sites

1.1 Characteristics of interviewed farmers

The demographic information of the interviewed farmers is presented in Figure 1. It shows that 49.5% of the farmers involved in the farming work are old and illiterate, 38.7% of the farmers are middle-aged and possessed basic primary and middle education levels. The young farmers represent only 11.8% of the farmers who work in the oasis. They have had more school education than the older farmers.

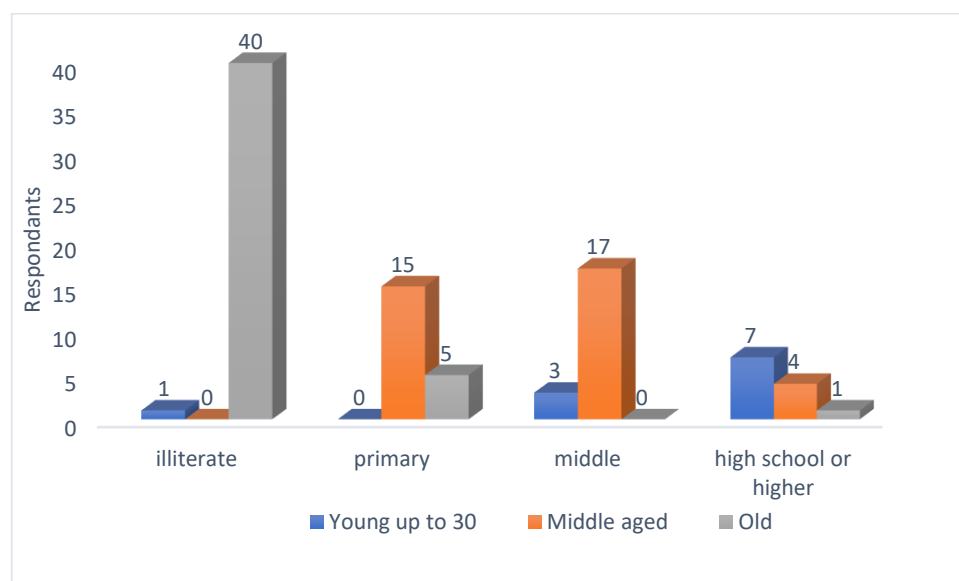


Figure 1 : Distribution of respondents according to their age and literacy level

1.2 Agricultural exploitation

Almost all farmers have their own farm (99%). The area of the majority of the farms (94%) is higher than 0.20 ha. The collected data also indicate that most farmers have been working in the oasis for more than 15 years (Figure 2). Most of the interviewed farmers (96%) own more than 100 date palm trees. Below the date palm trees, most of the farmers (89%) grows fodder as the oasis support a wide range of adapting local fodder for domesticated animal consumption or for trades (Figure 3).

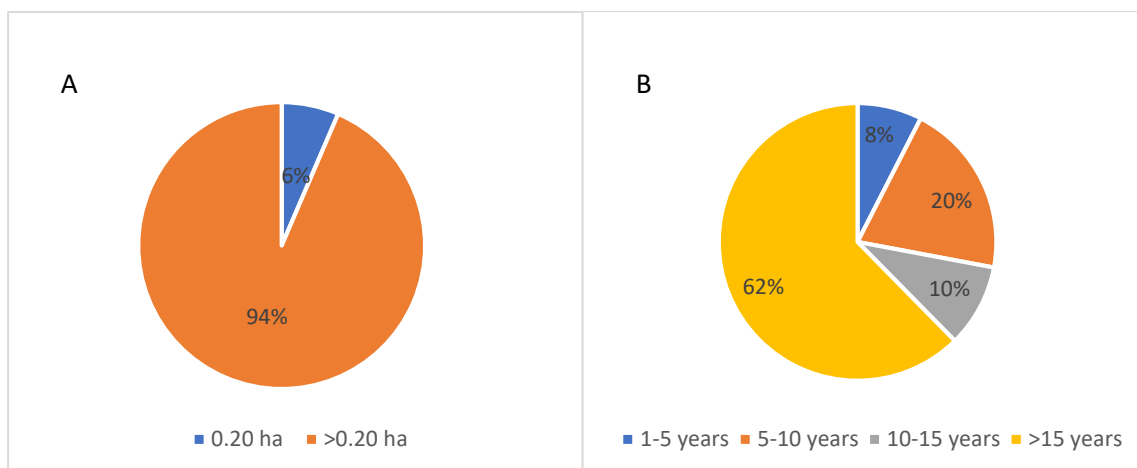


Figure 2 : A. Land distribution owned by the farmers, B. Work duration in the oasis

