



OLIVE FARMS IN NEW PLANTING AREAS IN SEARCH OF SUSTAINABILITY.

Case of the wilaya of Djelfa in Algeria

What is the economic situation and performance after 20 years of implementation?

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Abstract

Through several development programs launched in recent decades, Algerian olive growing has undergone profound changes aimed at improving the productivity of olive farms and increasing the area under olive trees in order to ensure a qualitative and quantitative increase in the national production of olives and olive oil. The steppe and southern regions, following the example of the wilaya of Djelfa, have integrated these development programs, thus changing the mapping of the olive tree in Algeria with the emergence of new areas and new techniques. 20 years after the implementation of these programs, it appears that many positive economic, social and environmental

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results have been achieved that have contributed to strengthening the sustainability of these farms and food systems in this region.

- ✓ Keywords: New plantation, Development, Olive growing farm, Djelfa, Sustainability

1. INTRODUCTION

In order to diversify its economy and give a real boost to non-hydrocarbon exports, Algeria is counting in part on the development of the agricultural sector, which has potential and capacity but which is nevertheless incapable of producing foreign exchange wealth. To achieve this goal, several programs have been developed to strengthen the agricultural sector as a whole and with a focus on olive growing.

Since 2001, the National Agricultural Development Program (PNDA) and the Agricultural and Rural Renewal Policy have enabled the implementation of new support mechanisms for the development of the main agri-food sectors with a view to improving the country's productivity and food security level. Government intervention has led to a profound transformation in the way the agricultural sector operates.

Among the sectors that have received financial and technical support is olive growing, which currently accounts for 4% of the utilized agricultural area and 40% of the total tree area. The area allocated to olive growing in 2021/2022 amounted to more than 440.000 ha, located mainly in the Centre-East of the country for olive oil plantations and North-West of the country for table olive plantations. (These are the traditionally olive-growing areas)

The integration of olive growing into the various development programs, in particular agricultural and rural renewal, has made it possible to revive this sector with an extension throughout the country (Highlands, Steppes and Sahara) and a significant improvement in production systems, which have moved from extensive and rainfed production to intensive and irrigated mode. Several wilayas are emerging in this

context, including the wilayas of Djelfa and M'sila. Cultivation methods that were previously unknown in Algerian olive growing have been introduced with the hypertensive mode and the use of new varieties such as Arbequina. The olive-growing landscape has thus been transformed by the creation of new olive-growing areas in the south and steppe regions of the country, an area once reserved for pastoralism and date palm.

The examination of the statistical data relating to olive growing which compares the olive growing areas between 2002 and 2022 (Table 1) will allow us to appreciate the evolution made by certain wilayas of the country and thus to identify the wilayas that we call in this work the new planting areas and which we can define as areas where the practice of olive growing is absent and insignificant and whose support programs have led to a considerable evolution of the surfaces, production and the creation and/or strengthening of the downstream segment by setting up and/or strengthening crushing and packaging units.

The changes that have taken place in olive growing are aimed at improving the productivity of olive farms and increasing the area under olive trees, in order to ensure a qualitative and quantitative increase in national olive and olive oil production. The steppe and southern regions have also integrated this development program, thus changing the mapping of the olive tree in Algeria with the emergence of new areas and new techniques.

Olive growing has conquered new planting areas, which in the past had no olive tradition and know-how, such as the wilaya of Djelfa, characterized by an arid and traditionally pastoral climate and whose surface area has increased from 100 ha in 2000 to more than 11,000 ha in recent years. Positive and conclusive results have been recorded both in terms of the quantities of olives and oil produced and in terms of quality, as evidenced by these press reports:

“Djelfa: Extension of the surface area and promotion of the olive growing sector: An extension of the olive growing areas has been carried out in recent years in Djelfa, leading to the development of this sector at the local level, synonymous with "very encouraging" results on the ground, according to the assurances of specialists in the field. The fact that more and more farmers are moving towards this sector is a real indication of the enthusiasm aroused by olive cultivation, despite the fact that it is limited to a few individual farms, which have nevertheless become, by the strength of their conclusive yields, real models in this area”¹.

“Djelfa: the export of olive oil depends on the quality of the product: They (the olive growers) considered that this challenge (the export of the olive oil) "is within reach", since the wilaya has already won "many prizes in this field in international competitions". This is notably the case of agricultural investor Hakim Alileche, owner of the "Dhahbia" brand, who won several international awards relating to olive oil in 2022...”²

However, it is necessary to take a close look at the results obtained 20 years after the establishment of these olive farms and try through this article to answer the following question: what has become of the olive farms set up since the 2000s in the wilaya of Djelfa? Have these farms progressed in a sustainable way by ensuring the economic function (producers of goods and services), the ecological function (environmental manager), and the social function (actor of the rural world)?

