The Study of the Techno-Economic Performance of an Algerian Olive Nursery

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Abstract: Olive tree nurseries play a critical role in sustaining the olive industry. An investigation into the operations and challenges faced by these nurseries reveals crucial insights. In examining multiple olive plant nurseries; a comprehensive study highlighted various constraints affecting optimal operations. These include shortages of growth hormones, lack of specialized personnel, absence of essential materials like perlite, and limited identified orchards for certified olive species. Commercially, the market faces challenges from informal vendors offering olive plants at significantly lower prices. The absence of traceability culture and smaller land parcels also affect the overall demand for olive plants. An in-depth analysis of production costs showcased the intricacies involved in producing olive plants. With data extrapolated from a Jijel Forest Directorate report, estimated costs were meticulously detailed, revealing critical expenses incurred. A crucial metric, the cost of producing a single olive plant was meticulously calculated at approximately 40.00 DA, covering all production expenses but not the final price. This production cost was deemed acceptable, especially when compared to the black market price of around 200.00 DA. Understanding the intricacies and challenges faced by olive plant nurseries is crucial for sustaining their operations. The study's findings shed light on critical issues such as cost implications, commercial obstacles, and essential factors affecting olive plant production.

Key words: analysis, production cost, techno-economic performance, olive oil sector, olive Nursery.

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1. Introduction

The production of olive seedlings in nurseries is experiencing a crucial resurgence in importance within the development and expansion of the national olive industry. It secures the sector by consistently providing subjects in both quantity and quality. The presence of olive nurseries on a national scale signifies the efficiency and role they play in the national olive economy. However, these nurseries face difficulties and constraints that endanger their existence.

Nevertheless, essential aspects of the international olive nursery sector and the organization of the multiplication process are not well-known as this information is typically included in the total production of fruit trees in official statistics.

Nurseries specializing in olive tree production are usually located in areas with a strong tradition characterized by significant development in this culture and the convergence of several favorable factors (environment, availability of qualified labor, etc.).

Olive nurseries are predominantly represented by small-scale enterprises (with average annual productions of 10,000 to 20,000 olive trees) mainly run as family businesses. Larger structures produce between 30,000 and 100,000 olive trees per year. In countries with a strong tradition in nurseries, there are also modern enterprises capable of providing productions ranging from 150,000-200,000 to 500,000 olive trees annually.

The olive oil industry in Algeria lags behind in both upstream and downstream development. Compared to Tunisia, Algerian production represents only one-third (Bensemmane, 2009). However, Algeria can carve out a significant place in the olive sector by laying the foundations for a realistic perspective on its olive industry development (Mousouni, 2009). In advanced agricultural systems, the results of the production sector are closely linked to the functionality of the nursery (IOOC, 2008).

The nursery's role as an economic structure is inherent in the productions it provides for agriculture and the capital it requires for this purpose. The nursery is also a technological enterprise as it employs equipment and skills similar to those used in industrial production processes. It also holds a social role by providing substantial employment and being attentive to the protection of its personnel and the environment. Moreover, it serves as an ideal platform for innovation transfer to the agricultural sector by providing goods and products that support the territory and community development (IOOC, 2008).

In Algeria, the national production of olive seedlings fails to meet the demand in the domestic market (MADR, 2016). This underscores the need for productive support within the olive

industry, a need fulfilled by nurseries that indeed play a strategic function, ensuring the production of necessary plant material.

In this context, we have initiated a study to analyze the technical and economic performance of this sector and identify its shortcomings.

Building on the previously introduced information, our work began with a central question that aims to shed light on the deficiencies perceived in the Algerian olive industry:

Why does the nursery segment in Algeria exhibit weaknesses, and how can their path of development be envisioned?

To attempt an answer to this question, we have formulated several hypotheses as follows:

1. The lack of strategic organizational plans is the root cause of poor nursery management.
2. The weakness in local demand has been detrimental to the economic profitability and continuity of local nurseries.

To ensure a systematic approach to our work and to substantiate our conclusions, we have designed a questionnaire to serve as the foundation of our investigation into the study of nurseries.

2. Materials and Methods

Nurseries are facilities where seedlings are cultivated for subsequent transplantation. Young plants are nurtured from the seedling stage to enable them to withstand the challenging conditions they will encounter in the field later on. Whether they are native or introduced species, it is observed that nursery plants have higher survival rates compared to seeds sown directly in place or through natural regeneration. Hence, nursery plants serve as the primary material for plantations, be it for production, protection, or landscaping purposes (FAO conservation guide, 1992).

