Understanding the current status, emerging challenges, global uncertainties and coping mechanisms of agriculture and food systems around the Mediterranean: proceedings

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Understanding the current status, emerging challenges, global uncertainties and coping mechanisms of agriculture and food systems around the Mediterranean

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Avant-propos

Le CIHEAM Montpellier a organisé le 3ème Forum Méditerranéen à l'intention des doctorants et jeunes chercheurs de la région méditerranéenne. Ce forum vise à favoriser la communication, le dialogue et la publication entre les différents partenaires de la recherche scientifique dans le domaine du développement rural dans les pays méditerranéens.

Ce forum a constitué une excellente occasion pour les doctorants, les jeunes chercheurs mais également pour la première fois les chercheurs confirmés de présenter et discuter leurs travaux de recherche avec des collègues venant du pourtour méditerranéen. Ce symposium était particulier, car il a donné le temps nécessaire à chaque participant de partager et débattre ses travaux devant un public venant de différentes disciplines.

Au total une cinquantaine de participants répartis en trois sessions thématiques ont pu s'exprimer. Les thématiques traitées étaient d'actualité et au cœur des débats méditerranéens actuels : 1) Les pratiques agroécologiques améliorant les services écosystémiques, 2) L'innovation dans les secteurs de l'agriculture et de l'agroalimentaire comme moyen de renforcer la durabilité des chaînes de valeur dans les pays méditerranéens, et 3) Les cadres institutionnels et politiques nécessaires pour renforcer l'inclusion et la participation des acteurs vulnérables de la chaîne de valeur aux échelles locale, régionale et nationale autour de la Méditerranée.

Ce symposium a pu montrer l'importance de cet évènement biannuel très attendu par nos jeunes chercheurs méditerranéens. Il constitue pour la plupart d'entre eux une des rares opportunités pour partager leurs travaux au niveau international, et pour avoir une première publication référencée. Ce symposium a montré également l'importance des travaux de recherche menés au niveau de la rive Sud de la Méditerranée et qui sont souvent très peu publiés et connus par la communauté scientifique.

Foreword

In coordination with CIHEAM Chania, Bari and Zaragoza, the 3rd Mediterranean Forum for doctoral students and young researchers had been organized at CIHEAM Montpellier, promoting communication, dialogue and publications between the different partners' institutions, for conducting scientific research linked to rural development in the different Mediterranean countries.

This forum was an excellent opportunity not only for doctoral students and young researchers, but also for experienced researchers to present and discuss their work with colleagues from all around the Mediterranean. Nevertheless, the needed time had been appointed carefully to each participant, allowing them to share and discuss their research with audience from various disciplines, making this symposium very special.

A total of fifty participants were divided into three thematic sessions. The themes dealt with the ongoing Mediterranean debates: 1) Agroecological practices enhancing the ecosystem services, 2) Innovation in the agricultural and food sectors as a mean to strengthen the sustainability of value chains in the Mediterranean countries, and 3) Institutional and political frameworks needed to enhance inclusion and participation of vulnerable value chain actors at local, regional and national scales around the Mediterranean.

This symposium was able to show the importance of this biannual event, which is eagerly awaited by our young Mediterranean researchers. It stems from the debates that this event constitutes, and most importantly, one of the rare opportunities to share their work on an international scale, having their first referenced publication. This symposium also showed the importance of the research work carried out on the southern shore of the Mediterranean, which is often rarely published and known by the scientific community.

Hatem BELHOUCHETTE

Administrateur scientifique, CIHEAM-IAMM
Coordinateur des comités scientifique et d'organisation

MedForum Program

Tuesday, July 6, 2021

TIME	EVENT
09:00 - 09:30	Online gathering - WELCOME on ZOOM
09:30 - 10:00	Welcome speech and introductory notes - Pascal BERGERET (Directeur/Director CIHEAM Montpellier)
10:00 - 10:30	Keynote - Hatem BELHOUCHETTE (CIHEAM Montpellier)
10:30 - 10:40	State and pressures on ecosystem services of agricultural land in the Mediterranean area - **Mejjad Nezha** [Day Awards]
10:40 - 10:50	A bio-economic model to improve irrigated durum wheat performance and regional profit in Mediterranean conditions - **Houda Mazhoud**
10:50 - 11:00	Libya between limited of water resources food insecurity and conflict after 2011 - **Ehdadan Jamal Ali Mohamed**
11:00 - 11:10	Valorisation de la biodiversité végétale de la région de Chréa : entre conservation et développement - **Ouelmouhoub Samir**
11:10 - 11:25	Discussion
11:25 - 11:35	Analyse Prospective du jeu des acteurs de la filière des légumineuses alimentaires au Maroc - **Toumi Larbi**
11:35 - 11:45	Comprendre la réponse de la culture associée blé-pois chiche à la fertilisation azotée en utilisant des indices de compétitivité agro-écologiques dans des conditions pédoclimatiques contrastées - **Omar Kherif**
11:45 - 11:55	Les enjeux de l'agriculture périurbaine dans l'espace périrubain de Bled Béja - **Hermi Sayari Monia**
11:55 - 12:05	Les anciennes palmeraies et les cultures sous-jacentes : peuvent-elles garantir la sécurité alimentaire au Sahara ? - **Faci Mohammed**
12:05 - 12:20	Discussion
12:20 - 12:25	Conceptual framework for defining options of crops-livestock integration under conservation agriculture using Farm Design model - **Ameur Wafa**
12:25 - 12:30	Influence du sol et de l'altitude sur le profil phénolique de quelques huiles d'olives algérienne - **Bendi Djelloul Mounsif**
12:30 - 12:35	Influence de la date de récolte sur la germination d'un porte-greffe des agrumes Citrus volkameriana Pasq. - **Benhizia Toufik**
12:35 - 12:40	Comprendre la place de la diversification des moyens de subsistance comme stratégie de résilience climatique des petits agriculteurs : cas de la vallée du Souss au Sud du Maroc - **El Jarari Mustapha**
12:40 - 12:45	The potato in the Souf region: a new agrosystem in the Algerian Sahara - **Faci Mohammed**
12:45 - 13:00	Discussion
13:00 - 14:00	Break / Lunch
14:00 - 14:05	Natural saline pasture, a potentially sustainable feed alternative for lambs in Mediterranean coastal lands - **Friha Mouna**
14:05 - 14:10	Impact of climate change and saline water on the physiological performance of olive tree (Olea europaea .L) in an arid climate - **Trabelsi Lina**
14:15 - 14:20	Etude préliminaire d'intégrer l'aquaculture dans le domaine agricole à partir d'étude de la diversité et la distribution de la faune benthique d'Oued Abiod Nord–Est Algérie - **Boudrari Samia**
14:20 - 14:25	Les déterminants de la consommation des produits issus de l'agriculture biologique - Labiad Samir *[no abstract]*
14:25 - 14:40	Discussion