These three components of sustainability are complementary. Indeed, Hulse (2008) uses the definition of Harwood (1990) which defines sustainable agriculture as follows: “can be considered as “sustainable” agriculture which evolves indefinitely towards greater human utility, more efficient use of resources and an environmental balance more favorable to humans as well as other living beings” (Hulse, 2008).

¹ Article published on 6 November 2016 in the Courrier D'Algérie

² Article published on Tuesday, January 10, 2023 by APS

At the scale of a farm, sustainability is defined by Landais (1998) as “a viable, livable, transferable and reproducible farm”. This is the definition most used in French-speaking scientific literature according to Zahm et al. (2015)

2. MATERIALS AND METHODS:

The study area, the wilaya of Djelfa in Algeria, is located between 2° and 5° East longitude and between 33° and 35° North latitude. It is located in the central part of Algeria, 300 kilometers south of the capital. The Wilaya of Djelfa is bordered to the north by the Wilayas of Medea and Tissemsilt, to the east by the Wilayas of M'Sila and Biskra, to the west by the Wilayas of Laghouat and Tiaret and to the south by the Wilayas of Ouargla, El Oued and Ghardaïa. The geographical location of this area, considered the gateway to the Great Sahara, makes it a region of major importance in the fight against desertification and the protection of soils against wind erosion.

The climate is semi-arid to arid. It is semi-arid in the areas located in the central and northern parts of the wilaya with an average rainfall of 200 mm to 350 mm/year and arid in the entire area located in the southern part of the wilaya with less than 200 mm of rainfall/year. The heaviest rainfall is recorded during the period from October to January and from April to May. The dry period begins in June and peaks in July and August.

The choice of this wilaya for the study is justified by the spectacular progress it has made in terms of changes in surface area and production (Table 1).

Table 1: Evolution of olive-growing areas in some wilayas of the new plantation areas

Wilaya	Area in 2002 (ha)	Area in 2022 (ha)	Change (%)
Djelfa	188	11 380	5 953
Oum El Bouaghi	36	2 111	5 764

El Oued	53	3 100	5 749
El Bayadh	30	1 273	4 143
Tissemsilt	204	8 572	4 102
Laghouat	69	2 327	3 272
Biskra	262	5 432	1 973
M'sila	500	9 522	1 804
Khenchela	256	4 286	1 574
Batna	1 246	11 973	861
Tebessa	1 004	9 563	852

Source: Done by the author using MADR data.

Statistical data was collected at the national level (MADR: Ministry of Agriculture and Rural Development) and at the local level (DSA: Directorate of Agricultural Services and Chamber of Agriculture) in order to be able to analyze the situation and draw up an inventory of olive farms at the level of the study region. Our methodological approach is historical-analytical, it will be based essentially on the analysis of data collected during the period from 2000 to 2022.

Non-directive interviews were conducted with resource persons and key stakeholders in the olive sector in the wilaya of Djelfa in order to gather their visions and points of view on the development of the olive oil value chain.

3. RESULTS AND DISCUSSION

1. Olive areas and production: Towards the creation of a new value chain

With a total agricultural area of 2,501,093 ha, including 378,665 ha of utilized agricultural area (UAA), the olive tree is the most widespread fruit crop in the wilaya

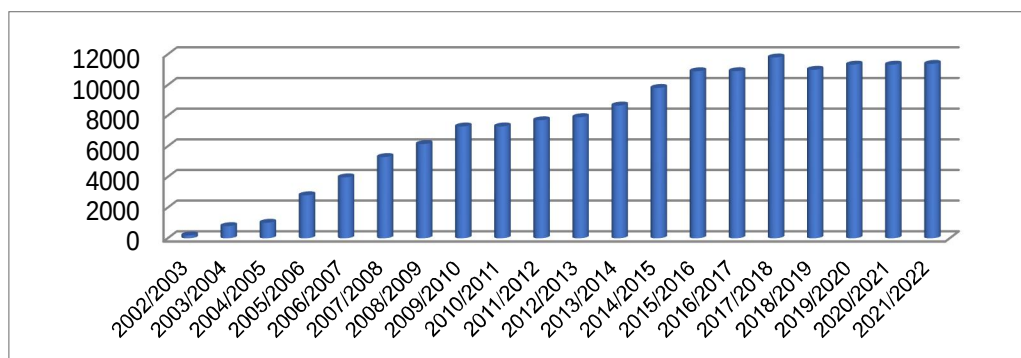
of Djelfa. The Djelfa olive orchard represents in terms of surface area nearly 3% of the Algerian olive orchard.

