



Beyond Pastoralism: Diversity and Dynamics of Olive Farming Systems in the Steppic Arid Region of Djelfa, Algeria

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Abstract: This study aims to analyze and characterize olive farms in the wilaya of Djelfa, a steppe and arid region undergoing rapid agricultural transformation. Traditionally known as a livestock-oriented region, particularly for sheep farming, Djelfa is now witnessing a growing interest in olive cultivation. Through surveys of 57 farms, a functional typology was developed, highlighting three distinct classes of farms. These categories reflect significant differences in terms of capital invested, farm area used, labor mobilized, as well as cropping and breeding choices. The results show that olive-growing, although still developing, is part of an agricultural landscape dominated by systems combining crops and livestock. The region's pastoral vocation influences farming practices, notably through the presence of rangelands and cereal crops. However, some highly capitalized farms are adopting simplified systems, focusing on specific crops such as olive growing. These results offer prospects for the development of agricultural policies adapted to the sustainable management of resources in steppe areas.

Key words: Algeria, Djelfa, farm, olive growing, steppe areas, typology.

In Algeria, as in many countries around the Mediterranean, olive growing occupies a strategic position in economic, social and environmental terms. The national olive orchard covers more than 450,000 hectares, with around 6.2 million olive trees (MADR, 2022). As a result of various public programs, the sector has grown significantly in recent years, with a marked expansion in cultivated area (Amrouni Sais *et al.*, 2021).

Traditional olive-growing dominates the Algerian agricultural landscape, with 80% of olive groves located in mountainous areas, on rugged, low-fertility terrain, benefiting from annual rainfall of 400 to 900 mm. These farms, mostly small (less than 5 hectares) and family-run, provide additional income for rural families, with production mainly for self-consumption (Hadjou *et al.*, 2013). This extensive model, characterized by maximum densities of 150 trees ha⁻¹ and limited mechanization, reflects a reality shared in many olive-growing countries of the Mediterranean basin.

However, modern production systems, such as intensive and super-intensive plantations, although less widespread, are gradually gaining ground. These models, which account for around 26% of the world's olive-growing area, are characterized by the use of irrigation systems and high densities. In Algeria, intensive plantations cover 19% of the olive-growing area, while super-intensive ones occupy 6%. (Vilar *et al.*, 2018). The expansion of intensive olive growing, which began in the 2000s, has resulted in the creation of new plantations in the High Plateau, steppe areas and the south of the country, transforming the traditional agricultural landscape. The evolution of these systems brings with it new challenges, notably the use of adapted varieties, such as arbequina (Khezzani *et al.*, 2020; Amrouni Sais and Benziouche, 2024).

The main objective of this work is to develop a typology of olive farms in the new plantation zones, an aspect still little or marginally explored by Algerian researchers. Indeed, apart from a few studies that have focused on specific themes, such as the impact of the National Agricultural Development Plan (PNDA) on the development of olive growing and the support measures granted to farmers in Djelfa (Attalaoui *et al.*, 2019; Zoubeidi and Dahane, 2018), the SWOT analysis of the olive industry in M'sila (Hadjloune *et al.*, 2021), the key factors influencing olive yields in Djelfa and M'sila (Saad *et al.*, 2023), the agro-economic indicators for the olive sector in the wilaya of Djelfa and El Oued (Khezzani *et al.*, 2020; Amrouni Sais and Benziouche, 2024), or the evaluation of the sustainability of olive farms and pathways for their development in Djelfa (Amrouni Sais *et al.*, 2025; Amrouni Sais and Benziouche, 2025), the structural and functional characteristics of olive farms in so-called new areas remain insufficiently documented.

In this context, it becomes essential to analyze the structural characteristics (utilized agricultural area -UAA-, annual work units -AWU-, total agricultural area -TAA-) and functional characteristics (crops grown, associated livestock) of olive farms in order to better understand their organization, dynamics, and specificities. Indeed, a better understanding of these systems, including both their strengths and limitations, would provide farmers with useful benchmarks to diversify their practices

and design more sustainable systems (Feike *et al.*, 2010).