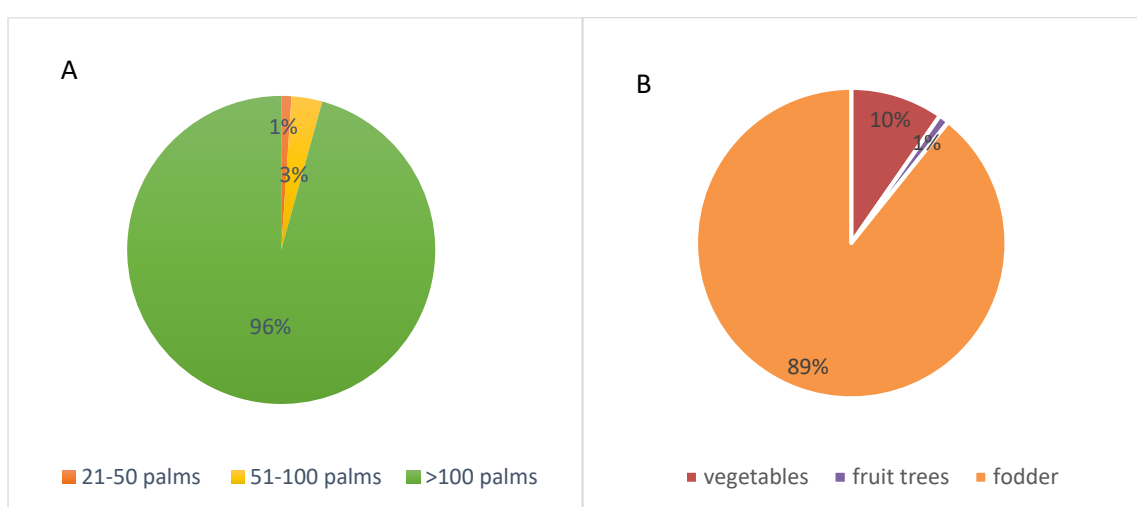


Figure 3 : Cultivation system in the oasis of Nefzaoua, A. Number of date palms owned by the farmer, B. Crops grown next to date palm

1.3 Irrigation system in the Nefzaoua region and low frequency of water turns

The results of the survey indicates that life in the oases depends almost exclusively on water. Water is the source of life for the oases populations in the Nefzaoua region.

The most widely used irrigation technique in the Nefzaoua oasis system is the submersion irrigation, it is used for 83% of the interviewed farmers (Figure 4).

In the oases surveyed, the frequency of the water delivery as shown in Table 1 is around 25.8 days, but it can reach a maximum of 40 days per water delivery for some farmers. Faced with this water shortage, the farmers are forced to drill illicitly for water to cover the water needs of their oasis, especially with the importance of extensions near traditional oases, which are areas not subject to government water (table 1).

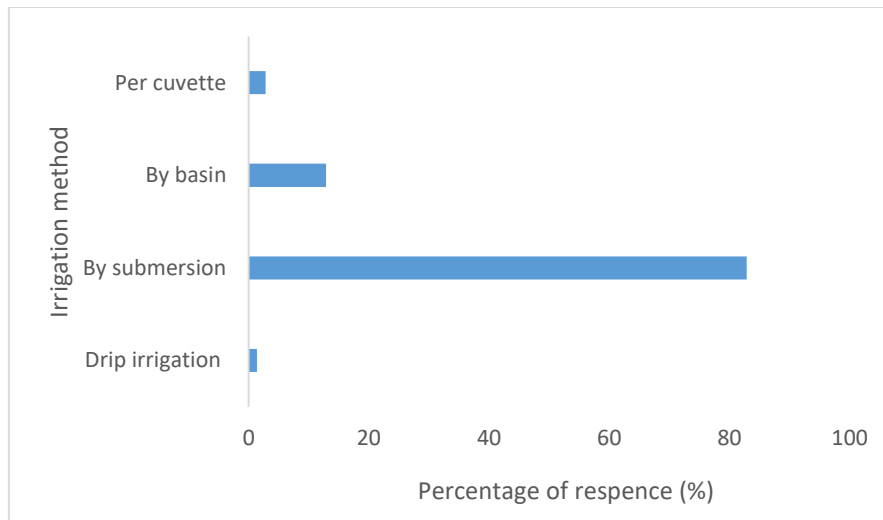


Figure 4 : Irrigation system in Nefzaoua oasis

Table 1 : Frequency of water delivery in Nefzaoua oasis

	n	Minimum	Maximum	mean
Water Delivery Return (days)	280	4	40	25.8 ± 6.9

Most of the soils in the Nefzaoua oases are hydromorphic. Temporary groundwater tables form in the deep soil horizons due to the absence of a drainage system. For 57% of farmers (Figure 5), as there is no drainage system, the soils are saturated with water in deep horizons for a period of the year, creating anoxic environments where root development is difficult.