Nurseries can be defined in two distinct parts, general and specific: **a. General:** This refers to the terrain, surface area, or chosen and adapted zone dedicated to the propagation and cultivation of plants until they are ready for transplantation elsewhere. For instance: vegetable or forestry nurseries. **b. Specific:** This pertains to the production of perennial, woody plants, outdoors, such as trees, shrubs, conifers, roses, and other similar species (Nicolas J., 1998).

2.1. Types of nurseries

There are two types of nurseries: **a. Temporary Nurseries:** These are established on or near the planting site. Once the plants intended for planting have reached the desired size, the nursery is integrated into the planted site, sometimes referred to as "flying nurseries. **b. Permanent Nurseries**: These can vary in size depending on the goal and the number of seedlings cultivated each year. Small nurseries hold fewer than 100,000 plants at a time, while large nurseries hold more. In all cases, permanent nurseries must be well-designed, situated in a suitable location with sufficient water supply (FAO conservation guide, 1992).

2.2. Site selection for a nursery

The nursery is established 6 to 8 months before planting. It is usually located near a water source to facilitate watering. It can be close to the future plantation, camp, village, or near fertile soil. The

key is for the nursery to be situated near a water source. Often, nurseries are entirely located in low-lying areas, which is not recommended (KOUAME S; 2007).

The selection of a nursery site should consider the coexistence of several factors:

- Permanent availability of sufficient quality water
- Easy access to the nursery site (valid road infrastructure)
- Good quality soil, favorable for drainage (sufficient proportion of sandy and coarse elements), and chemical quality for the production of "bare-root" plants and adequate chemical quality nearby for the production of containerized plants.
- Favorable topography: ideally flat to very slightly inclined (internal slope less than 3%), allowing good drainage.
- Proximity to inhabited areas to meet labor needs for monitoring and supervision.
- Nearness to planting sites (to reduce transportation costs of plants).
- Proper soil openness: minimized herbaceous and shrub layers (to reduce installation costs) and the favorable presence of light tree cover (reducing drying effects of wind, providing partial shading to plants, and creating a forest-like atmosphere) (BAGLO; ABE, 1998).

2.3. Nursery planning and setup

a. Nursery Layout

The general shape of the nursery should closely resemble a square. This is to minimize unnecessary movements during maintenance and also to reduce the costs of installing perimeter fencing when necessary (BAGLO; ABE, 1998).

To plan the preparation of the nursery, the following points should be considered:

i. The nursery area must account for both the total area and the usable production area (S.U.P).

ii. The total area includes the usable surface plus access paths to the nursery, storage for tools, space for preparing substrate mixes, pot filling, and germination shelters (BAGLO; ABE, 1998).

The nursery is divided into three areas: buildings, plots for cultivating mother plants, and areas occupied by structures for the propagation and growth of young plants.

The plans also incorporate other infrastructures such as internal roads, parking areas, storage spaces, water supply for mist propagation and irrigation, and the necessary facilities for providing electricity and gas.

The nursery consists of three clearly defined main sections referred to as "squares," each designated for plant production:

b. Multiplication Squares:

These are designed based on the following elements:

- Receiving seeds, cuttings, young grafts, and transplanted marcots.
- Having access to a water source.
- Providing fertile and light soil.
- Being situated near the buildings.
- Having a large surface area to allow disinfection of a part of the soil while the other part is under cultivation (Nicolas J; 1998).

i. Rearing or Transplantation Squares:

Characterized by the following:

- Intended for producing larger subjects.
- Areas where planting or transplanting takes place.
- Grafting and nurturing young plants until they are ready for removal.

ii. Mother Plant Squares:

Characterized by the following:

- Supplying seeds, cuttings, grafts from plants grown specifically for this purpose.
- Identifying plants (labels, planting plans).
- Requiring maintenance (soil work, fertilization, pest treatments), especially pruning for rejuvenation and facilitating work (BAGLO, ABE, 1998).

The olive tree (Olea europaea L.) holds a crucial place in human life, more than any other plant, and faithfully reflects the development of culture and sustenance.

As a functional plant within the agricultural system of numerous countries, the olive tree has held significant economic and social importance over millennia. Its longevity and adaptability have established it as an integral part of landscapes in challenging pedoclimatic environments.

The fundamental aspects of the international olive nursery sector and the organization of the multiplication process remain relatively unknown, as this information is often included in the total production of fruit trees in nursery statistics.