Materials and Methods

This study was carried out in the wilaya of Djelfa, located in central Algeria, some 300 km south of the capital (34.67°N, 3.26°E). The climate is semi-arid in the central and northern zones, with mean annual rainfall varying between 200 and 350 mm, while it becomes arid in the southern part of the wilaya, where rainfall is less than 200 mm yr⁻¹. The wilaya of Djelfa was chosen for the remarkable progress it has made in recent years in terms of expanding the area dedicated to olive growing and increasing production volumes. From a mere 51 ha in 1999, to 188 ha in 2002, the area under cultivation has increased 223-fold, reaching almost 1,380 ha by 2021/2022, an increase of over 11,300 ha. Olive production has risen from 10 tons in 2002/2003 to over 27,000 tons in the 2021/2022 season. With such quantities produced, the wilaya of Djelfa has become one of Algeria's leading olive oil-producing wilayas (Amrouni and Benziouche, 2024).

To efficiently collect the information needed to characterize the farms, a structured questionnaire was designed and administered to 57 farms spread across the wilaya of Djelfa. Data collection took place between November 2023 and May 2024, targeting exclusively olive-growing farms, the main selection criterion. Data were processed using IBM SPSS Statistics 27 software for descriptive statistics and typology using CAH classification based on Euclidean distance, Ward's method and standardization of variables to ensure that each variable played an equitable role in group formation.

Results and Discussion

Descriptive parameters of olive farms

This section presents the main socio-economic characteristics of the surveyed olive farms:

Farmer profile: The land concession program and the geographical location of Djelfa have attracted farmers from different regions of Algeria. While 46% of farmers are native to Djelfa, the others (54%) come from outside the wilaya, often relying on hired managers, which creates opportunities for local labor. The average age of farm heads is 57 years

(28-87), and 63% are over 60, contrasting with Attallaoui (2022), who reported only 33% in this age group.

Land structure and crops: Total farm area ranges from 6 to 210 ha (average 34.5 ha; mode 10 ha in 23% of cases). Most farms (90%) operate less than 60 ha. The average utilized agricultural area (UAA) is 30 ha, close to the 33 ha observed by Benidir (2015) for livestock farms, and much higher than the national situation, where 84% of farms have less than 20 ha (MADR, 2003).

Olive growing, the focus of this study, is practiced by all farms. Most orchards are in the maturation or full production stage (ITAFV, 2013). Olive orchards average 9.45 ha (1 to 50 ha), accounting for 38% of UAA. Most farms (65%) cultivate 5 to 30 ha, consistent with Attallaoui (2022) and Hadjloune *et al.* (2021). Planting density is highly variable (160 to 1,200 trees ha⁻¹), diverging from the recommended 400 trees ha⁻¹ (MADR, 2008), reflecting heterogeneous technical practices, also noted by Attallaoui (2022) and Hadjloune *et al.* (2021).

Cereal production, mainly barley, is widespread. Although 37% of farms do not grow cereals, the rest use them mainly for livestock feed, as is common in the region (DSA, 2023). Fruit trees (peach, apple, pomegranate) are cultivated in 37% of farms, providing additional high-value income. Forage crops are limited (30% of farms), in small plots (average 1.51 ha), consistent with Benidir (2015). Livestock therefore depends mainly on degraded steppe rangelands (Nedjraoui and Bédrani, 2008; Medouni *et al.*, 2004), which still provide an average of 9.41 ha per farm, although more than half (54.4%) manage less than 5 ha.

Livestock systems: The sheep/crop system remains dominant (30% of farms), confirming its central role in the steppe economy (Medouni *et al.*, 2004). With an average flock of 66.4 heads, sheep valorize olive by-products (leaves, pruning residues), supply manure for soil fertility, and provide regular or emergency income ("savings account"), while also covering household meat consumption (Attallaoui, 2022). Cattle are rare, present in only 12 farms (2.8 head on average), with a preference for imported dairy breeds (Holstein, French Friesian) over less productive local breeds (Atchemdi, 2004). Poultry farming is expanding (7% of farms), often as the main

activity, with flocks ranging from 4,800 to 600,000 birds, representing a diversification into high-value products.

Labor and farm management: Farm management requires an average of 4.86 annual work units (AWU), close to Benidir's (2015) observations. Most farms (67%) require fewer than four AWU, while poultry farms demand more permanent labor. Seasonal labor for olive harvest and pruning is paid per task (25-35 DA kg⁻¹ for harvest, 250 DA kg⁻¹ for pruning) and represents the main wage expense. Olive farming being relatively new in Djelfa, there is a shortage of skilled workers, particularly for pruning, leading farmers to hire qualified labor from outside the wilaya. However, general and seasonal tasks are mainly performed by local workers, especially during harvest, contributing to rural employment.