TIME	EVENT
14:40 - 14:50	Identifying drivers of inequalities that induce food insecurity and nutrition with a food system approach: case study of Ghana - **Alpizar Rojas Daniel**
14:50 - 15:00	Social capital and rural territories: the impact on local cooperation Case study of Albania - **Muco Elda**
15:00 - 15:10	Factors influencing innovative circular business models in the Mediterranean olive oil value chain - **Radic Ivana**
15:10 - 15:20	Geographical indications and sustainable rural development: possible paths from PDO honey in Italy to Albania - **Caso Antonio**
15:20 - 15:35	Discussion
15:35 - 15:45	By-product valorization strategies implemented by small Mediterranean olive oil farmers - **Manuel Martin Judit** [Day Awards]
15:45 - 15:55	Panorama of the apple sector in Lebanon: structure and constraints - **Abdallah Hala**
15:55 - 16:05	Répondre au manque d'inclusion des jeunes dans les systèmes agroalimentaires en valorisant les chaines de valeurs territorialisées : cas des filières huile d'olive et ovin-lait dans le nord-ouest de la Tunisie - **Ouertani Emna**
16:05 - 16:20	Discussion and Awards for the day's presentations

Wednesday, July 7, 2021

TIME	EVENT
09:30 - 10:00	Online gathering - WELCOME on ZOOM
10:00 - 10:30	Economically and environmentally resilient farming systems in the Mediterranean Basin. A case study of the importance of pollination services in French arable crop farms - Georgios KLEFTODIMOS (CIHEAM Montpellier)
10:30 - 10:35	The enhancement of the specialized local food system in Lebanon via rural/urban & rural/rural linkages - **Gholam Nicolas**
10:35 - 10:40	Contribution à l'étude des contraintes liées à la labellisation de l'huile d'olive marocaine - **Yatribi Taoufik**
10:40 - 10:50	Discussion
11:00 - 11:10	Potential impact of marine algae extracts on growth, mineral content and essential oil composition of salinity stressed fennel (Foeniculum vulgare Mill.) plants - **Kalleli Fatma**
11:10 - 11:20	Application of a traditional pre-treatment as a green method to improve the quality of raisins - **Khiari Ramla**
11:20 - 11:30	Nicotiana glauca Graham: an emerging threat to crop fields in Tunisia - **Sayari Najla**
11:30 - 11:45	Discussion
11:45 - 11:55	Soil biostimulant application on tomato seedlings - **Kizildeniz Tefide**
11:55 - 12:05	Chemical and functional characterizations of different cereal and pseudocereal flours: rice, maize, quinoa and chia - **Allouch Wafa**
12:05 - 12:15	Improvement of the functional and nutraceutical quality of cake by adding Erodium glaucophyllum powder - **Abdelkebir Radhia**
12:15 - 12:30	Discussion
12:30 - 12:35	Ultrasonic microencapsulation of wild Zizyphus lotus L. fruit as source of natural antioxidants - **Abcha Imen**
12:35 - 12:40	Relationship between litter size and body linear type traits in local goat population raised under arid conditions - **Ahlem Atoui**

TIME	EVENT
12:40 - 12:45	Effects of a liquid seaweed extract (Ulva intestinalis) on photosynthetic pigments and water status of hydroponically grown purple basil (Ocimum basilicum var. purpurascens Benth.)-Lamiaceae - **Annabi Hibat Allah**
12:45 - 12:50	Technological aspects of lactic acid bacteria isolated from Tunisian camel and goat kefir - **Arroum Saidi Samira**
12:50 - 12:55	Place de l'activité de maquignonnage dans les élevages ovins de la région agropastorale de Tiaret en Algérie - **Zemour Hafidh**
12:55 - 13:10	Discussion
13:10 - 13:35	Break / Lunch
13:35 - 13:40	Innovation in the agriculture and food industry as a way to strengthen the resistance of olive growing in the Mediterranean climate-era in Turkey - **Başak Esmer**
13:40 - 13:45	Use of a bioaccumulative plant for the evaluation of heavy metal concentrations in western Algeria - **Bemmansour Ennabaouia Hanene**
13:45 - 13:50	Valorisation des extraits aqueux de deux plantes acclimatées en Tunisie - **Ben Hassine Dorsaf** [Day Awards]
13:50 - 13:55	Study of the sensitivity of Myrtus Communis L. in condition of saline stress - **Ben Khelil Malek**
13:55 - 14:10	Discussion
14:10 - 14:15	Prévalence de la nosemose dans les colonies d'abeilles mellifères dans quelques régions du centre d'Algérie - **Haider Yamina**
14:15 - 14:20	Diversité floristique d'adventices des agrumeraies du secteur phytogéographique oranais (Ouest d'Algérie) - **Hanitet Karima**
14:20 - 14:25	In silico assessment of insecticidal activity of Thymus algeriensis and T. numidicus - **Lebbal Salim**
14:25 - 14:30	Interactions tritrophiques entre aleurodes, auxiliaire et flore adventice dans des écosystèmes agrumicoles biologiques au nord-ouest d'Algérie - Mahmoudi Abdelhaq *[no abstract]*
14:30 - 14:45	Discussion
14:45 - 14:50	Characterization of mechanically extracted almond oil and its residue for specific cosmetic and food applications - **Melhaoui Reda** [Day Awards]
14:50 - 14:55	Lutte biologique, via l'application des filtrats fongiques des mycoendophytes, contre le puceron noir de la feve; Aphis fabae (Hemiptera, Aphididae) - **Rouabah Elkhamssa**
14:55 - 15:00	Influence of geographic and climatic factors on variation of the most significant essential oil compounds of Mentha pulegium L. in Tunisia - **Soilhi Zayneb**
15:00 - 15:05	Evaluation du taux de colonisation mycorhizienne et du potentiel mycorhizogène du sol rhizosphérique d'une halophyte des dunes littorales d'Oran (Nord-Ouest de l'Algérie) - **Tabti Souad**
15:05 - 15:15	Health lipid indices of autochthonous hemp seed oil from four regions in northern Morocco - **Belhaj Kamal**
15:15 - 15:30	Discussion and Awards for the day's presentations
15:30 - 16:00	Concluding notes

Abstracts

State and pressures on ecosystem services of agricultural land in the Mediterranean area

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1. Introduction

Creating opportunities and facing challenges related to food systems and agriculture in coastal areas depend mainly on natural resources availability (FAO, 1998) and environmental quality (Mejjad et al., 2018). The special environmental characteristic and conditions of coastal areas favour the growth of specific crops. Mediterranean areas share the same climatic conditions and characteristics (mild winter and hot and dry summers) with a large variety of natural resources, economic, and social difference, which create variability in agricultural activities and practices throughout the area. Besides, this region occupies only 5 % of the Earth's surface but holds about 10 % of its plants diversity, yet harbour about 50000 known vascular plants species (half of which are locally endemics plants), almost 20 % of the world total (Richard et al., 1996).