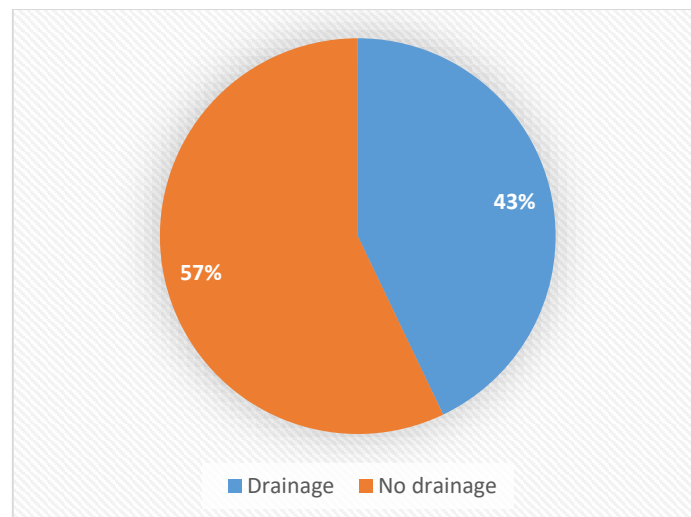


Figure 5 : The drainage system in the oasis

1.4 Waste in the oasis

Only 9% of the interviewed farmers use the date palm residues (Figure 6), usually as fences for windbreak. Most don't use this waste and burn the date palm leaves (91%).

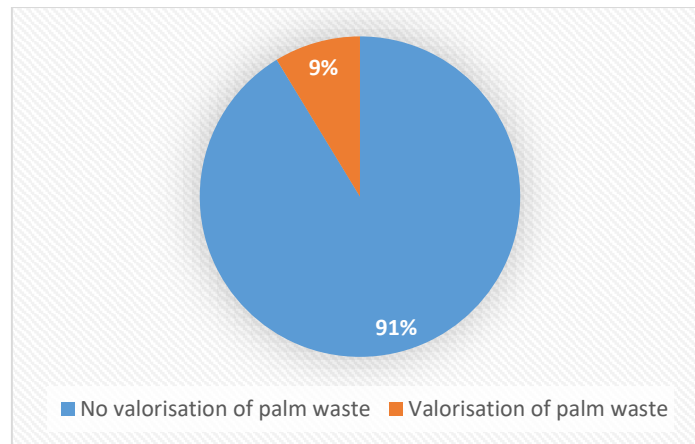


Figure 6 : Palm tree waste in oasis system

1.5 Amendments applied by farmers

A large majority of the interviewed farmers said that they have some sustainable farming practices to fight soil degradation (96.8%, Table 2). According to the farmers, the soil conservation measures they use help to limit soil erosion and mitigate the effects of soil salinity and hydromorphy. Most farmers (90.3%) apply sand mixed with animal manure to improve soil fertility. Few farmers (6.5%) apply windbreaks near their fields to avoid soil erosion and breakage of palm branches by strong winds.

Farmers believe that the fight against oasis degradation is complicated, that it is beyond their capacities and that the applied agricultural practices do not present a long-term and radical solution to limit the general degradation of oases but rather help to mitigate the local effects of this degradation.

The results of the interviews revealed that most farmers (84.9%) acquired their knowledge of land management from other farmers (farmer-to-farmer knowledge).

Table 2 : Amendments applied by farmers

<u>Farmer's response to</u>	<u>Frequency</u>	<u>Percent (%)</u>
Farming practices combating oasis degradation		
Yes	275	96,8
No	3	3,2
Sustainable practices adopted		
Use of sand and organic matter amendments	264	90,3
Wind breakers to avoid wind erosion	6	6,5
No adopted practices	8	3,2
Source of knowledge		
Ancestors	14	7,5
Farmer to farmer knowledge	259	84,9
state rules and regulations	2	2,2
Agricultural extension services	5	5,4

According to the results of the survey, in the Nefzaoua oasis, the average quantity of dune sand supplied is 491 ± 92 m³ per hectare of cultivated area. For manure, the average quantity supplied is 31 ± 7 tonnes per hectare of cultivated area.

The results of the surveys also show that the cost of a dune sand amendment per unit of amendment (tractor) is on average 10 ± 3 TND, i.e. about 3.3€. The cost of a manure amendment per unit of purchase (ton) is 94 ± 28 TND or about 31€ (table 3).

Table 3 : Cost of oasis soil amendment

Variable		n	Minimum	Maximum	means
Cost of a dune sand tractor	TND ¹ / tractor	280	5	15	10 ± 3
	€ / tractor	280	1.50	4.50	3.00 ± 0.90
Cost of organic matter	TND / ton	280	0	240	94 ± 28
	€ / ton	280	0	72.00	28.20 ± 8.40
Quantity of sand added	m ³ / ha	280	15	3600	491 ± 92
Quantity of organic matter added	Ton / ha	280	1	200	31 ± 7
Cost of total sand input	TND / ha	280	-	-	2593
	€ / ha	280	-	-	777.90
Cost of total organic matter input	TND / ha	280	-	-	4834
	€ / ha	280	-	-	1450.20

⁽¹⁾ TND : Tunisian Dinar, 1 TND correspond to 0.30 EUR ; 28/03/2023)

1.6 Effect of the amendment on a fodder crop

All the farmers interviewed who use mineral and organic soil amendments say that in the year of application of the soil amendment, there is little or no improvement in the yield of the date palm. According to the farmers' explanations, after tilling the soil and applying the amendment, the tree regenerates its roots. Thus, several farmers visited observed that the amendment applied will have a positive effect on the morphology of the palm tree and will increase the number of palms on the palm tree. It is after the first year of application of the amendment that the yield of the date palm is improved for 48% of the farmers concerned (Figure 7). This improvement is observed in the second year after the application of the amendment for 35% of the farmers. This improvement is observed by 17% of the farmers in the third year after the amendment. It is generally at the end of this period, 3 years, that the farmer renews the amendment in his cultivated plot.