Functional typology of olive farms: A typology is a representation of the diversity of farming systems based on the distinction between types of farms according to discriminating criteria. The aim is to identify both groups of observations with similar characteristics and groups that differ significantly. Gibon (1994) points out that developing a typology means organizing the understanding of farm diversity into a few broad types considered homogeneous. Any typology seeks to classify farms objectively so that the units within the same class are highly homogeneous among themselves and highly heterogeneous compared to farms in other classes (Cerf *et al.*, 1987). The typological approach, methodologically applied to the diagnosis of farm functioning, is an effective analytical tool for schematizing and simplifying complex realities (Anderson *et al.*, 2007).

In order to identify and characterize the types of olive farms present in the study area, a typology was developed based on sixteen quantitative variables: i) Total agricultural area, ii) utilized agricultural area, iii) estimated farm capital, iv) human labor unit, v) arboriculture area, vi) viticulture area, vii) cereal area, viii) Fodder area, ix) Market gardening area, x) rangeland area, xi) Olive-growing area, xii) total number of olive trees, xiii) sheep herd size, xiv) Goat herd size, xv) Cattle herd size, and xvi) Poultry flock size.

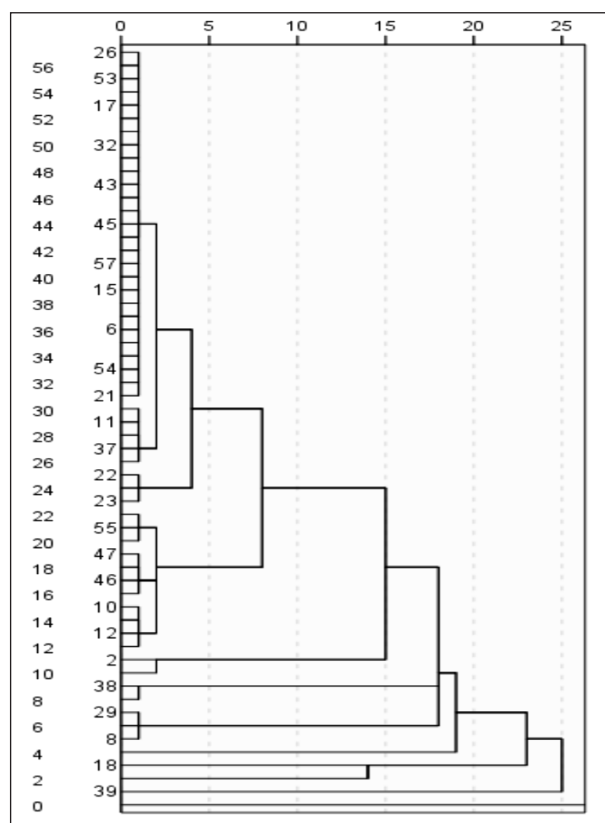


Fig. 1. Typology dendrogram.

The typological analysis made it possible to distinguish three classes of farms, differentiated by their size, capitalization, productive orientation, and labor management (Fig. 1).

The first class, referred to as “capitalized olive-arboriculture farms”, includes 13 units, representing 22.8% of the sample. These farms have an average total area of 59 hectares, of which 47 hectares are utilized agricultural area (UAA). They show the highest level of capitalization, with an average estimated capital of 138 million Algerian dinars, reaching up to 500 million. Labor requirements are also significant, with an average of 7.8 annual work units (AWU).

Their production system relies heavily on arboriculture (10.7 ha on average) and especially on olive growing, which covers nearly 19 ha and about 7,928 olive trees per farm. A substantial part of the land is also allocated to rangelands (21.6 ha on average), mainly used for sheep farming, with around 65 heads per farm. These farms therefore combine a high capital intensity, relatively large areas, and an orientation toward high value-added crops, particularly olives (Table 1).

The second class corresponds to “traditional agro-pastoral farms”. It includes 9 farms, representing 15.8% of the sample. These units have an average total area of 65 ha, of which 56 ha are utilized agricultural area (UAA), and mobilize an intermediate level of capital (83 million Algerian dinars on average). Labor requirements are comparatively lower than in

Table 1. Descriptive statistics for class 1 “capitalized olive-arboriculture farms”