Most of the agriculture activities in the Mediterranean countries are concentrated in the limited coastal plain due to the particular morphology of the Mediterranean basin, which favours the growth of the crops and productivity (Daccache et al. 2014; EEA, 1999). Agricultural land is among the natural resources on which pressures related to social and economic development are the strongest (Mejjad et al., 2020). Therefore, this sector is regarded as the dominant consumer of the coastal aquifers after domestic and industrial activities in many Mediterranean countries (FAO, 2016) with an average of about 64% of total water use (fluctuating between 50% and to certain cases reach 90% in some countries). In addition, the development of agricultural activities throughout the Mediterranean coastal areas modify their environment through the diffusion of different kind of pollutants, which affect water, soil quality, and threaten marine organisms.

The present study analyzes different agricultural land ecosystem services, drivers and pressures of agriculture activities in the coastal zone around the Mediterranean Area.

2. Materials and Methods

The analysis study is based on reviewing available data related to the agriculture and food systems in the Mediterranean area and the agricultural activities interaction with the coastal area environment, economy and ecosystems. In this order, we combined the ecosystem services approach (Figure 1) with the DPSIR (Driver-Pressure-State-Impact-Response) framework to define the main driving force and pressures on agriculture in coastal areas.

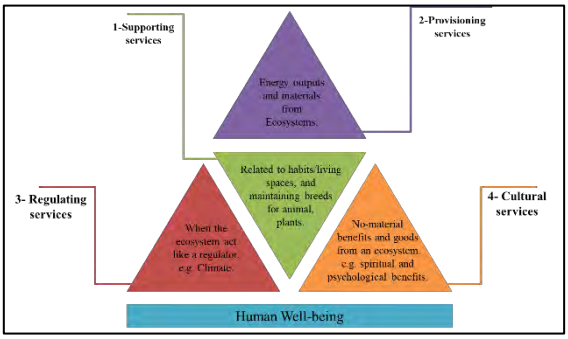

Figure 1: Four categories of ecosystem services according to The Millennium Ecosystem Assessment (Ma, 2005).

3. Results and discussion

Agricultural lands (AL) provide many ecosystems services and good to people (Figure 2) as they are mainly managed for crops and production of livestock. Besides, AL provide various services as presented in figure 2, which are divided according to Ma framework into four categories:

Supporting services provided by AL include soil formation, water and nutrient cycling and habitat for wildlife. AL are considered more suitable habitat for birds (Muñoz-Sáez et al., 2017) and native wildlife (Blann, 2006). Nevertheless, the land-use change induced by agricultural activities growth has led to the introduction of new species, alteration of native species and disturbed natural nutrient and water cycles (Blann, 2006). A similar observation was reported in a study carried out in Small-Medium Mediterranean River Basins (South of Portugal) where the land-use change resulting from agricultural activities has impacted stream habitat, soil and water quality (Matono et al., 2019).

Provisioning services include food security, fibre, woods, biofuel and bioenergy. These direct services include agriculture activities, which is the main driver leading to the change of the aforementioned supporting services. Because of the adequate

climatic conditions that characterize the Mediterranean area, a wide variety of crops are growing there and the sector contributes considerably to the regional economy as it employs a significant share of the population (Harmanny et al., 2019). Besides, the development of the agriculture sector in the Mediterranean area impact the environmental quality at all levels and the provided ecosystem services (Harmanny et al., 2019).

Regulating services are indirect services where AL act like a regulator ecosystem allowing the retention of sedimentation, erosion control and flood control. Agriculture practices are reported in (Hill et Shannon, 2008) as a factor contributing to the reduction of flood risk.

Cultural services are all no material benefits to human through contact with agricultural land including education and scientific research. In fact, recently, in the Mediterranean countries, there is an increasing trend for scientific and innovative researches for developing agriculture and all related sectors.

These direct and indirect services are threatened by the increase of human activities (Fig.2. A). The demographic expansion and demand increase for food security (*state of change*) to satisfy human needs (*driver force*), are the factors leading to overexploitation of natural resources and land uses change (*Pressures*). These practices around the Mediterranean areas have affected negatively the natural resources including groundwater resources (*Impacts*), and other vital sector such as the blue economy activities including coastal tourism, aquaculture and fishing (*Impacts*) (Fig.2.B) (EEA, 1999).

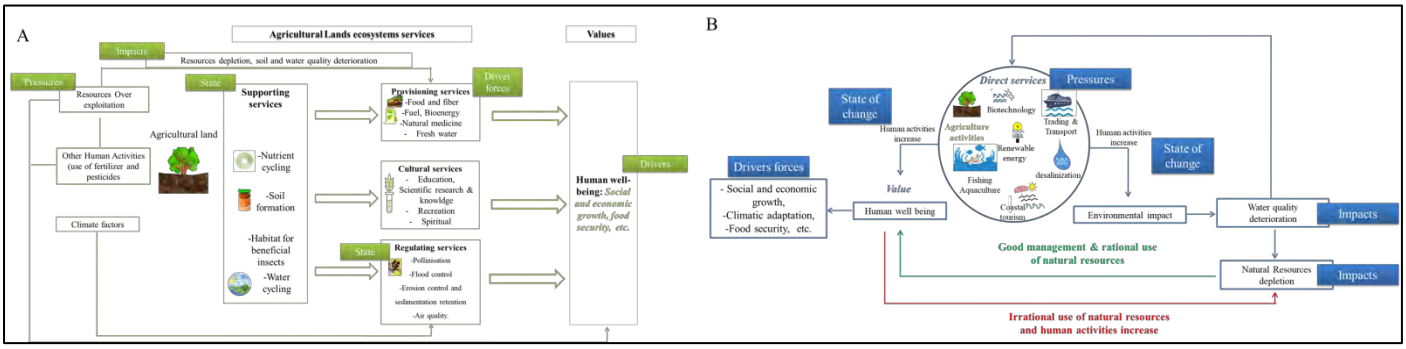

Figure 2: (A): Ecosystem service of Agricultural Land. (B): Direct provided service by the marine environment and human activities related impacts on Environment (*Credit: Mejjad Nezha*)

4. Conclusion

The analysis shows that every ecosystem service feeds into the other one, and the direct services depend mainly on the indirect ecosystem services of the agricultural land as the development and sustainability of agriculture yield are governed by soil quality, water quality and availability. On the other hand, we concluded that the agriculture practices in such fragile areas (Mediterranean coastline) are leading to marine environment deterioration and damage. We would like also to highlight that there is an urgent need for building combined strategies between actors from the agriculture and marine sectors for sustainable green-blue growth.