Nurseries specializing in olive tree production are typically situated in areas with strong cultural traditions, characterized by significant development in this cultivation and a combination of various favorable factors, including environmental conditions and the availability of qualified labor.

Olive nurseries are predominantly represented by small-scale family-run businesses, with annual productions averaging between 10,000 and 20,000 olive trees. Larger facilities produce between 30,000 and 100,000 olive trees annually. In countries with a strong nursery tradition, modern enterprises capable of producing between 150,000-200,000 and 500,000 olive trees per year can also be found.

Critical decisions must be made to organize and maximize resources (land, buildings, facilities, equipment, personnel, etc.), schedule business activities, and align production with market demands. Initially, determining production cycles and identifying areas for buildings, greenhouses, plots, and infrastructure installation are essential.

Planning should also encompass the type of propagation (number of plants, rootstocks, and grafted plants), sourcing vegetative material for propagation, labor recruitment, and plot management.

Programming production processes involves defining market shares, commercial procedures, and evaluating critical points at different production stages.

Once these choices are made and optimal solutions identified to minimize costs without compromising commercial quality, the nursery layout can commence. The proposed structure is suitable for large-scale nursery productions.

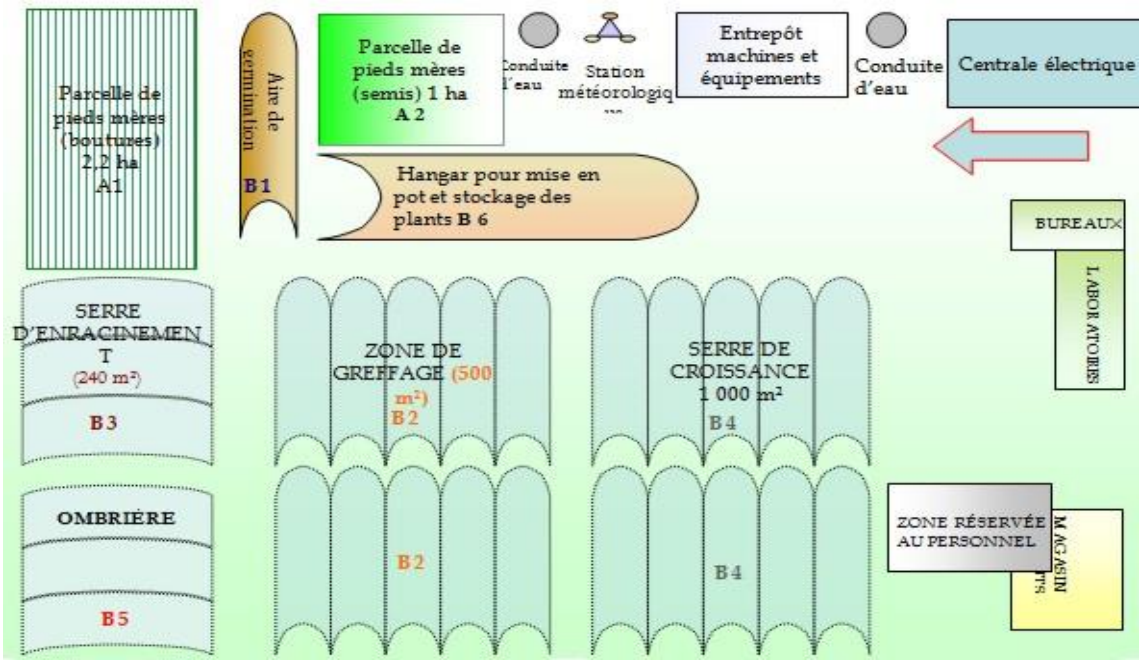

Figure 1: Example of an Olive Nursery Organization

The production of olive seedlings in nurseries has regained crucial importance in the development and advancement of the olive industry. It secures the industry by consistently supplying subjects in quantity and quality. The presence of olive nurseries at the national level signifies the interest and role they hold in the national olive economy. However, these face difficulties and constraints that endanger their existence.

3. Results and Discussion

3.1 Survey Presentation

During our study, we engaged with the head of the olive sector at the Ministry of Agriculture. He stated that the national olive cultivation development plan aims to achieve a potential of one million hectares by 2019. Additionally, the national production of olive seedlings fails to meet the demands of the domestic market, necessitating the State to import these seedlings from Spain and Italy.

To conduct our study effectively, we initiated an investigation in the Jijel province. The nursery in focus primarily practices olive cultivation as its main activity. Established in 2003 by Mr. KRIKET Laid, it operates as an individual agricultural exploitation (EAI) spanning across a 4-hectare area.