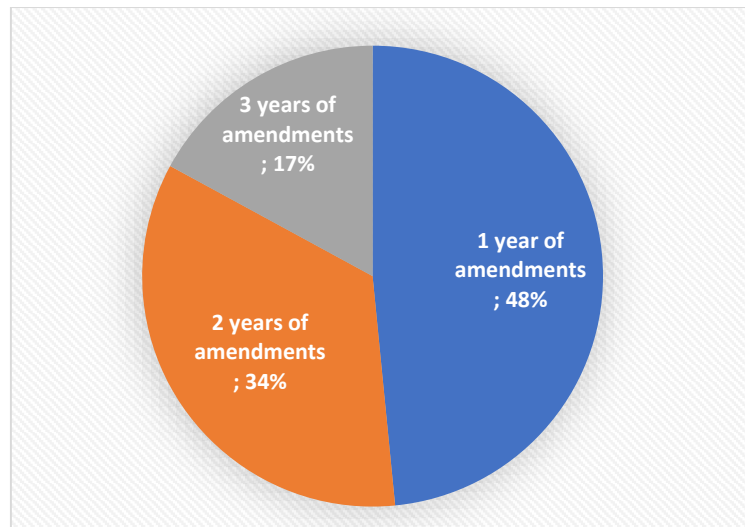


Figure 7 : Effect of soil amendment in improvement of date palm production

1.7 Indicators of the degradation

The majority of farmers recognised water scarcity (97.8%) and soil salinity (90.3%) as visible signs of oasis degradation. Biodiversity loss was assessed by 60.2% of farmers as a strongly visible sign of degradation. Pests and diseases, on the one hand, and soil erosion, on the other hand, were identified by 39% and 33.3% of farmers respectively as a visible sign of degradation (Fig 8).

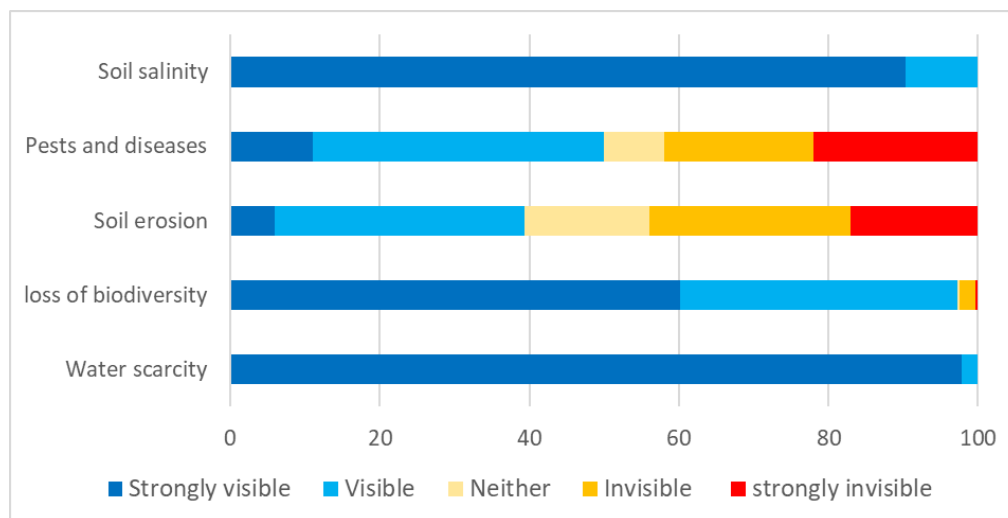


Figure 8 : Farmer's perceptions on a set of common degradations signs of Nefzaoua oasis in %

2 Algerian study sites

The production system in the oases in the Algerian study regions, Ziban, region of Biskra site, and Oued Righ, region of oued Righ and Ouargla sites, consists in an association of 3 vegetal strata. In addition to date production at the top, this system offers a microclimate conducive to mixed farming with market gardening, fodder crops and cereal crops. The development of this system accelerated with the advent of several agricultural projects that allowed for the development of some underlying crops and tree crops for commercial purposes (Bouammar, 2009). It can be associated with a goat and sheep breeding of family and traditional type particularly in the region of Oued Righ (Dubost, 1990; Benziouche, 2008). Thus, particularly in Oued Righ, forage crops in these regions have increased in recent years to the detriment of market gardening. This progression is to be compared with the

increase in the proportion of livestock farmers and the high demand for bundles of alfalfa at very profitable prices (Benzouche, 2006, Benzouche and Cheriet, 2012). In Biskra region, farmers developed plasticulture in a strategy of intensification and diversification of crops. The surface area of plasticulture exceeds 10 000 ha (DSA Biskra, 2021), which has made this region a national center for fodder production. Nevertheless, oases system, with its different production stages, remains extensive and based on monoculture in most cases, in the Ziban region.