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A bio-economic model to improve irrigated durum wheat performance and regional profit in Mediterranean conditions

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1. Introduction

In Tunisia, Durum wheat (DW) holds the most important place among irrigated cereals in terms of production and cultivated area. It is grown on an average annual area of 48 700 ha, which represents two-thirds of the irrigated cereal area. This area allows producing an average of 180 000tons representing around 20% of national durum wheat production. However, the achieved yield of the durum wheat, reached 360kg/ha against an expected yield of 700 kg/ha (El Faleh and Gharbi, 2014). This result showed also very low water productivity and economic performance. Focusing on the irrigation practices, researches have shown that poor management in terms of applied dose and irrigation timing are major factors limiting the agronomic performance of the DW. Other researches have focused on the cropping system and have pointed out the negative impacts of pricing policy on the economic performance of DW and profit at regional level. In order to improve the durum wheat production and the economic performance, there is an urgent need for approaches that integrate both economic and agronomic criteria. As pointed out by many studies that bio economic modelling approach is the most widely recommended approach for studying the effect of different management practices on farm performance (Blanco and Flichman, 2002). Several bio-economic models have been developed for production at the field level and farm level (Reckling et al., 2016). However, they fail to identify impacts at higher levels (e.g., region, country) that may be useful to policy makers. Hybrid models address this issue by aggregating results from the farm level to higher levels (Britz et al., 2012). These models usually consider the diversity of farm types (e.g., crop, livestock) and technologies, but none of them focuses on cereal production.
This work aims to highlight the main levers for improving the agronomic and economic performance of DW crop and the regional profit. In order to do this issue, we develop the economic model MORBIT coupled to the biophysical model CROPSYST.

Materials and Methods

The study was carried out in the governorate of Kairouan, Jendouba and Siliana, which are the main zone where the irrigated DW has been grown.
In order to identify the main technical and economic levers offering a better profitability of the activity and a better valorisation of water resources a bio-economic model coupling the biophysical model CropSyst (*Cropping System Model*) and the economic regional model *MORBIT (regional model of irrigated durum wheat in Tunisia)* has been developed. Cropsyst is used to assess the impact of management irrigation alternatives on DW yield taking into account climatic factors, and soil characteristics. MORBIT is an optimization regional model, which has been developed by adapting the SARAS model for Tunisian conditions (Olubode -Awosola et al ., 2008). MORBIT maximizes a regional profit subject to set of resource constraints. The general mathematical formulation of MORBIT is presented below (Eq.1):

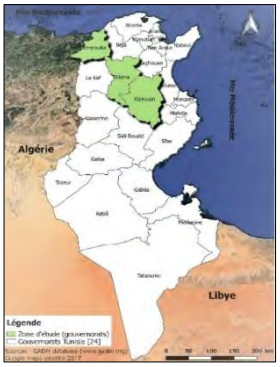

Figure1: Location of the study

$$\text{Maximize} \prod = \sum_f \sum_t \sum_c \left((PB_{f\,t\,c} - (\alpha_{f\,t\,c} + 0.5\beta_{f\,t\,c})) \, sup_{f\,t\,c} \right) - \sum_f \left(\theta_f \left(\sum_t sup_{f\,t\,c} \right)' \, covPB_c \left(\sum_t sup_{f\,t\,c} \right) \right) \quad \text{(Eq.1)}$$

Subject to: $Nf \sum_f \sum_t \sum_c sup_{f\,t\,c} \leq Disp_{Rterre}$ (Eq .2)

$\sum_t \sum_c sup_{f\,t\,c} \leq Disp_{fterre}$ (Eq .3)

$Nf \sum_f \sum_t \sum_c (Beseau_{f\,t\,c} \, sup_{f\,t\,c}) \leq Disp_{Reau}$ (Eq .4)

$\sum t \sum c \, Beseau_{f\,t\,c} \, sup_{f\,t\,c} \leq Disp_{feau}$ (Eq .5)

The principal technical and socio-economic constraints are irrigable land and water constraints. Eq. (2) and (Eq. 3) represent the land constraint respectively at the regional and farm level. The regional irrigation water capacity was also modelled as constraints at both farm type and regional levels (Eq.4 and Eq.5)

To apply the CROPSYST- MORBIT model chain, three types of data are required: (i) the bio-physical characteristics of the agri-environmental zones used as input for the biophysical model CROPSYST, (ii) the farm type characteristics used in MORBIT to define the resources availability and (iii) the input output data/coefficients of the current activities which include technical and economic information such as yield, input, prices and costs.

To collect data on farm operations during the cropping year (2014-2015), we carried out face to face a targeted survey with 698 farms. We have focused mainly on the characterization of the farms' structure (SAU, access to water) and on the farming system (land use, irrigated activity, etc.). It allows to gather detail data regarding the technical management (tillage, fertilization, irrigation, treatment, harvesting) of the DW crop as well as all the input and product prices. The data collected made it possible to develop a typology of farming systems and to analyse the performance of the durum wheat cultivation activity. Three types of farming systems were identified: A monocultural system based on durum wheat cropping, a diversified cereal-oriented system and a diversified horticulture-oriented system. Performance analysis revealed a clear disparity between two distinct performance levels for each farming system (Mazhoud et al., 2020). Ten farm types were considered in the region. Each farm type identified represents a virtual farm obtained by averaging data from farm that are grouped in the same type.

3. Results and discussion

The results showed that the surveyed land reached 4327 ha. The area of the irrigated Durum reached 2095 ha representing around 48% of the irrigated area. In terms of irrigation practice, results showed that the consumption of the DW reached 1609 m^3/ha. The practice of the complementary irrigation allowed the surveyed farmers to achieve an average yield of DW of 360 kg/ha. Given this result, the total production of DW reached 9367 tons and the water productivity reached only 7.6 kg/ha /mm/ which is the half of the potential level that should be reached following agronomical studies (Lasram et al., 2015). Economic results showed that Gross margin of DW reached only 509 TND/ha and the regional profit account for 201480TND.

The analysis of farmers' practices in terms of irrigation revealed that the low performance of the irrigated DW crop is due to the practice of low irrigation dose, the inadequation of the irrigation schedule and the cereal pricing. Given these results and by using the bio economic model, two types of scenarios were simulated, including: (S_1) implementing of adequate irrigation to meet the needs of the plant taking into account the rainfalls and (S_2) increasing cereal price by 20%.

The simulation of scenarios showed that the yield of the durum wheat may increase by 20% compared to the baseline scenario (S_0) (Table1). This improved the water productivity by 25% reaching an average of 9.5 kg/ha/mm and allowed farmer to earn 1170 TND/ha as Gross margin. These results showed an improvement of total production of DW to reach 11419 tons and allowed to achieve a better regional profits (219910 TND) representing an increase of 9 % compared to (S_0)

Table 1. Simulation results of scenarios

Scenarios	Definition	Yield (kg/ha)	Water productivity (kg/ha/mm)	Gross Margin (TND/ha)	Production of durum wheat (Tons)	Profit (TND)
S_0	Baseline	400	7.6	509	9367	201480
S_1	Adopting adequate irrigation	480	9.5	1170	11419	219910
S_2	increasing cereal price	400	7.6	1012	9676	216700

4. Conclusion

This work aims to highlight the main levers for improving the performance of DW crop and the regional profit. This was done using the bio-economic modelling approach coupling the biophysical model CROPSYST and the economic regional model MORBIT**.** This model allowed to identify main levers relate to (i) the control of irrigation and (ii) the increase of cereal price. The concretization of these paths requires a concerted reflection between the actors to put forward suitable strategies according to the studied context.