Olive growing has been developed since the 2000s thanks to the PNDA, and has continued to grow in recent years with the establishment of new intensive and irrigated plantations. Indeed, many farmers in the region have benefited from the support scheme launched by the State. Zoubeidi and Dahane (2018) point out that 92% of the olive farms surveyed in the wilaya of Djelfa benefited from subsidies and support granted by the State in terms of plantations and 100% for irrigation systems.

The olive area, which represented only 51 ha in 1999, 188 ha in 2002 multiplied by 223 to reach nearly 11380 ha in 2021/2022, an increase of more than 11,300 ha (Figure 1).

It is clear that progress has stagnated in recent years, which can be explained by the lack of incentives for the creation of new plantations, probably combined with the COVID-19 pandemic, which has slowed down the development of the various sectors, including agriculture.

Figure 1: Evolution of the olive growing area in Djelfa (2002-2022)



Source: Done by the author using MADR data

In terms of the location of olive orchards in Djelfa, they are mainly concentrated in the flat area of the north. Of the 36 municipalities in the wilaya of Djelfa, only two

do not have olive growing areas. However, the majority of the olive growing area (75%) is located in 11 municipalities (Table 2). The municipality of Benhar comes first with 26% of the olive growing area. The nature of the soil, as well as its topography and the availability of water in the municipalities mentioned above, are the factors that have favored the development of olive growing in these areas.

Table 2: Location of olive growing in the wilaya of Djelfa

Municipality	Area (ha)	%
Benhar	2963	26
Ain Ouassara	1040	9
Birin	740	7
Hassi F'doul	735	6
Had Shary	630	6
Zaccar	568	5
Bouiret Lahdab	383	3
Ain Fekka	382	3
Ain El Bel	375	3
Deldoul	360	3
Hassi Bahbah	350	3
Other	2854	25
Total	11380	100

Source: Done by the author using DSA data

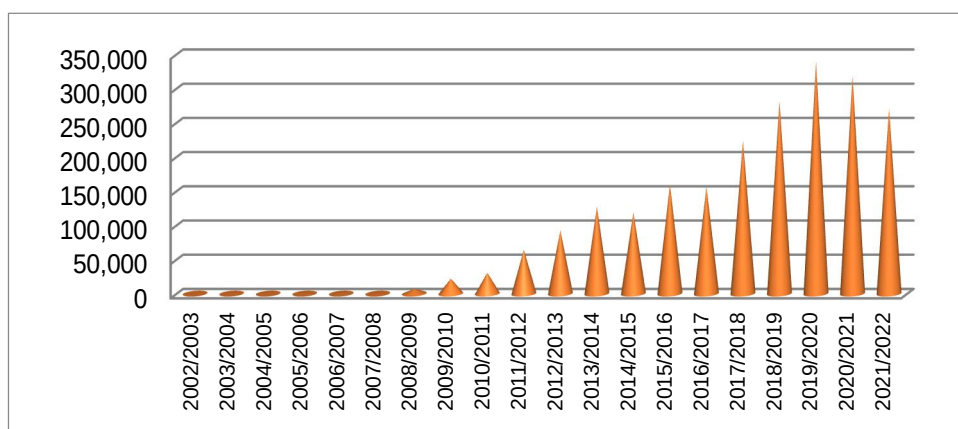
The olive growing developed in the wilaya of Djelfa is mainly intended for the

production of oil. The data provided by the DSA of Djelfa show that the area reserved for olive trees for oil production in the 2021/2022 campaign is 10 440 ha, that for table olive production is 940 ha. The majority of the area planted with olives (92%) is destined for the production of olive oil, consisting mainly of the national orchard of the Chemlal variety.

Attllaoui L. (2021) notes through his surveys carried out in the Djelfa region that more than 70% of the olive orchard is made up of the Chemlal variety. It explains this varietal dominance by the fact that the seedlings supplied during the various support programs for the olive sector were essentially made up of the Chemlal variety. As a reminder, Chemlal is a dual-purpose variety that has a high vigor with a spreading habit, a medium density of foliage, an average resistance to cold and drought, a medium fruiting body and an oil content varying from 18 to 22%.