Variables	N	Min.	Max.	Mean	Standard deviation
Total agricultural area (ha)	13	20.00	210.00	59.29	49.48
Useful agricultural area (ha)	13	19.00	98.00	47.33	20.26
Estimated farm capital (million DZD) *	13	45.00	500.00	138.84	117.54
Annual work unit	13	2.30	25.00	7.78	5.93
Arboriculture area (ha)	13	0.00	32.00	10.65	10.80
Viticulture area (ha)	13	0.00	14.00	1.08	3.88
Cereal cultivation area (ha)	13	0.00	10.00	2.54	3.80
Forage cultivation area (ha)	13	0.00	10.00	2.31	3.75
Market gardening area (ha)	13	0.00	13.00	1.46	3.84
Rangeland area (ha)	13	0.00	150.00	21.58	40.82
Olive cultivation area (ha)	13	5.00	50.00	19.00	14.89
Total number of olive trees	13	2000.00	30000.00	7927.69	8074.32
Sheep population	13	0.00	400.00	65.38	149.14
Goat population	13	0.00	0.00	0.00	0.00
Cattle population	13	0.00	12.00	1.15	3.36
Poultry population	13	0.00	20000.00	1538.46	5547.00

*: 1 USD= 130 DZD

Table 2. Descriptive statistics for class 2 "traditional agro-pastoral farms"

Variables	N	Min.	Max.	Mean	Standard deviation
Total agricultural area (ha)	9	30.00	130.00	64.89	28.88
Useful agricultural area (ha)	9	30.00	74.00	55.67	14.03
Estimated farm capital (million DZD) *	9	20.00	200.00	83.33	58.10
Annual work unit	9	2.00	7.50	4.56	1.53
Arboriculture area (ha)	9	0.00	15.00	2.22	4.92
Viticulture area (ha)	9	0.00	0.00	0.00	0.00
Cereal cultivation area (ha)	9	25.00	40.00	31.44	5.55
Forage cultivation area (ha)	9	0.00	15.00	4.44	5.29
Market gardening area (ha)	9	0.00	0.00	0.00	0.00
Rangeland area (ha)	9	0.00	18.00	5.78	6.20
Olive cultivation area (ha)	9	1.00	18.00	11.00	6.58
Total number of olive trees	9	318.00	7200.00	3868.67	2659.23
Sheep population	9	0.00	1000.00	229.33	322.47
Goat population	9	0.00	0.00	0.00	0.00
Cattle population	9	0.00	50.00	9.56	17.23
Poultry population	9	0.00	4800.00	533.33	1600.00

*: 1 USD= 130 DZD

the first class, with an average of 4.6 annual work units (AWU).

Their production system relies mainly on cereal cultivation (31 ha on average), complemented by forage crops (4.4 ha) and a smaller share of olive growing (11 ha and about 3,869 olive trees). Livestock represents a central component of their strategy, with an average herd of 229 sheep and about 10 cattle per

farm. These farms thus follow a mixed agro-pastoral model, where olive cultivation plays a secondary role compared to cereal farming and livestock husbandry (Table 2).

The third class, referred to as "small diversified farms", represents the majority of the sample (35 units, or 61.4%). These farms have the smallest areas (17 ha on average, including 16 ha of utilized agricultural area -

Table 3. Descriptive statistics for class 3 "small diversified farms"

Variables	N	Min.	Max.	Mean	Standard deviation
Total agricultural area (ha)	35	6.00	50.00	17.47	10.91
Useful agricultural area (ha)	35	5.00	50.00	16.29	10.74
Estimated farm capital (million DZD) *	35	10.00	100.00	32.90	21.50
Annual work unit	35	1.00	60.00	3.86	9.90
Arboriculture area (ha)	35	0.00	10.00	1.07	2.32
Viticulture area (ha)	35	0.00	1.00	0.03	0.17
Cereal cultivation area (ha)	35	0.00	15.00	3.53	4.15
Forage cultivation area (ha)	35	0.00	3.50	0.46	1.00
Market gardening area (ha)	35	0.00	2.00	0.06	0.34
Rangeland area (ha)	35	0.00	38.00	5.83	9.25
Olive cultivation area (ha)	35	1.50	15.00	5.50	2.94
Total number of olive trees	35	500.00	8000	1814.80	1395.32
Sheep population	35	0.00	220.00	24.86	56.85
Goat population	35	0.00	80.00	2.29	13.52
Cattle population	35	0.00	20.00	1.69	4.25
Poultry population	35	0.00	600000	19314.29	101853.30

*: 1 USD= 130 DZD

UAA) and the lowest level of capital (32 million Algerian dinars on average). Labor input is also limited, with an average of 3.9 annual work units (AWU).

Their production system is characterized by strong diversification, but on small areas: olive growing covers 5.5 ha on average (1,815 olive trees), while other crops (cereals, arboriculture, vegetables, fodder) do not exceed a few hectares. Livestock breeding is underdeveloped, with an average of about 20 heads per farm. By contrast, poultry farming is much more significant than in the other classes, with an average of 19,300 birds, representing a compensatory strategy in response to low agricultural productivity (Table 3).