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Libya between limited of water resources food insecurity and conflict after 2011

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Introduction

Libya is a North Africa country that lies on the south coast of the Mediterranean Sea with a coastline of about 1.900 Kilometres. Apart of Mediterranean Sea coast, Libya has frontiers with six Arabic and non-Arabic African countries, namely, Algeria and Tunisia in the west, Egypt in the east, Sudan on the southeast, and Chad and Niger in the south. The country has a small population. The population was about 6.09 million inhabitants in 2005. It occupies a relatively large area of about 1,760,000 square kilometres. It is the fourth-largest country in Africa and seven times as large as Great Britain and Northern Ireland Before the discovery of oil in Libya in 1958, the agricultural sector accounted for 25% of the economic activity, and the population of Libya was only 1.2 million in 1952 (Business Opportunities Report for Dutch Companies, 2018). Libya is the 16th largest country in the world in terms of land area. Libya discovered oil in 1959 and started exporting oil in 1961. with its small population of 6.3 million (about twice the population of Nevada) it has a per capita gross domestic product (GDP) that averaged US$12,000 between 2007 and 2010 (World Bank). Therefore, Libya is classified as an upper middle-income country. The Libyan economy depended mainly on the agricultural sector, which contributed more than 25% to the GDP and employed about 70% of the total labour force (El Azzabi, 1974) before the discovery the petroleum. Libya was classified at that time as one of the poorest countries in world. In general, agriculture in Libya is suffering from many challenges 90 per % of the country is desert

Water resources in Libya

According to FAO report, water resources will be enough to produce enough food at the global level up to 2050, but many regions will face substantial water scarcity. Water shortages will result in increased competition and agriculture sector will continue to be the largest user of water resources in most of the countries around the world and account for 70 per cent or more of water withdrawals from rivers, lakes, and aquifers There are two types of water resources in Libya; the conventional water resources (natural) including surface and groundwater that represent about (97.3%) of the nation's water resources, and non-conventional water resources including desalination of seawater and treated wastewater, which together account for (2.7%). Libya's surface water resources are prone to drought in much the same way as in other countries across North Africa, the average annual rainfall for the years 1945–2010 in the eastern region was 350 mm, 254 mm in the western region, 168 mm in the central region; and 22 mm in the Sahara region (an average of 72 mm for north Sahara and 2 mm for south Sahara). Libya is one of the driest countries in the world. Temperatures are very high (Edwin & Ronny, 2005).

Conflict and Food Insecurity in Libya

The onset of the ongoing Libyan conflict could be traced back to the anti-Gaddafi protests which started on 17 February 2011, arguably, inspired by the uprising called the Arab Spring in neighbouring countries, such as Tunisia and Egypt El-Anis and Hamed. (Rashd Mohamed_ 2019) established that the Arab Spring as the revolutions taking place across the Middle East North Africa region (MENA) which has remarkably changed the political and economic situations espcially in Libya case because majoraty of theses countires import at most 80% of food items the The different among Arab spring Libya Tunisia Egypt , Libya has Petroleum with these Revenues we can buy what Libyan People need ,As for the rest of the countries, Egypt and Tunisia, it will be difficult to buy food from abroad because of the lack of capabilities of countries, as well as the number of population is considered high compared to Libya. 6.5 million

Main challenges affecting agriculture sector in Libya after 2011:

Power cuts in some parts of the country especially the south part of the country such as Marzuq Sometime 4 days without electricity

Increased insecurity situation in Libya because of the Civil War

Depreciation of the Libyan dinar

Libya imports about 80% of food commodities (WFP-2011).

The country is over 90% desert.

Displacement the farmers from their areas Because of the conflicts such as Marzuq

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Valorisation de la biodiversité végétale de la région de Chréa : entre conservation et développement

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1. Introduction

A l'ère de la Covid-19, le rôle des institutions, est plus que jamais important, dans la mise en place de stratégies visant à soutenir l'économie et la société. Dans la rive sud de la Méditerranée et plus particulièrement en Algérie, un pays doté de richesses naturelles, d'une population majoritairement jeune, mais qui reste frappée par le chômage et l'austérité. Dans les zones rurales ou récemment appelées "zones d'ombre", les populations n'ont pas été épargnée des conséquences engendrées par la crise sanitaire. Plus particulièrement, la région de Chréa, est une zone forestière par excellence. Elle surplomb la ville de Blida et s'insère dans la chaîne montagneuse de l'Atlas tellien. Les conditions bioclimatiques favorables conjuguées aux courants frais et humides provenant de la Méditerranée, ainsi qu'à l'exposition Nord, garantissent une couverture végétale luxuriante à l'Ubac du massif en question. Les subéraies occupant une place particulière dans cet écosystème, sont dotées d'un sous bois riche et diversifié [4].
Ce dernier, constitue habituellement, une source d'enjeux ou de conflits entre usagers et gestionnaires de la biodiversité [3], étant donné le double statut dont bénéficie la zone d'étude : Parc national et Réserve de Biosphère. Le confinement imposé par la pandémie, a particulièrement provoqué l'engouement des autochtones, privés de l'exercice de leur métier (dans le secteur tertiaire en particulier), vers la nature à la recherche de moyens de subsistence, par le biais des cueillettes de plantes notamment.

2. Méthodologie

Afin de définir les potentialités végétales des subéraies, et tenter de mesurer l'impact humain, notre démarche méthodologique a consisté à la réalisation de 50 enquêtes. Nous nous sommes basés sur un questionnaire structuré, tout en optant pour des entretiens. La méthode semi-directive a été adoptée [5], permettant aux personnes rencontrées, d'aborder des aspects relatifs la problématique, que nous leur proposons ouvertement. Les questions posées s'enchaînent alors, en fonction des réponses fournies. Le traitement des données qualitatives codées, s'est fait par le logiciel SPSS, en optant pour le test de Khi deux.

3. Résultats et discussion

Les échantillons considérés, concernent quelques riverains rencontrés, mais aussi des citadins de la région de Blida, fréquentant régulièrement les forêts en amont [1]. Sans oublier les gestionnaires, représentés essentiellement par la conservation des forêts et ses services déconcentrés, ainsi que par le Parc National de Chréa. Pour une meilleure lecture des résultats, nous avons élucidé notre hypothèse, en procédant au classement des éléments traités par le questionnaire en variables dépendantes et indépendantes. Le but étant de formuler l'hypothèse suivante : le sexe, l'âge, le niveau d'instruction, l'activité des usagers et leur rythme de fréquentation des forêts, ainsi que leur connaissance (ou pas) de la réglementation en vigueur et leurs rapports avec les institutions chargées de la gestion du patrimoine floristique, influencent le rythme des cueillettes, le type des espèces végétales les plus convoitées, ainsi que leurs finalités [2]. Les corrélations retenues, ont été celles ayant présenté une signification asymptotique (p) n'excèdant pas le seuil de 0,05 (tableau 1).