The cultivated crops in this nursery include olive trees, floriculture, apple trees, with olive cultivation being the primary activity for several reasons:

- Regional inclination towards olive cultivation.
- Public demand in the market.
- Development of the olive sector in the region.
- Availability of reproductive material (nebulization greenhouse).

3.2. Production Technique Used

Initially, the nursery opted for olive tree propagation using the misting technique, which involves employing semi-hardwood cuttings (12-15 cm in length) from one-year-old trees. This technique requires favorable conditions of temperature, humidity, and light, typically available in specialized greenhouses.

The misting technique also involves treating the cuttings with hormones to enhance their natural rooting abilities.

The resulting plants from misting will undergo grafting using the previously mentioned grafting technique.

a. Workforce

Upon the nursery's establishment, the workforce consisted of four individuals, including:

- The owner and his son.
- Two engineers recruited through the National Employment Agency (ANEM).

b. The production capacity of seedlings in this nursery

The olive variety cultivated in this nursery is "Chemlal." The communicated production capacity is 15,000 plants per year. It's worth noting that this figure was the goal set by the nursery in its first year of olive seedling production.

c. The nursery's production yield

Production yield, by definition, is the ratio between the quantity produced and the nursery's production capacity. To accurately determine the actual quantity produced after implementing the aforementioned techniques, it's essential to estimate the number of altered plants.

The primary cause leading to decreased production is the lack of necessary hormones for misting, resulting in the degradation of a significant number of cuttings, estimated at an 80% elimination rate. This corresponds to approximately 3000 plants intended for grafting. At the end of this process, the mortality rate is 2%, resulting in a final produced quantity of 2940 plants. This yields a production rate of 19.6%, calculated as follows: (2940/15000) x 100. This rate was deemed sufficient to meet demand only in the first year of production; subsequently, the nursery reduced its production starting from the second year, resulting in a significant drop in production within just three years, between 2005 and 2008. The manager explained that the sole reason for this decline was sales issues. Consequently, the decision was made to halt production until today.

3.3. Production Constraints

- According to the survey results, we attempted to identify various constraints hindering the nursery's smooth operation. These primarily include:
- - Lack of growth hormones in the market, essential for the development of cuttings in the misting greenhouse. Purchasing from the informal market comes at high prices, elevating the cost of plants significantly and drastically reducing profitability.
- - Shortage of qualified personnel, particularly for greenhouse production, requiring technically and scientifically qualified personnel (engineers). The departure of the two engineers after their

contracts ended and the increased demands and prices from qualified grafters in the market has led to heightened risks of plant mortality due to grafting faults.

- Absence of perlite, a substrate used as a support (soil) for plant cultivation.
- Lack of a timber park to ensure the sustainability of the activity.
- Absence of identified and certified olive species orchards.

3.4. Marketing Constraints

- Through our investigation, we had the opportunity to discuss with the nursery manager, who provided us with indicators that impede successful commercial operations. These constraints include:
- Presence of sellers in the informal market offering unbeatably low prices, posing as significant competitors.
- Absence of traceability and guarantees in Algerian operations.
- Low quantities demanded due to agricultural land fragmentation.
- State plantation program contracts are awarded to suppliers outside the province or centralized by the ministry in the capital, Algiers. Purchases are limited to a few nurseries, or plants may be imported and distributed to various agricultural service departments in other provinces, discouraging local production in each province.

3.5. Commercial Estimates for Two Nurseries

During our investigation, we couldn't access specific commercial data. Therefore, we attempted to estimate the production cost of an olive plant based on a cost structure model obtained from the Jijel Forest Department.

The costs presented in the table below cover the production expenses for 70,000 olive plants according to the Jijel Forest Department. The table displays prices in Algerian Dinar (DA) for each expense:

Table 1 with production costs and prices in Algerian Dinar for various expenses related to olive plant production

Table 1: Production Cost Data

Source: Jijel Provincial Forest Department

Item	Costs (DA)
Equipment	200 000,00
Hormones	8 000,00
Electricity	80 000,00
Treatment Products	4 000,00
Pouches	4 000,00
Small Tool Expenses	10 000,00
Timber Park Kit	30 000,00
Phytosanitary Products	10 000,00
Fertilizer (10 hectares)	100 000,00

Source: Jijel Provincial Forest Department

3.6. Application for the Jijel Nursery

a. Labor

The nursery owner works independently with his son, apart from two engineers hired under the National Employment Agency (ANEM), who are paid by the government.

b. Other Expenses

The list of expenses summarized in the following table shows the extrapolated data from Table 2 for 15,000 plants.