The comparison between the three classes highlights contrasting development trajectories. The first group consists of highly capitalized farms, oriented towards high value-added perennial crops and relying on abundant labor. The second illustrates a more traditional agropastoral model, based on the combination of cereal cultivation and sheep farming, with olive growing playing a complementary role. Finally, the third reflects the reality of many small, low-capitalized units, where diversification and poultry farming emerge as survival strategies and means of securing income (Table 4).

As far as olive growing is concerned, Class 1 is the most focused on olive growing, with the largest average dedicated area (19 ha) and the highest number of olive trees (7,928 trees), Class 2 has an intermediate olive growing practice (11 ha, 3,868 trees) and Class 3 devotes the least area and effort to olive growing (5.5 ha, 1,815 trees).

For comparison with other Mediterranean countries, in France, De Lange *et al.* (2024) also distinguish intensive irrigated systems, often associated with other fruit crops or livestock. Similarly, in Tunisia, Jackson *et al.* (2015) show that farms larger than 20 ha, modern and intensive, concentrate nearly half of the national olive-growing area. These situations resemble Class 1 in Djelfa, characterized by large capitalized farms, although in the Algerian case the association with sheep farming remains more prominent. In the same context, Rezgui *et al.* (2023) highlight the diversity of associations practiced in Tunisian olive groves (vegetables, fruit trees, cereals, livestock), which echoes the practices observed in Djelfa, where olive growing is often combined with sheep farming and other fruit crops.

At the other end of the spectrum, Hadjloune *et al.* (2021) describe in M'sila small family farms of less than 10 ha, fragmented and weakly capitalized, which are comparable to Class 3

Table 4. Three cluster averages

Variables	Cluster 1	Cluster 2	Cluster 3
Total agricultural area (ha)	59.29	64.89	17.47
Useful agricultural area (ha)	47.33	55.67	16.29
Estimated farm capital (million DZD)*	138.0	83.0	32.0
Annual work unit	7.78	4.56	3.86
Arboriculture area (ha)	10.65	2.22	1.07
Viticulture area (ha)	1.08	0.00	0.03
Cereal cultivation area (ha)	2.54	31.44	3.53
Forage cultivation area (ha)	2.31	4.44	0.46
Market gardening area (ha)	1.46	0.00	0.06
Rangeland area (ha)	21.58	5.78	5.83
Olive cultivation area (ha)	19.00	11.00	5.50
Total number of olive trees	7,928	3,869	1,815
Sheep population	65.38	229.33	24.86
Goat population	0.00	0.00	2.29
Cattle population	1.15	9.56	1.69
Poultry population	1,538	533	19,314
N	13	9	35

*: 1 USD= 130 DZD

farms in Djelfa. More broadly, Gurtler (2004) notes that in Europe, alongside small family olive farms (often less than 2 ha in Italy and Greece, and less than 6 ha in Spain and Portugal), there are also so-called professional farms, with average areas of 13.5 ha in Spain, 9.4 ha in Portugal, 3.2 ha in Greece, and 4 ha in Italy. In our typology, Class 1 farms, characterized by high capital levels and a strong orientation toward olive and tree crops, can be compared with these professional models. However, their average size (59 ha) is well above European standards, reflecting different land tenure and socio-economic contexts, but the same logic of specialization and professionalization.

Finally, more advanced intensification trajectories are observed in other Mediterranean regions. In Morocco, Mesbah (2024) identifies monospecific olive groves irrigated by drip systems, sometimes super-intensive with densities of up to 1,000 trees/ha, while in Andalusia large modernized farms have contributed to the creation of a true “olive belt” (Anglès, 2015). These models are reminiscent of the emerging dynamics in Djelfa but reflect a more advanced degree of specialization and professionalization.

Practical implications and recommendations

The identification of the three classes of farms highlights differentiated needs in terms of public policies and technical support. Farms in the first class appear as units already engaged in intensive, high-value systems. Such farms in the Mediterranean context have demonstrated their economic reliability (Mokrani *et al.*, 2022; Sobreiro *et al.*, 2023) as well as their performance in terms of sustainability (Mokrani *et al.*, 2022). For these farms, priority interventions should aim to strengthen the sustainability of their practices. This notably includes the promotion of water-saving irrigation techniques (Fraga *et al.*, 2021; Sobreiro *et al.*, 2023), the valorization of by-products as olive cake, leaves and pruning wood (Khezzani *et al.*, 2020), and the encouragement of adopting organic certifications (Amrouni Sais *et al.*, 2025; Iofrida *et al.*, 2020; Saker *et al.*, 2022; Cardone *et al.*, 2021; Mohamad *et al.*, 2013) in order to better position their products on national and international markets. Specialized workforce training is also an essential lever to

improve productivity and reduce dependence on external labor.