The entry into production of the new olive plantations from 2011 (10 years after the planting) has made it possible to have considerable quantities of olives for the production of oil. As a result, olive production increased from 10 tons in 2002/2003 to more than 27,000 tons in the 2021/2022 campaign. (Figure 2)

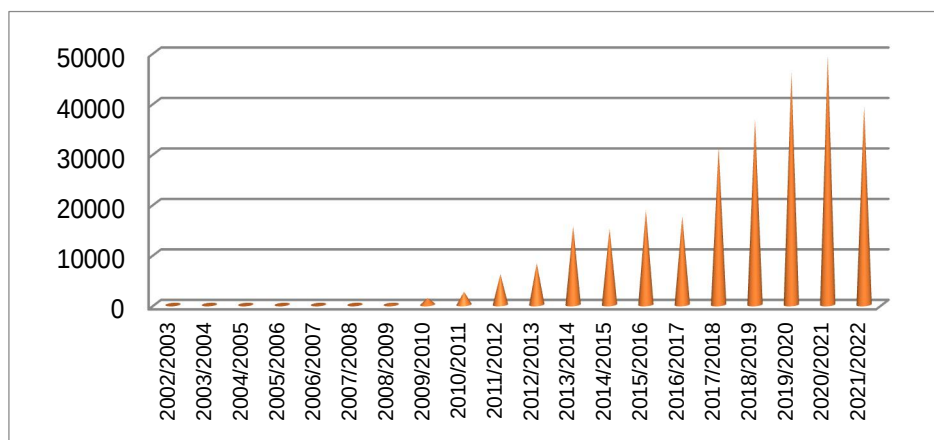
Figure 2: Evolution of olive production (q) in the wilaya of Djelfa



Source: Done by the author using MADR data

In the same way, olive oil production, which amounted to only 10 hl in 2002/2003, has increased to quantities varying from 40 000 to 50000 hl of olive oil in recent seasons (Figure 3) and which, according to experts, consists mainly of very good quality oil classified as extra virgin olive oil or virgin olive oil.

Figure 3: Evolution of olive oil production (hl) in the wilaya of Djelfa



Source: Done by the author using MADR data

The development of olive growing and the increase in the area under olive cultivation in the wilaya of Djelfa has made it possible to have large quantities of olive oil, which previously came only from the traditional production areas located mainly in the Centre-East region of the country. With such quantities of olive oil produced, the wilaya of Djelfa is one of the first wilayas producing olive oil in Algeria.

It also happens that many olives are bought by oleifactors in the traditional areas located in the north of the country from the wilaya of Djelfa, which allows them to start their crushing campaign early while waiting for the production of the traditional areas which are generally later than in the Djelfa region. A survey carried out through 24 oil mills in the wilayas of Tizi Ouzou, Béjaia and Bouira (traditional production area) shows that 50% of these mills buy olives and 20% of the quantities crushed at these

mills come from the purchase of olives from the new plantation areas including the wilaya of Djelfa (Amrouni et al., 2023 b).

However, production varies from one year to another and is dependent on yields. The use of MADR data during the period (2002-2022) shows variable yields from one year to another with a minimum of 7 Kg/tree, a maximum of 28 Kg/tree and an average of 12 Kg/tree. These yields remain relatively low compared to the potential of the irrigated crop and the national yield of 18 kg/tree. However, in terms of hectares, yields in Djelfa will be higher due to the planting density, which is generally between 300 and 400 plants/ha compared to a density of 70 to 200 plants/ha in traditional planting areas.

Some yields are well above the average for the wilaya. According to Zoubeidi and Dahane (2018), yield and production levels vary between 20 and 40 kg/tree. This depends, according to the authors, on the agricultural conditions established by agriculture (irrigation, fertilizers...etc.).

2. Job creation and the number of olive growers: a sector that provides employment

The agriculture sector in Algeria is a key sector and is a major pillar of the national economy due to its contribution to national employment and GDP. According to the ONS (Office for National Statistics), it employs a population of 1.08 million, which represents 8.5% of the national workforce (ONS, 2019).

The file of the National Chamber of Agriculture shows a number of 322 olive growers in 2018 recognized for their quality as farmers who operate in the wilaya of Djelfa.