Corrélations retenues	Valeur	ddl	Signification asymptotique (p)
Age - type	46,342	30	0,029
Age - raison	35,901	20	0,016
Age - **approvisionnement**	31,955	20	0,044
Niveau - **approvisionnement**	20,765	12	**0,054**
Activité - **approvisionnement**	28,037	12	**0,005**
Fréquentation - Type	13,260	6	0,039
Fréquentation - organe	11,798	5	0,038
Fréquentation - **approvisionnement**	12,544	4	0,014

Tableau 1. Résultats du test de Khi-deux

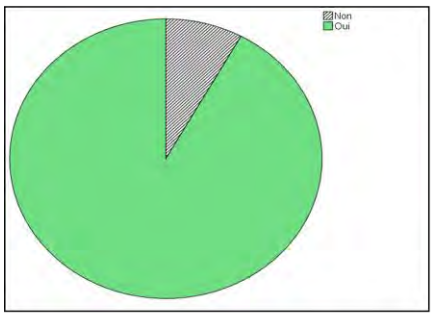

Figure 1.1 : Usage des plantes

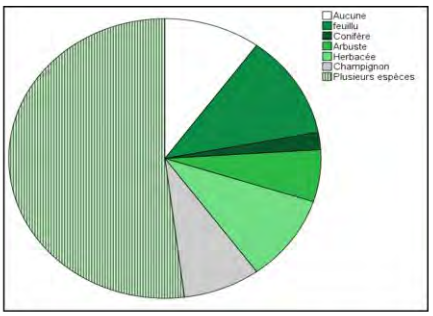

Figure 1.2 : Types de plantes utilisées

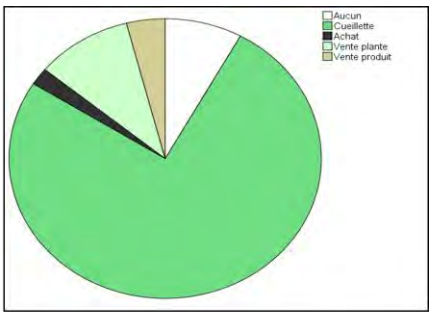

Figure 1.3: Mode d'approvisionnement

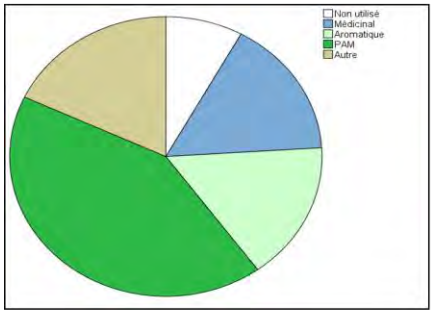

Figure 1.4 : Domaines d'utilisation

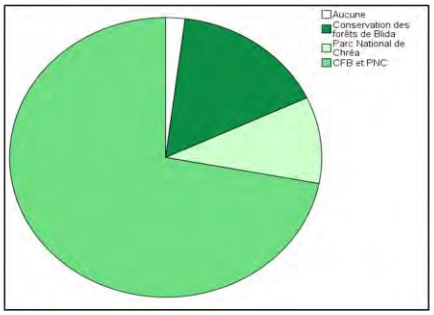

Figure 1.5 : Rapports avec les institutions

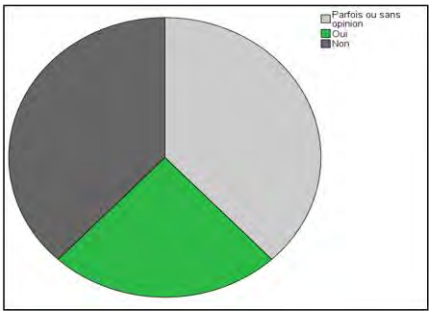

Figure 1.6 : Respect de la législation

Figure 1: Principaux aspects qualitatifs retenus

A des degrés différents, l'approvisionnement en plantes occupe la moitié des corrélations, notamment avec le rythme de fréquentation des forêts. A cet effet, les cueillettes directes domine le mode d'approvisionnement des enquêtés, qui n'achètent que rarement ces herbes ou les vendent informellement, que ce soit à l'état brut ou bien transformé. Tels que : l'huile de lentisque et des plats culinaires réalisés à base d'herbes, très ancré dans le terroir de la population blidéenne.

4. Conclusion

Les potentialités floristiques est une évidente constatation, révélée par l'étude engagée sur la valorisation des ressources végétales des subéraies. La modération des cueillettes, la mise en place d'une chaine de valeur, organisant les circuits de commercialisation des différentes filières, peuvent constituer une bonne alternative, pour le maintien de ce gisement menacé d'une part et pour développement local d'autre part.

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Analyse Prospective du jeu des acteurs de la filière des légumineuses alimentaires au Maroc

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1. Introduction

La filière des légumineuses alimentaires est de plus en plus inscrite dans les politiques agricoles et systèmes alimentaires durables, vu son rôle crucial dans une alimentation saine et équilibrée, dans la production alimentaire durable et surtout dans la sécurité alimentaire. Au niveau national, Le Maroc était dans les années 60-70 un des exportateurs mondiaux des légumineuses. Toutefois, la politique de soutien du blé adoptée par l'Etat en 1985 a eu des incidences négatives sur l'extension et le progrès technique de cette filière. Avec l'avènement du Plan Maroc Vert, les légumineuses n'ont pas été parmi les filières stratégiques de ce plan ayant bénéficié d'un contrat programme à l'instar des autres filières. Les acteurs de la filière ne sont pas organisés et travaillent séparément sans aucune vision stratégique commune (Toumi et al., 2020). La prise en compte des jeux stratégiques entre acteurs représente un immense intérêt puisqu'ils définissent les modes de coopération, d'interaction entre les différents acteurs dans une perspective d'établissement de relations durables entre ces acteurs (Crozier et Fiedberg, 1977) et requiert une importance stratégique compte tenu des enjeux de développement des filières agricoles dans un contexte marqué par une crise sanitaire liée à la pandémie du COVID-19. Plusieurs études récentes mettent le focus sur les stratégies des acteurs et les mécanismes de pouvoir entre acteurs (Belfellah et Gassemi, 2016 ; Nobre et Zwadzki,2013,…). Cependant au niveau du secteur agricole national, ce genre d'études connait encore un déficit. C'est pour cette raison, nous voulons explorer davantage ce champ de recherche en répondant aux questions suivantes liées à la dynamique des relations entre acteurs de la filière des légumineuses alimentaires et les perspectives de son développement futur: Quels sont les acteurs qui œuvrent pour la filière des légumineuses et qui en sont les plus influents ? Comment se manifeste les jeux de pouvoir ainsi que la structure d'influence entre ces acteurs ? Comment se positionnent ces acteurs vis-à-vis des enjeux et objectifs stratégiques de cette filière ? Quelles sont les perspectives du développement futur de la filière ? D'où, l'objectif de cette recherche est, d'une part, cartographier les relations des acteurs de cette filière et d'autre part repérer leurs influences et dépendances, ainsi que leurs convergences ou divergences potentielles pour son développement futur.