The second class of farms is distinguished by their agro-pastoral profile, dominated by the cereal-sheep farming association, with complementary olive cultivation. In this case, priority actions should focus on improving rangeland management, which is often subject to high grazing pressure (Bencherif and Slimani, 2021; Houari *et al.*, 2021). Closer integration between olive growing and livestock also represents a promising pathway (Amrouni Sais *et al.*, 2025; Adair *et al.*, 2022). Such an integrated approach would enhance the resilience and sustainability of agro-pastoral systems.

Finally, the third class, characterized by strong diversification, calls for specific measures to improve productivity and economic viability. These farms would primarily require better access to financing (Khandker, 2021; Goudjo, 2023) through the revision of existing schemes. Indeed, the issue of agricultural financing remains a major challenge in Algeria (Oubraham *et al.*, 2021). The diversification already present could be better harnessed through the establishment of short supply chains, local markets, and marketing cooperatives (Chiffolleau, 2008), thereby reducing dependence on intermediaries. Technical support would also be crucial to strengthen farmers’ capacities in crop and livestock management.

Overall, recommendations should therefore be differentiated according to farm profiles, combining support for innovation in capitalized farms, improved agro-pastoral integration for mixed systems, and targeted technical and financial assistance for small diversified farms.

Conclusion

This study, carried out in the Djelfa region, highlights the diversity of olive farms in the new olive-growing zones, characterized by varied configurations in terms of capital, labor and production systems. Using a typological approach, three main farm categories were identified, each reflecting distinct crop and livestock strategies.

The typology reveals three distinct farm profiles, each with unique strengths and weaknesses. Strengthening sustainable olive production, improving livestock integration,

and enhancing market access are essential for the long-term resilience of these farms. The results show that, although olive growing is gaining in importance in this region, farming practices remain influenced by the traditional pastoral vocation, with a strong integration of cereal crops and rangelands. In addition, the mobilization of substantial capital on certain farms represents both an opportunity for development and a challenge, particularly in terms of sustainability and intergenerational transferability.

However, this study has certain limitations. The analysis is based on a sample of 57 farms which may not capture the full diversity of olive-growing systems across Djelfa or other Algerian steppe regions. Furthermore, the focus on a single wilaya limits the generalization of results to other contexts where structural, ecological, or socio-economic conditions may differ. Future research should therefore broaden the geographic scope, increase sample size, and integrate longitudinal data to better capture farm dynamics and assess the long-term sustainability of olive-growing systems.

This diversity underlines the need for policies and programs tailored to local realities to support the sustainable development of olive farms and boost their performance, focusing on interactions between crop and livestock systems, as well as on long-term economic and environmental impacts.