Based on the results obtained by Amrouni et al. (2023a) who identify an average number of days to carry out the different cultivation operations and an UTA of 0.39 per hectare (UTA is the unit of measurement of the amount of human labor provided on a farm) for intensive and irrigated farms, the number of working days required for an

olive growing area of 11,380 of 984,370 days and an overall UTA of 4438.2. In addition to the related professions, the establishment of new olive farms in Djelfa has created at least the equivalent of 4400 jobs per year.

The oil mill also contributes to the creation of employment in the wilaya of Djelfa. Indeed, the survey carried out in the wilaya of Djelfa indicated that the wilaya has 10 oil mills including an oil mill with 3 processing units with a crushing capacity of 26 q/hour each. These oil mills are modern continuous chain units, all acquired as part of the support program granted by the State.

The establishment of these crushing units in parallel with the planting program has helped to reassure farmers about the outlets for their production by avoiding the often-costly travel to other wilayas to carry out crushing.

According to Amrouni et al. (2023b), a crushing unit employs the equivalent of 3.38 UTA. Based on this data, the crushing units contributed to the creation of the equivalent of 34 UTA. Although the number is limited, it is still interesting in view of the employment difficulties encountered in the region, which stem mainly from agriculture.

These crushing units play another social role, they are meeting points that bring together different players in the sector. They are also points for tasting and selling olive oil, thus contributing to its promotion among a population whose eating habits it did not fit into.

A survey on olive oil consumption revealed that in the wilaya of Djelfa, the level of consumption reached 5.3 l/capita, which remains close to the national average of 6 l/capita (PASA, 2021). In fact, the consumption habits of the inhabitants of the region have been modified and the culture of introducing olive oil into the consumption model has become natural, even indispensable. (Zoubeydi and Dahane, 2018)

3. Profitability at the level of olive farms: Economically efficient farms

In new planting areas such as the wilaya of Djelfa, Attllaoui (2021) confirms through his surveys and calculations that the results obtained at the level of olive farms are positive by obtaining a net result per hectare in subsidized olive farms in the region of nearly 800,000 DZD ($\approx$ 5700 USD). This profit is almost DZD 500,000 (USD $\approx$ 3700) for non-subsidized producers.

Zoubeidi and Dahane (2018), by calculating certain economic indicators in the first year of entry into production (8th year after planting), obtain a result or a net profit of 700,000 DZD ($\approx$ 5200 USD), which is still very correct, knowing that the turnover will be high from one year to the next because the production has not reached its full capacity and therefore the profit will also be so.

The various farmers interviewed confirmed the profitability of olive farms but at the same time mentioned the problem of labor, especially during the harvest period, which remains unavailable, very expensive and often unspecialized.

4. Impact on the environment: Water resources drown out the positives

The introduction of the olive tree has made it possible to preserve the land capital and prevent its erosion, especially wind erosion. Zoubeidi and Dahane (2018) attest that ecologically, this crop has helped to revitalize and protect abandoned and/or destroyed soils.

The production system in the new production areas can be environmentally friendly. Indeed, Attllaoui (2021) points out that olive growing is associated with animal livestock, which is practiced by 69% of farmers. This extensive farming with an average presence of sheep of 30 to 40 head per farmer and goats (20-23 heads) makes it possible to recover olive tree waste, to produce manure, milk and meat for self-consumption. It also makes it possible to build up living savings that are easy to

convert into liquid cash (Attlaoui, 2021). In line with this idea, Adair et al. (2022) specify that promoting the combination of agriculture and livestock can constitute a model of production in a semi-arid environment that optimally combines the sustainability of plant resources and synergy with sheep farming.

Finally, we often talk about carbon sequestration or carbon footprint in relation to the environment and we are referring to the balance of greenhouse gas (GHG) emissions throughout the life cycle of a product, in carbon equivalent per unit declared. Various scientific studies have shown that olive growing has positive effects on the environment (biodiversity, soil improvement, barrier to desertification, etc.) and that the adoption of appropriate agronomic practices makes it possible to increase the capacity to fix CO₂ from the atmosphere in permanent vegetative structures (biomass) and in the soil. The CO₂ sequestration of the olive tree being much greater than the emissions of GHGs to produce one unit (one liter of virgin olive oil). More simply, according to studies published so far, if the production of one liter of olive oil (virgin or extra virgin) results in the emission into the atmosphere of an average of 1.5 kg of CO₂-eq throughout the life cycle of the product, the adoption of relevant agronomic practices allows the olive tree to fix in the soil a quantity of about 11.5 t CO₂/ha/year. (Serafini, 2016)