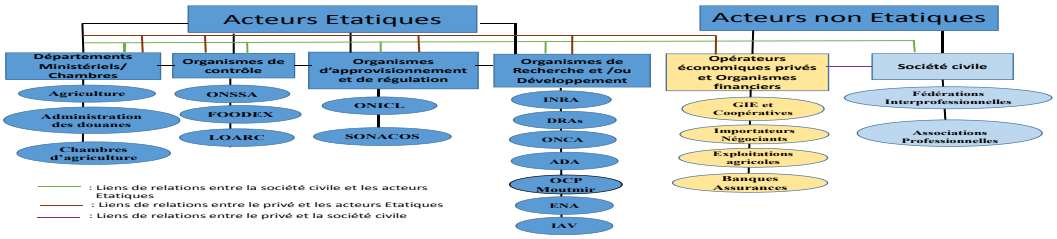
2. Matériels et Méthodes

Le cadre d'analyse choisi est la prospective stratégique dont le jeu des acteurs constitue une de ses étapes importantes (Godet, 2007) et la résolution des conflits entre des acteurs poursuivant des projets différents (Crozier et Thoening, 1976). De même, la cartographie de la chaîne de valeur (GTZ, 2007) a été utilisée pour faire ressortir la dynamique des relations entre acteurs de l'amont, de l'aval et les acteurs facilitateurs et de support de la chaîne de valeur de la filière. Pour collecter les données autour du questionnement posé de notre problématique, nous avons eu recours à un questionnaire auprès des différents acteurs de la chaine de valeur de la filière des légumineuses alimentaires. Ledit questionnaire comporte à la fois des questions fermées avec un système de scoring selon la méthode MACTOR (Méthode ACTeurs, Objectifs, Rapports de force) et des questions ouvertes pour amener l'interviewé à identifier avec quel acteur il collabore pour ses missions/projets en faveur de la filière et exprimer son avis sur cette relation. Le choix de la méthode MACTOR d'analyse de jeu des acteurs de la filière des légumineuses alimentaires dans une démarche prospective repose sur la pertinence de la méthode et ses modalités de mise en œuvre. Au total, 34 personnes ont été sélectionnées et représentant les différentes institutions d'ordre publique, privé et de la société civile qui œuvrent dans les différents maillons de la chaîne de valeur de la filière des légumineuses.

3. Résultats et discussion

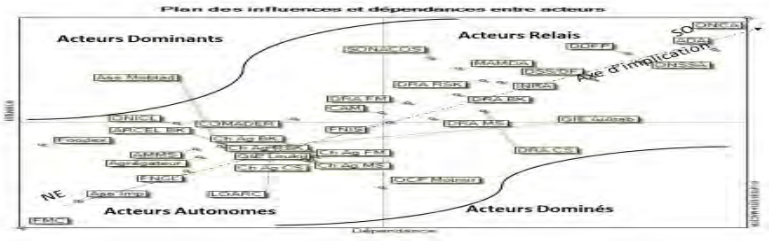
La figure ci-après présente une cartographie des relations des acteurs qui œuvrent pour la filière des légumineuses alimentaires au Maroc. Il ressort de cette cartographie qu'il y a une multitude d'acteurs qui interviennent pour la filière et entretiennent des relations entre eux. La matrice des acteurs est caractérisée par deux entrées principales : les acteurs étatiques et les acteurs non étatiques (privé et société civile).

Figure 1: Cartographie des relations des acteurs de la filière des légumineuses alimentaires au Maroc



L'analyse du plan des influences et de dépendances entre ces acteurs (Fig. 2) montre l'absence aussi bien d'acteurs dominants que d'acteurs dominés. Par contre, il y a une concentration des acteurs entre les acteurs autonomes et les acteurs relais. Les acteurs autonomes sont composés principalement des acteurs de l'amont et de l'aval de la filière et font partie des groupements d'intérêt économique (GIE), coopératives, importateurs, négociants, chambres d'agriculture et acteurs de la société civile. Ces acteurs sont faiblement connectés, mais ils sont susceptibles d'être intégrés et impliqués davantage dans la dynamique de la filière, alors que les acteurs relais ayant un rapport de force élevé, sont composés principalement des acteurs étatiques et représentent les organismes de recherche et/ou de développement, de l'approvisionnement, de contrôle et des assurances. Ils n'arrivent donc pas à jouer le rôle de changement et faire impliquer les acteurs opérationnels de l'amont et de l'aval dans la dynamique de la filière. Par ailleurs, l'analyse de la position des acteurs sur les objectifs stratégiques de la filière, a montré une convergence et une mobilisation élevée des acteurs autour de ces objectifs.

Figure 2: Plan des influences et de dépendances entre les acteurs de la filière des légumineuses alimentaires au Maroc



4. Conclusion

En guise de conclusion, cette analyse prospective du jeu des acteurs de la filière des légumineuses alimentaires au Maroc nous a permis d'esquisser quelques dynamiques et trajectoires possibles autour de 3 questions clés suivantes déterminant l'avenir de la filière : Comment peut-on émerger des acteurs influents parmi les acteurs opérationnels de la chaîne de valeur de la filière (Amont-Aval) afin qu'ils contribuent à l'élaboration des politiques en faveur de la filière ? Quelles stratégies de ces acteurs opérationnels et quelle(s) recomposition (s) du jeu autour de la chaîne de valeur de la filière ? Quels rôles peuvent jouer les acteurs relais notamment les acteurs étatiques pour impulser la filière dans une dynamique évolutive positive ? Les perspectives de développement futur de la filière peuvent se dessiner autour de deux scénarios : Un premier scénario de permanence où la dynamique de la filière ne s'inscrit pas dans une évolution positive avec la persistance d'acteurs opérationnels (amont-aval) non influents et peu connectés et d'acteurs relais n'assurant pas une ouverture du jeu. Un deuxième scénario de changement où les acteurs opérationnels de la chaîne seront pionniers en termes de changement et les acteurs relais devront redonner la priorité à cette filière dans leurs plans d'action et puiser de leurs moyens d'action pour tirer la filière vers le haut. Ce changement est d'autant obligatoire notamment durant la période post-COVID-19 où le besoin de transformation de filières agricoles s'oriente vers une restructuration et une proximité de médiation entre acteurs de la filière. Cette transformation est le fruit d'une série de mutations multi-scalaires, en partie portée par les acteurs opérationnels de la filière mais nécessairement confrontée à une matrice institutionnelle conçue pour préserver les intérêts de ces acteurs (Ugaglia et al., 2021).