2.1 Agricultural exploitations in Ziban and Oued Righ

Date palm groves in the oases in the study regions, Ziban (Biskra site) and Oued Righ (oued Righ and Ouargla sites), although better than in other date palm growing areas of the country, cannot be considered as modern palm groves. The date orchards are characterized by the increasingly small size and fragmentation of the properties, which has a negative impact on the management of the palm groves.

2.1.1 Farm size

Farms in the study area are characterized by their small size: based on 169 interviews, 16% of the farms are smaller than one hectare and 53% ranged between 1 and 3 hectares (Figure 9). The so-called "large" farms (over 3 ha) represent 31% of the total on average. Economically, the smaller the size of a plot, the less profitable it is (Benzouche and Chehat, 2010). In the study regions, the situation is better than the national level mean (Benzouche and Cheriet, 2012) because of the large potential of the two regions and their position at the national level.

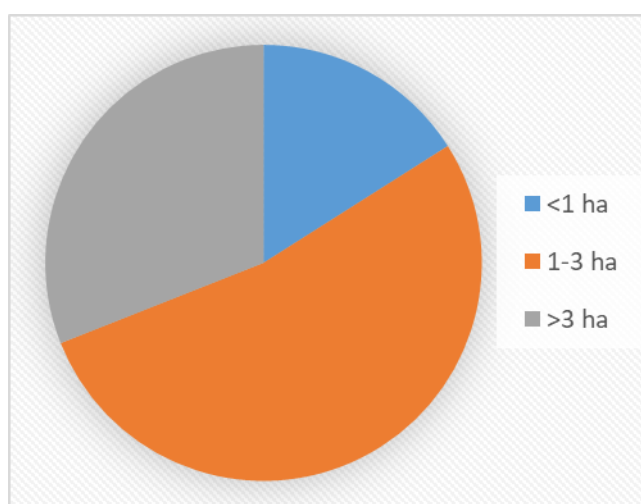


Figure 9 : Farm size of the Algerian farmers interviewed

In addition, the majority of date palm farmers in the Oued Righ region generally have several plots, unlike producers in the Ziban. The average number of plots per respondent is 2 for all categories of farms. However, the number of plots owned by the farmers does not necessarily indicate the size of the properties. Indeed, a farmer may have several plots but these may be very small (less than 1 ha) and therefore less profitable. This indicator is important because it provides information on the level of income and on farmers' strategies (Benzouche, 2012).

2.1.2 Varietal structure of the phoeniculture potential

The results of varietal inventories in the Algerian palm groves show that more than 940 varieties have been recorded (Benzouche and Chehat, 2010). However, in the study regions, Ziban and Oued Righ, the varietal composition is dominated by Deglet Nour, followed by Ghars, Degla Beida, Mech Degla and some other common varieties.

Thus, there is a clear decrease in genetic diversity due to an economic reorientation. Moreover, the strong pedoclimatic and crop requirements of Deglet Nour strongly influence biodiversity decrease within these palm groves (Abdellaoui, 2016; Abdellaoui and Benziouche, 2018).

2.1.3 Date palm density

Heterogeneity in planting density is considered as a constraint in palm plantations. However, contrary to the oases at national level, and especially those in the southwest of Algeria, the oases in the study regions are characterized by a tree density, close to the standards recommended in modern palm groves: between 7 and 8 m between each date palm tree, which represent around 150 trees per hectare.

In low-density oases, this value is around 100-120 plants/ha. This density can be as high as 160 plants/ha in private properties in old oases, which are characterised by high planting density. This high planting density has harmful effects on the aeration of the palms, the reduction in yields and also on the rationalization of the exploitation of the plots, particularly in underlying culture. In addition, 1/3 of the palm groves do not have homogeneous distances between the plants in their groves, which makes mechanization impossible. Mechanization and handling within these palm groves is hampered, making any development efforts very difficult (Benziouche, 2012). Moreover, this high plantation density can lead to the formation of a microclimate unfavorable to the good quality of dates. The increase in plantation density strongly reduces the radiative flux available for light-demanding subcultures (alfalfa), which leads to a decrease in the development of the herbaceous layer (Benziouche, 2000; Benziouche and Cheriet, 212).

2.1.4 The age of the plantations

One of the main constraints of current date palm groves is the old age of the plantations (Belguedj, 2004). Analysis of the age structure of the orchards in the study area shows that the palm groves are relatively old, but the majority are still in full production. Only a small proportion of these orchards are in the early years of planting (7.5%).