Table 2. Estimated production costs for other expenses

Item	Extrapolated Cost (DA)
Equipment	42857,14
Hormones	1714,29
Electricity	17142,86
Treatment Products	857,14
Pouches	857,14
Small Tool Expenses	2142,86
Timber Park Kit	6428,57
Phytosanitary Products	2142,86
Fertilizer (04 hectares)	40000,00
Total	114 142,86

c. Cost of Production per Single Plant

Calculating the production cost per seedling enables us to assess the level of expenses incurred per plant, aiding in setting the plant's selling price.

Its calculation was performed using formula (IV.3).

Plant cost = 114,142.86 / 2940.

The estimated cost is 38.82 DA.

We have found that the production cost of a single plant is approximately 40.00 DA.

According to our calculations, the cost price of 40.00 DA represents the necessary cost that covers the production expenses, without accounting for the profit margin. As observed during our investigation, the black market price is approximately 200.00 DA. Therefore, we can conclude that the final cost (defined as the sum of the cost price and profit margin) is deemed acceptable. We emphasize that this estimation solely represents the cost price covering all financial charges during production and does not represent the final cost of the plant. The final selling price of the plant will be determined after adding the profit margin, a decision made by the nursery owner.

4. Conclusion:

Following the illustration of the findings from our investigation into the UPEV and Jijel nurseries, it can be concluded that olive tree nurseries face collective issues, whether in production or commercialization.

Key problems hindering the development of the olive oil industry encompass both technical and economic aspects:

- Shortage of qualified labor force
- Prevalence of an informal market
- Unsatisfactory sales of plants

The financial results are estimations aimed at providing a general understanding of production costs and the underlying calculation principles.

References

[1] **Acila, S.** 2018. Introduction de l'olivier (Oleaeuropaea L.) à Oued Souf : Situation actuelle et perspectives de développement, cas de l'exploitation Daouia, Thèse de doctorat en sciences agronomiques, université Kasdi Merbah, Ouargla, 194p.

[2] **Alexandre F., Angles S., Cohen M.** 2006. L'aire de l'olivier, indicateur bioclimatique ou marqueur culturel de la méditerranéité, in Géopoint 2004 : La forme en géographie. Avignon, Groupe Dupont et UMR Espace, p159-163.

[3] **Belhouadjeb FA, Boumakhleb A, Toaiba A, Doghbage A, Habib B, Boukerker H, Murgueitio E, Soufan W, Almadani MI, Daoudi B, et al.** 2022: The Forage Plantation Program between Desertification Mitigation and Livestock Feeding: An Economic Analysis. Land 11: 948

[4] **Bensemmane A.**, 2009. «Développons le secteur de l'Huile d'Olive en Algérie», Filaha Innove, N. 4. 7 pages.

[5] **Bérard L, Marchenay P.** 2009. Lieux, cultures et diversité : un regard anthropologique sur les productions localisées. Options Méditerranéennes. N° 89. p. 31-37

[6] **Boucheffa S., Miazzi M. M., Di Rienzo V., Mangini G., Fanelli V., et al.** 2016.The coexistence of oleaster and traditional varieties affects genetic diversity and population structure in Algerian olive (Oleaeuropaea) germplasm. Genet ResourCropEvol.

[7] **Boukerker H, Boumedjene Mouna R, Doghbage A, Belhouadjeb FA, Kherifi W, Hecini L, Bekiri F** 2021: State of Pastoral Resources in the Algerian Steppe Regions: Main Factors of Degradation and Definition of Preservation and Rehabilitation Actions. Livest Res Rural Dev 33: 1-9

[8] **Boukerker H, Hecini L, Salemkour N, Boumedjane MR, Kherifi W, Doghbage A, Belhouadjeb FA, Bekiri F, Boultif M, Diab N** 2022: Impacts of Grazing Restoration by Planting on the Pastoral Potential Floristic Richness and Diversity of the Southwestern Steppe of Naâma (Algeria) in the Context of Climate Change. Livest Res Rural Dev 34: 1-12

[9] **Bouri, C.** 2010. Les politiques de développement agricole le cas de l'Algerie « impact de PNDA/PNDAR sur le développement économique », thèse de doctorat à l'université d'Oran à la faculté des sciences économiques de gestion et des sciences commerciales, 483p.