In terms of water use, the water use efficiency of each crop is expressed in (kg/m³) which corresponds to a ratio of the weight of marketable production in (kg) and the volume of water consumed by the crop during its entire vegetative cycle in (m³). For irrigated olive trees in Djelfa, the water use efficiency calculated by Imessaoudene (2014) is 0.09 kg/m³, which means that it takes 11.1 m³ to produce one kg of olives, which is still very high compared to the world average of 3 m³ to produce one kg of olives and compared to the amount of water needed to produce one kg of olives in the wilaya of Bejaia (in the north of the Algeria) with 5.2 m³, half of that used in Djelfa. These data reflect overexploitation and waste of water resources in an area where this

factor is very rare and limiting.

Finally, a lack of knowledge of cultivation management could lead to negative effects on the environment, such as the inappropriate use of pesticides and fertilizers or even inadequate tillage. Hadjloune et al. (2021) by analyzing the situation in the wilaya of M'sila (another newly olive-growing wilaya bordering the wilaya of Djelfa) show a low technicality due to the lack of local training-extension and emphasize that the analysis of the technical itinerary in olive farms has made it possible to note that farmers' decisions are mainly due to the lack of extension. More than 78% of farmers say they have never had contact with an extension agent. Although these data concern the wilaya of M'sila, it is possible to extrapolate them to the wilaya of Djelfa in view of the natural and social similarities between these two steppe wilayas.

4. CONCLUSION

At the end of this work, the objective of which is to closely analyze the situation of olive growing in the new planting areas after a little more than 20 years of establishment, it appears that many conclusive results have been achieved in terms of increasing the surface area, increasing production, job creation and other social services.

These positive results do not allow us at this stage to judge the sustainability of these farms, it is necessary to quantitatively assess the sustainability of using methods to assess the sustainability of farms. This will allow us to assess the level of sustainability through its different scales but also to intervene with possible recommendations to correct any shortcomings.

Indeed, the demand for methods for assessing the sustainability of agricultural systems has increased in recent years in order to enable farmers to identify the levers of action likely to improve the overall performance of their farms (level of sustainability), on the other hand for agricultural development to broaden its technical

advice in the light of sustainability and finally for public action to evaluate its systems in the light of the transition agroecology. (Zahm et al., 2019).

Work on sustainability assessment methods has revealed that there are an extremely large number of them (more than 120) assessing different characteristics, using distinct indicators and meeting different objectives. (Richard, 2010)

A great deal of work has been done to assess the sustainability of farms at the different scales of farms. The majority of the work used the Farm Sustainability Indicators (IDEA) method, which assesses the sustainability of a farm based on a set of indicators structured in three independent sustainability scales (the agroecological sustainability scale, the socio-territorial sustainability scale and the economic sustainability scale).

Unlike the IDEA method, the use of other methods of sustainability assessment in Algeria is very rare or rarely encountered in the bibliography. It would be interesting to test the IDEA method on olive farms, to adopt it or adapt it in order to have a reliable tool for assessing the sustainability of olive farms in the Algerian context.

When we talk about sustainable farms, we talk about the sustainability of production. This leads to another aspect that remains closely linked to farms, which is that of sustainable food systems defined by FAO as: "Food that protects biodiversity and ecosystems, is culturally acceptable, economically accessible, fair and realistic, safe, nutritionally adequate and healthy, and optimizes the use of natural and human resources"

Rastoin (2018) describes the food system of the future as one that should have the following characteristics: i) sustainable food consumption with food security, food availability in sufficient quantities and varied foods of good nutritional, organoleptic and cultural quality and health, ii) food production characterized by triple proximity. Proximity in the ecosphere, by diversifying agricultural production, by "reconnecting"

the plant, animal and forestry sectors, the second proximity concerns the rapprochement between agriculture and the food industries and the third proximity is through a reorientation of the food supply towards a more abundant and varied local offer. iii) an organization of agri-food sectors into networks associating family farming, microenterprises and agri-food SMEs and short marketing circuits within a regional geographical framework, ensuring an equitable sharing of the value created, minimizing losses and optimizing human and natural resources and finally vi) partnership governance, within the framework of territorialized food systems, which leads to favoring forms of the social economy and solidarity, in particular cooperatives, mutualists and associations.

These characteristics, especially the first and second, were induced and/or reinforced by the introduction of olive growing in Djelfa. The last two characteristics seem to be difficult to achieve in a climate where professional, associative and interprofessional organization seems to pose a great deal of problems.

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