The problem of ageing concerns much more the old traditional plantations that have not benefited from rejuvenation actions since their planting. This problem is largely explained by a lack of funding (41%), by the difficulty of the palm tree replacement operation (22%) and by the poverty of the soils in these old palm groves (22%) (Benziouche, 2012).

2.2 Cultivation management

2.2.1 Agricultural operations

The various operations of the Cultivation management of the date palm, vary from one farmer to another, from one operation to another and from one region to another, depending on the need, the specificity, the importance of these operations and the financial means of phoeniciculturists (Benziouche and Chehat, 2010). However, pollination, carried out during a limited time, on the one hand, and harvesting, descent and sorting carried out due to climatic hazards, to avoid theft and the risk of disruption of prices, on the other hand, are carried out by all phoeniciculturists (Faci et al, 2021; Faci, 2021; Benziouche, 2012).

The operations of descent, despite their economic importance, remain weakly practiced in the oases of the region of Oued Righ unlike the Ziban region. In the Oued Righ region, chiseling, protection of bunches and limiting the number of bunches are operations almost never performed (Benziouche, 2000 and Benziouche 2012).

The proportion of phoeniculture farmers who practice pruning in both regions is very high. This is due to the performance of this operation at the same time as harvesting, pollination and descent (Benzouche and Chehat, 2010; Benzouche and Cheriet, 2012).

Tillage in the oases of both regions remains below the expected effects. It is limited to a few hours or days of work generally carried out manually with traditional tools by family labor or by employees whose costs are high. This work, in the majority of cases, consists of manual weeding and preparation of small irrigation beds around the feet especially in small farms (Benzouche, 2012; Hadoud, 2018).

Regardless of the category of the farm, the agricultural operations do not seem to be mastered. These are carried out extensively and with old traditional methods and means inherited from parents. The appropriate times for these operations and the advice of specialists in each cultivation operation are often not respected (Benzouche and Chehat, 2010; Benzouche and Bedrani, 2000).

2.2.2 Mechanization

Phoeniculture farmers in the two regions studied suffer from the insufficiency or absence of different types of equipment. This explains the low level of mechanization in all operations related to the activity, particularly the application of organic or mineral amendments, plowing and harvesting. The low financial capacities of farmers combined with the total absence of bank credits and the high cost of equipment are the causes of this situation (Benzouche, 2006). The insufficiency or absence of means of transport and storage, force some phoeniculturists to use traditional means that are not very efficient (carts and labor) or to rent equipment with excessive costs. The major repercussions of this situation, are the poor management of palm groves and the neglect of certain operations (Benzouche, and Bedrani, 2000; Hadoud, 2018).

2.2.3 Pesticide use

The phytosanitary situation in the palm groves of the two study regions is alarming, but is still improving. Indeed, diseases, whatever their source, and weeds are a major constraint for the development of phoeniculture in general and the underlying crops in particular. Their spread and the absence, in some cases, of effective biological treatments, lead to the use of traditional means and pesticides. Insecticides against Boufaroua can be used anarchically in time and space, sometimes without respecting the conditions of use (Hasni and Bouallegue, 2011; Benzouche, 2012).

2.3 Irrigation and drainage

In these regions, water is of great importance in the phoeniculture activity. The poverty in water resources compared to other Saharan regions has been aggravated by the rapid change in area in recent years. The degradation of water quality and the weakness of water infrastructure have put the oases of the study regions in difficulty with respect to this resource (Benzouche and Chehat, 2018; Benzouche and Cheriet, 2012). The water situation in the oases of the two regions is alarming and worsening day by day, especially due to the increase in agricultural areas and the low mobilization of water resources in this region. The non-rational use of water in a large part of palm groves leads to a lowering of the water table. Traditional irrigation methods such as submersion by row or basin (Benzouche and Chehat, 2018; Benmecheri, 2015), which consume a lot of water, are still frequently used, even if the use of water-saving techniques is increasing, particularly in the Ziban region.

Almost all phoeniculture farmers suffer from the inadequacy of the quantities of water distributed, which are below the standards recommended for a palm grove (Benzouche et al, 2014). Indeed, the irrigation dose does not sometimes exceed 20 L/s/ha and the time between 2 irrigations is sometimes more than 15 days. Consequently, this water deficit causes the deterioration of yields in quantity and

quality and even the death of a significant number of palm trees in some areas of Oued Righ (Benzouche and Chehat, 2018; Benzouche and Cheriet, 2012).

The pedological nature of the soils in the region, the overexploitation of aquifers, the irrigation methods and the inadequacy of the drainage networks put in place, have favored the rise in the level of water in the soils (Benzouche, 2009). These are the major causes of soil hydromorphy in the majority of oases in the region of Oued Righ. In the western Ziban, this phenomenon has been increasing in recent years (Khechai et al, 2016). The seriousness of the hydromorphy problem has reached a delicate situation in the majority of areas, which has led to a decrease in growth and a significant drop in date yields. This water retained in the deep horizons of the soil must be evacuated by drainage. However, the establishment of an effective drainage network with its maintenance each year generates significant costs, thus reducing the economic performance of these farms (Benzouche, 2012; Benzouche, 2006).