[10] **Cheniti, F.** 2018. Système de gestion des ressources en eau de la ville de Jijel : évaluation et planification, Mémoire en Géologie, Université Mohammed Essedik Ben Yahia, p 112.

[11] **COI**, 2015a. Étude internationale sur les coûts de production de l'huile d'olive. International Olive Council, Octobre 2015. Madrid, Spain., 41p.

[12] **COI**, Conseil oléicole Internationale, **Nº 145** JANVIER 2020,p 18.

[13] **Derbal, S**. 2008. La détermination du coût de revient d'huile d'olive dans deux commune de la wilaya de Jijel, Mémoire d'ingéniorat, ENSA, El Harrach, 67p.

[14] Etablissement nationale des produits de l'agriculture et de la mer, FranceAgriMer,

[15] Fiche filière oléicole du MADRP/DRDPA, mai 2017.

[16] **Guissous, M**. 2019. La filière oléicole en petite Kabylie: quelles innovations pour un développement durable?, Thèse de doctorat en Science, Spécialité production végétale, Université Ferhat Abbas Sétif 1, 234p.

[17] **Hadjloune H, Kihal O, Kaci A, Belhouadjeb FA** 2021: Quel Avenir Pour La Filière Huile d'olive Fraichement Introduite Dans Une Zone Steppique? Cas de La Région de M'Sila. New Medit 20: 125-140

[18] **ISMEA**,Institute of Services for the Agricultural and Food Marke, 2020.Olive OilAveragePrices Trend.

[19] **Lachibi, M**. 2019/2020. Analyse des formes de valorisation des potentialités oléicoles nationales : cas du Nord-Est algérien, Thèse de doctorat en Sciences Agronomique, ENSA, El Harrach, Alger, 129p.

[20] **Lachibi, M., Chehat, F., Belhouadjeb, F. A.** 2019. Les facteurs influençant le rendement oléicole : cas de la région de Jijel du Nord-Est algérien. OCL 26: 12. https://doi.org/10.1051/ocl/2019008

[21] **Lazzeri Y. (2009).** Les défis de la mondialisation pour l'oléiculture méditerranéenne, L'olivier en Méditerranée, Conférence Centre Culturel Français de Tlemcen - Algérie.

[22] **Boudi, M.,Chahet, F., Cheriet, F**. 2013. Compétitivité de la filière huile d'olive en Algérie: cas de la wilaya de Bejaïa, Les cahiers du Cread n°105/106, 24p.

[23] **Maxime Debas**. Plan de restructuration de la pépinière de l'entreprise Jacquet SA. Sciences agricoles. 2015. ffdumas-01217096

[24] **Mendil, M., Sebai, A**. 2006. L'olivier en Algérie. Alger: Institut technique de l'arboriculture fruitière et de la vigne, 26-97p.

[25] **Mouloud, M. A**. 2014. La valorisation de la qualité de l'huile d'olive de la région Kabyle: quel signe de qualité mettre en place?. Terroirs en Méditerranée: Concepts, théories, pratiques et perspectives de recherche.

[26] **Moussouni A.** 2009. L'oléiculture : technologie et développement. Filaha Innove. N°4. P8-9.

[27] **Moutier, N., Pinatel, C., Martre, A., Roger, J. P., Khadari, B., Burgevin, J. F., Artaud, J.** 2011. Identification et caractérisation des variétés d'Olivier cultivées en France-Tome 2.

[28] **Noelle, T**. 1997. Guide de pratique de l'approche filière : le cas de l'approvisionnement et de la distribution des produits alimentaires dans les villes, Revue et collection « Aliments dans les villes », FAO, Italie, 26p.

[29] **Orregia, M., Marinelli, L. 2017**. FLOS OLEI. Del tribunal Di Roma. Italie.

[30] **Oubraham F, Bédrani S, Belhouadjeb FA** 2021: Does Interest Rate Subsidy Really Promote the Financing of Farms? The Case of the Wilaya of Laghouat in Algeria. Cah Agric 30: 23

[31] **Ouferhat, N., Ait Hamlat, N.** 2015.Les contraintes de la filière Huile d'Olive en Algérie, Cas de la Wilaya de Bejaia ; Commune d'Ighil Ali, Mémoire de Master 2 en Biologie, Université Mouloud Mammeri de Tiz i -Ouzou, p63.

[32] **PNT, Parc National de Taza. 2006.** Plan de gestion II 2006-2010, Phase A, Approche descriptive et analytique. 38 p

[33] **Sansoucy, R.**1985. Olive by-products for animal feed.Food & Agriculture Organization.Amazon France, 44 p.