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References

- Adair, P., Lazereg, M., Bouzid, A. and Ferroukhi, S.A. 2022. L'agriculture algérienne : l'héritage du passé et les défis contemporains. *Les Cahiers du CREAD* 38(3): 413-440.
- Amrouni Sais, H., Fethallah, R. and Fahas, M. 2021. Les exploitations oléicoles en Algérie : quelle performance économique? *Recherche Agronomique* 19(1): 65-76.
- Amrouni Sais, H. and Benziouche, S.E. 2024. 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? *Management and Economics Research Journal* 6(3): 95-112.
- Amrouni Sais, H. and Benziouche, S.E. 2025. Assessing the sustainability of intensive olive farming in arid areas through multi-criteria analysis. *An-Najah University Journal for Research - Natural Sciences A*. (In press).
- Amrouni Sais, H., Benziouche, S.E. and Merrouchi, L. 2025. Pathways to strengthening the sustainability of intensive olive farms in Algeria. *Natural Resources and Sustainable Development* 15(1): 102-114. <https://doi.org/10.31924/nrsd.v15i1.179>
- Anderson, E., Albersen, B., Godeschalk, F. and Verhoog, D. 2007. Farm management indicators and farm typologies as a basis for assessments in a changing policy environment. *Journal of Environmental Management* 82: 353-362.
- Atchemdi, K.A. 2004. L'élevage de bovins laitiers en milieu steppique. *Grain de Sel* 26: 9.
- Attallaoui, L. 2022. La filière oléicole en Algérie : état des lieux, opportunités et stratégies d'acteurs. Thèse de doctorat, Université de Djelfa, 268 p.
- Ben Abdallah, S., Parra-López, C., Elfkih, S., Suárez-Rey, E.M. and Romero-Gámez, M. 2022. Sustainability assessment of traditional, intensive and highly-intensive olive growing systems in Tunisia by integrating life cycle and multicriteria decision analyses. *Sustainable production and consumption* 33:73-87.
- Bencherif, S. and Slimani, H. 2021. La gestion des espaces pastoraux en Algérie : dynamique et stratégies des acteurs. *Cahiers de la Méditerranée* 102: 43-62. <https://doi.org/10.4000/cdlm.14110>
- Benidir, M. 2015. Évaluation multicritère de la durabilité des systèmes d'élevage ovin en zone steppique. Thèse de doctorat, ENSA El Harrach, 176 p.
- Cardone, G., Bottalico, F. and Prebibaj, M. 2021. Assessment of the economic sustainability of an organic olive oil farm in the Puglia Region (Italy) under the voluntary regional quality scheme. *New Medit* 20(1): 8-17.
- Cerf, M., Damay, J. and Silier, J.P. 1987. La typologie des exploitations. *Chambre d'Agriculture*, supplément 743.
- Chiffolleau, Y. 2008. Les circuits courts de commercialisation en agriculture : Diversité et enjeux pour le développement durable. In *Les circuits courts alimentaires : Bien manger dans les territoires*. Dijon: Éducagri Éditions (Ed. Maréchal, G.), pp. 19-30. <https://doi.org/10.3917/edagri.colle.2008.01.0019>
- De Lange, R., Bernard-Michinov, R., Métral, R., De Tourdonnet, S. and Hossard, L. 2024. Caractérisation de systèmes oléicoles et viticoles diversifiés dans le sud de la France. *Cahiers*