2.4 Wastes in oasis

Each year, the waste from the palm groves is collected during the various agricultural practices that are part of the technical itinerary: grooming, pruning, harvesting and packaging. The quantities obtained from each waste varies from one producer to another, from one region to another and according to the cultivation system (association or monoculture) between 4 and 15 quintals. The wastes are by order of importance of quantity: the palms, the Kornaf, the Lif and the branches of the regimes.

In Oued Righ, about 30% of farmers use this waste (Figure 10). In the Ziban, the proportion is much lower. None of them declare using palm waste for compost. Among the farmers who value this waste, 55% use it as windbreaks or fences, 15% use part of the waste (kornaf and lif) as a raw amendment to their palm tree and 20% sell it to craft producers or compost production units. The majority of farmers (70%) do not use these date palm wastes; they either incinerate them and bury them in the soil to provide organic matter, or they give them away for free to anyone interested in these products.

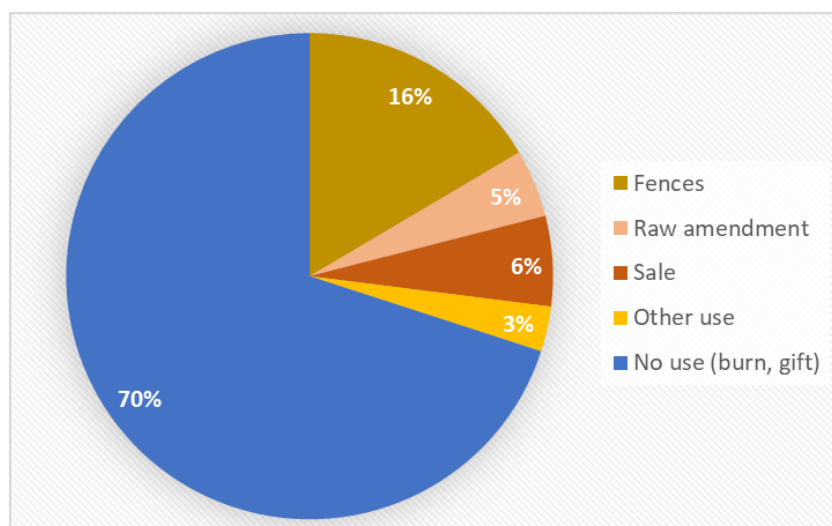


Figure 10 : Use of waste in the Algerian oases

2.5 Organic and mineral amendment

Fertilization and soil amendments in the oases are sometimes weak. When they exist, they are only applied in some palm groves, generally in large farms. Mineral amendments are rarely used, particularly in Oued Righ.

In the Ziban, this practice is more commonly used with the addition of a quantity of urea 46% of 1 to 2kg per palm tree per year and of 15.15.15 2 to 3kg/palm tree/year. Organic amendments are increasingly used in both regions, with sheep manure being the most commonly used.

More than 90% of producers in the region use organic matter (75% sheep manure, 40% cattle manure, 15% poultry droppings, Figure 11). This OM is provided in small quantities, below the needs of oases with very poor soils. In the palm groves surveyed, on average, these inputs do not exceed 80 kg of manure/palm tree/year, 0.9 T of sand/palm tree/3 years and a negligible quantity of fertilizer (Benzouiche, 2000). However, ITDAS advises that each palm tree should be fertilized with at least 150 kg of manure/palm tree/year and 1 T of sand/palm tree/3 years.

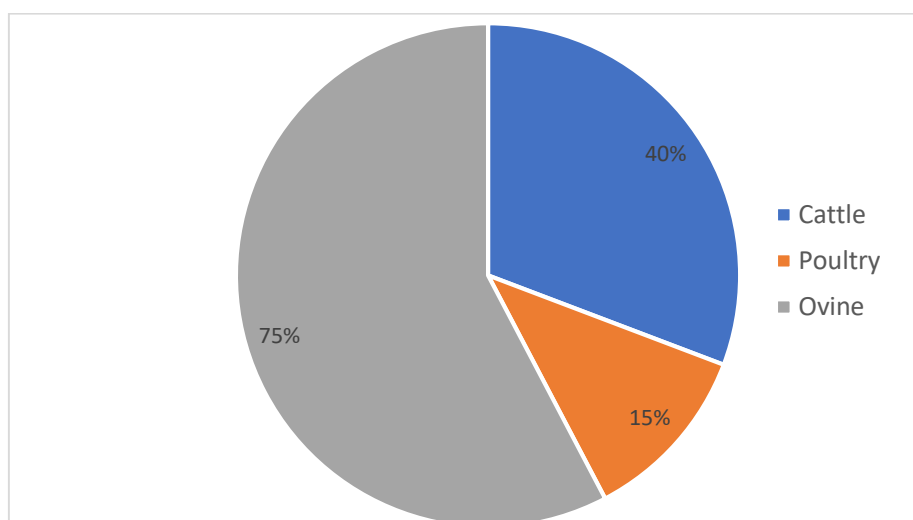


Figure 11 : Type of manure used by date producers

3 Conclusion

These agricultural surveys in the study sites allowed to better know the socio-economic and technical aspects of the date palm cultivation in the studied regions. They also allowed to analyze the current status of the valorization of date palm waste, in particular the use of organic amendments in the palm groves.

The dominant variety in the oases studied is Deglet nour. In the different farms, the main irrigation system in the oases is the submersion system.

Among the existing threats to soils in the oases, water scarcity and soil salinization appear to be the ones best identified by the farmers. They believe that the fight against oasis degradation is beyond their capacities and that the methods they currently use do not represent radical long-term solutions to combat oasis degradation.

Very little use is made of the waste from the palm groves. Most farmers burn this waste. Depending on the region studied, the use of date palm residues varies between 9 and 30%. Most farmers use these residues as fences to combat wind erosion. Very few of them use them as compost, none of them use them to make biochar. Instead, farmers use organic amendments, such as animal manure.

This shows the importance of the ISFERALDA project in changing farming practices and leading farmers to use more date palm residues as organic amendment (compost and biochar) to improve the fertility and properties of their soils.

Références bibliographiques.

- Abdelaoui, I. (2016). Les produits de terroir en Algérie: état des lieux, enjeux et efficacité des stratégies de développement (Cas des dattes Deglet Nour de Tolga). Mémoire Magister en sciences agronomiques. Université de Biskra.
- Abdelaoui I et Benziouche S E. Valorisation des produits de terroirs en Algérie :situation et démarche cas de la datte Deglet Nour de Tolga. Comm affichée; Colloque Scientifique International AGROSEM II ,Univ Biskra : du 09 au 10 Décembre 2018.
- Belguedj A, 2004 Analyse diagnostic du secteur du palmier dattier en Algérie: Etude des marches des produits du palmier dattier au maghreb. *PNUD*
- Benmechri, M. (2015). Efficience des systèmes d'irrigation pratiqués aux Ziban. Mémoire Master en sciences agronomiques, Univ Biskra Algérie.
- Benziouche S, (2012). «Analyse de la filière datte en Algérie, constats et perspectives de développement. Etude de cas de la daïra de Tolga». Thèse de doctorat, ENSA, Alger, 470p.
- Benziouche S., 2009. *Le phénomène de l'hydromorphie dans les palmerais algériennes; causes et conséquences*, Revue Régions Arides; 24,1223-1231.
- Benziouche S, 2008 L'impact du PNDA sur les mutations du système de production oasien dans le sud algérien. *Revue des régions aride IRA Médenine, Tunisie*, 21,1321-1330.
- Benziouche S., 2006. *L'agriculture dans la vallée de Oued Righ:Quelques éléments d'analyse*, Revue des sciences humaines, 10, p.112- 100.
- Benziouche, S. E. (2000). Analyse de la filière datte en Algérie. Etude du cas des daïras de Djamaa et Mghaer. Mémoire de magister es Sciences Agronomiques, INA, Algérie.
- Benziouche, S. E., & Cheriet, F. (2012). Structures et contraintes de la filière dattes en Algérie. *New Médit*, 11(4), 49–57.
- Benziouche S.E et Chehat F, 2018. *Irrigation problem in Ziban oases (Algeria): causes and consequences. Environment, Development and Sustainability. Publisher:Springer. 21 (6), 2693-2706.*<https://link.springer.com/article/10.1007%2Fs10668-018-0155-6>
- Benziouche, S. E., & Chehat, F. (2010). La conduite du palmier dattier dans les palmeraies des Zibans (Algérie). Quelques éléments d'analyse. *European Journal of Scientific Research*, 42, 630–646.
- Benziouche, S. E., Chehat, F., & Belhamra, M. (2014). L'irrigation dans les palmeraies des Ziban: pratiques et contraintes. In *Actes proceedings: Séminaire international sur la gouvernance des eaux souterraines au Maghreb, Biskra* (pp. 66–67).
- Bouamar, B. 2009. Le développement agricole dans les régions sahariennes. Thèse de doctorat. Science économiques. Univ de Ouargla, Algérie.
- DSA, 2021 Direction des services agricoles de Biskra, rapport d'activité.
- Dubost D. 1990. Mutation du système de production oasien en Algérie. Ed *CRSTRA. Alger*.
- Hadoud S. 2018. La mécanisation agricole dans les palmeraies des Ziban; Situation, et impact technico-économiques. Mémoire de Master 2. Production végétale. Univ Biskra.
- Khechai, S., Belbahi, I., Bsis, S., & Belkahla, A. (2016). Evaluation de la qualité des dattes Deglet- Nour irriguée par les eaux de drainage; (Cas des oasis des Ziban). In *Proceeding du 2ème workshop international sur: la durabilité des systèmes de production phoenicicoles en Algérie*. 6 et 7 Déc 2016. Univ Biskra.