- Agricultures* 33: 20. <https://doi.org/10.1051/cagri/2024019>
- DSA (Direction des Services Agricoles) 2023. Données statistiques sur la filière oléicole dans la wilaya de Djelfa. Direction des Services Agricoles de la wilaya de Djelfa.
- Fernández-Escobar, R., de la Rosa, R., León, L., Gómez, J.A., Testi, L., Orgaz, F., Gil-Ribes, J.A., Quesada-Moraga, E., Trapero, A. and Msallem, M. 2012. Evolution and sustainability of olive production systems. Present and future of Mediterranean olive sector. *Options Méditerranéennes* OPA 106: 11-42.
- Feike, T., Chen, Q., Graeff-Hönninger, S., Pfenning, J. and Claupein, W. 2010. Farmer-developed vegetable intercropping systems in southern Hebei, China. *Renewable Agriculture and Food Systems* 25(4): 272-280. <https://doi.org/10.1017/S1742170510000293>
- Fraga, H., Moriondo, M., Leolini, L. and Santos, J.A. 2021. Mediterranean olive orchards under climate change: a review of future impacts and adaptation strategies. *Agronomy* 11(1): 56.
- Gibon, A. 1994. Dispositifs pour l'étude des systèmes d'élevage en ferme. In *Gibon, A. and Flamant, J.C. (éds.), The study of livestock farming systems in a research and development framework. In: Proceedings of the 2nd International Symposium on Livestock Farming Systems*. EAAP Publications 63: 410-422.
- Goudjo, G.G. 2023. Accès au financement et productivité de l'agriculture familiale au Bénin: cas des petites exploitations. Thèse de doctorat, Université Thomas Sankara, Ouagadougou, Burkina Faso. <https://tel.archives-ouvertes.fr/tel-04496575>
- Gurtler, J.L. 2004. Analyse comparée de la structure des exploitations oléicoles européennes. *Oléagineux, Corps Gras, Lipides* 11(3): 208-209. <https://doi.org/10.1051/ocl.2004.0208>
- Hadjou, L., Lamani, O. and Cheriet, F. 2013. Labellisation des huiles d'olive algériennes: Contraintes et opportunités du processus. *New Medit* 12(2): 35-46.
- Hadjloune, H., Kihal, O., Kaci, A. and Belhouadjeb, F.A. 2021. Quel avenir pour la filière huile d'olive fraîchement introduite dans une zone steppique? Cas de la région de M'Sila. *New Medit* 20(2): 125-140. <https://doi.org/10.30682/nm2102i>
- Houari, A., Djenane, A.M. and Chettouh, B. 2021. Impact bioéconomique du projet de plantation pastorale sur les parcours steppiques de la wilaya de Djelfa, Algérie. *Livestock Research for Rural Development* 33(3). <https://lrrd.cipav.org.co/lrrd33/3/hhoua33038.html>
- Iofrida, N., Stillitano, T., Falcone, G., Gulisano, G., Nicolò, B.F. and De Luca, A.I. 2020. The socio-economic impacts of organic and conventional olive growing in Italy. *New Medit* 1: 117-131.
- ITAFV 2013. La culture de l'olivier. Institut Technique de l'Arboriculture Fruitière et de la Vigne, Alger, 37 p.
- Jackson, D., Paglietti, L., Ribeiro, M. and Karray, B. 2015. Analyse de la filière oléicole en Tunisie. FAO, Rome.
- Khandker, S.R. 2021. Credit for agricultural development. In *Agricultural Development: New Perspectives in a Changing World*. IFPRI Chap. 16: 529-562.
- Khezzani, B., Messaoud, H. Z., Ghezal, H. and Halis, Y. 2020. An assessment study of olive a new crop adopted in Algerian Oases: A case study of the Oasis of El-Oued Province. *Annals of Arid Zone* 58(3&4). <https://doi.org/10.56093/aaz.v58i3 & 4.97987>
- MADR (Ministry of Agriculture and Rural Development) 2003. Recensement général de l'agriculture 2001. Rapport général des résultats définitifs. Ministère de l'Agriculture et du Développement Rural, Alger, 125 p.
- MADR (Ministry of Agriculture and Rural Development) 2022. Série B, Données statistiques, Superficies et productions, direction des statistiques agricoles et des systèmes d'information. Ministère de l'Agriculture et du Développement Rural.
- MADR (Ministry of Agriculture and Rural Development) 2008. Cahier des prescriptions techniques pour l'installation et conduite d'une oliveraie en intensif. Document réalisé par l'ITAFV, l'INSID, le CNCC et l'ITDAS, 21 p.
- Medouni, Y., Omrane, B. and Khader, M. 2004. Étude du système d'élevage et du mode d'exploitation des parcours collectifs : Cas de la zone de Aïn Oussara (région de Djelfa, Algérie). In : *L'évolution des systèmes de production ovine et caprine : Avenir des systèmes extensifs face aux changements de la société* (Ed. J.-P. Dubeuf), Options Méditerranéennes, Série A, n°61: 279-288. CIHEAM, Zaragoza.
- Mesbah, N. 2024. Diversité et performances des systèmes oléicoles au Nord du Maroc (zone de Moulay Idriss Zerhoun). Mémoire. <https://dumas.ccsd.cnrs.fr/dumas-04969199>
- Mohamad, R.S., Bteich, M.R., Cardone, G. and Marchini, A. 2013. Economic analysis in organic olive farms: The case of the ancient olive trees in the rural parkland in Apulia. *New Medit* 4: 53-60.
- Mokrani, A., Ben Nasr, J., Sai, M.B. and Bachta, M.S. 2022. Sustainability assessment of Tunisian olive growing systems. *New Medit*. <https://doi.org/10.30682/nm2204a>
- Nedjraoui, D. and Bédrani, S. 2008. La désertification dans les steppes algériennes : causes, impacts et actions de lutte. *VertigO* 8(1). <https://doi.org/10.4000/vertigo.5375>

- Oubraham, F., Bédrani, S. and Belhouadjeb, F.A. 2021. La bonification du crédit favorise-t-elle vraiment le financement des exploitations agricoles ? Cas de la wilaya de Laghouat en Algérie. *Cahiers Agricultures* 30: 23.
- Saad, A., Lamine, M., Salamani, C. and Saied, S. 2023. Key factors influencing olive yields for sustainable development in arid regions of Djelfa and M'sila, Algeria. *Natural Resources and Sustainable Development* 13(2). <https://doi.org/10.31924/nrsd.v13i2.137>
- Sobreiro, J., Patanita, M.I., Patanita, M. and Tomaz, A. 2023. Sustainability of high-density olive orchards: hints for irrigation management and agroecological approaches. *Water* 15(13): 2486.
- Vilar, J. *et al.* 2018. L'oléiculture internationale: Diffusion historique, analyse stratégique et vision descriptive. 1ère éd. Fundación Caja Rural de Jaén, Espagne, 153 p.
- Zoubeidi, M. and Dahane, A. 2018. Une agriculture durable au service d'une alimentation durable: Culture de l'olivier dans la steppe algérienne. *Options Méditerranéennes, Série A*, n°124: 18-20.