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Comprendre la réponse de la culture associée blé-pois chiche à la fertilisation azotée en utilisant des indices de compétitivité agro-écologiques dans des conditions pédoclimatiques contrastées

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1. Introduction

La culture associée blé-pois chiche restent peu étudiées d'un point de vue agro écologique malgré leurs importances pour augmenter la rentabilité agricole et assurer la sécurité nutritionnelle et alimentaire. En effet, nous supposons qu'en raison de la fixation biologique de N_2 par le pois chiche en association avec le blé dur dans un sol à faible teneur en N et en conditions suffisantes en eau. Le rendement et l'efficacité de l'utilisation de l'azote par la céréale peuvent être plus élevés qu'en monoculture sous faible apport d'engrais azoté. Pour fournir une meilleure décision pour aider les agriculteurs à optimiser l'utilisation des terres et l'application d'azote dans un système de monoculture ou de culture en association, cette étude a trois sous-objectifs: i) Évaluer les cultures associées blé dur-pois chiches en termes d'avantages agronomiques en calculant des indices tels que l'efficacité d'utilisation des terres (LUE) ii) Évaluer l'efficacité de l'utilisation de l'azote par chaque système de culture et identifier la dose de fertilisation optimale. iii) Mettre en évidence la compétitivité entre les deux espèces intercalées en estimant CR (rapport de compétition). La présente étude vise à évaluer les services éco-systémiques de l'association pois chiche-blé dur dans des conditions contrastées de gestion des champs et de climat. Cette évaluation est basé sur les indices agronomiques et écologiques les plus utilisés dans la littérature. Le blé dur (*Triticum turgidum durum* L.cv. VITRON) et le pois chiche (*Cicer arietinum* L.cv. FLIP 90/13 C) ont été cultivés, à la fois en culture unique et en association pendant la compagne 2018/2019.

2. Matériels et Méthodes

L'étude réalisée sur trois sites expérimentaux: S2 (nord-est d'Alger), S1 et le S3 respectivement au Nord et au Sud de la région de Sétif, dans des conditions pédoclimatique contrastées (Figure 1, Tableau1), Le dispositif expérimental est un Split-plot ou chaque facteurs: système de culture (pures et association) et les doses d'engrais azotés (30, 60 et 100 U d'azote) combinés sont représenter en trois répétitions. Les échantillons sont réaliser au semis, la floraison et au stade de la récolte.

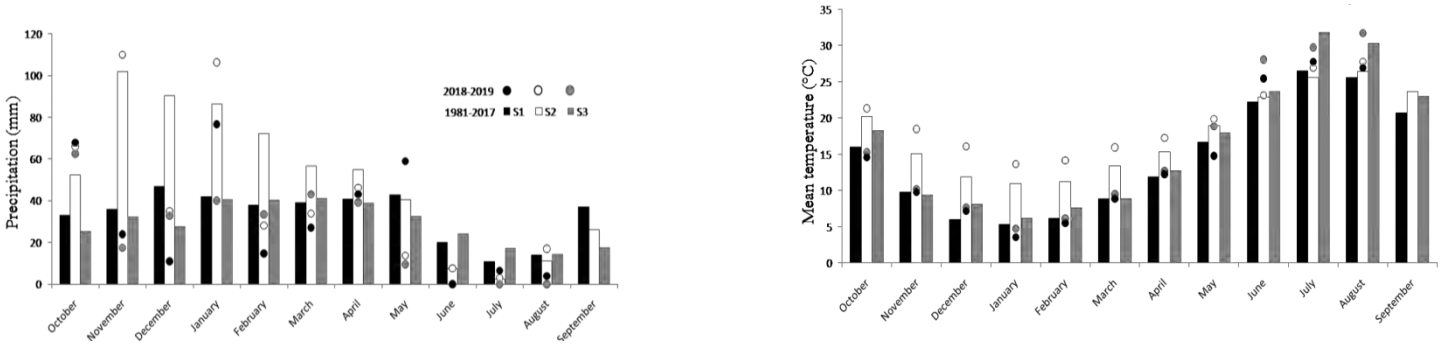

Figure 1: Températures et précipitations mensuelles (2018-2019) et moyenne (1981-2017) pour les trois sites expérimentaux

La biomasse végétale, le rendement en grains et le dosage d'azote sont déterminés et ainsi permis de calculé les indices agro-écologiques : L'efficacité de l'utilisation des terres (LUE) et l'indice de nutrition azoté (NNI).

Tableau 1: Propriétés physico-chimiques sol sites S1. S2 et S3. Moyenne de 6 répétitions ± SE (erreurs standard).

Sites	Argile (%)	Limon (%)	Sable (%)	CaCO3 (%)	MO (%)	N Total (g kg−1)	N assimilable (mg kg−1)	P Total (mg kg−1)	P assimilable (mg kg−1)	pH
S1	42.5±1^{b}	35.8±1.2a	21.7±1^{a}	21.9±0.8^{a}	1.2±0.1^{b}	1.4±0.1^{b}	22.9±1.3^{b}	283.8±20.4^{b}	9.32±0.3^{b}	8.38±0.08^{a}
S2	56.5±1.4^{a}	35.2±1.4a	8.4±0.7^{b}	1.1±0.1^{b}	1.8±0.2^{a}	1.4±0.1^{b}	9±0.7^{c}	155.6±4.1^{c}	13±0.7^{a}	7.9±0.1^{b}
S3	49.2±1.7^{c}	34.8±1.9a	16±3.3^{a}	20.6±0.5^{a}	1.9±0.1^{a}	2.4±0.2^{a}	35.8±1.6^{a}	387.3±10.1^{a}	5.37±0.5^{c}	8.30±0.07^{ab}
p-Value	≤0.001	0.9	0.01	≤0.001	0.004	≤0.001	≤0.001	≤0.001	≤0.001	0.02

Une analyse factorielle de la variance (ANOVA) à p-value = 0,05 a été réaliser après confirmation de l'homogénéité de la variance ; Le test de Tukey à identifier les différences significatif des moyenne a l'aide du logiciel statistica 8 sous Windows

3. Résultats et discussion

Tableau 2. Rendement du mélange de cultures sous différents traitements (culture × N) et Valeurs NNI au stade floraison et récolte.

			Mélange		Pois Chiche		Blé Dur	
Système			Grain (t ha^{-1})	N-Grain (Kg ha^{-1})	$NNI_{floraison}$	$NNI_{recolte}$	$NNI_{floraison}$	$NNI_{recolte}$
S1	Culture pure	N-30	1.21 ± 0.06^{b}	50.67 ± 2.7^{bc}	$0,48_{\pm0,01c}$	$0,58_{\pm0,02bc}$	$0,79_{\pm0,02b}$	$0,58_{\pm0,01bc}$
		N-60	1.99 ± 0.2^{a}	54.34 ± 4.3^{b}	$0,83_{\pm0,04b}$	$1,07_{\pm0,005a}$	$0,33_{\pm0,01d}$	$0,45_{\pm0,03c}$
		N-100	1.96 ± 0.08^{a}	70.31 ± 3.1^{a}	$0,79_{\pm0,08b}$	$0,86_{\pm0,06ab}$	$0,78_{\pm0,08b}$	$0,96_{\pm0,05a}$
	Association	N-30	0.75 ± 0.07^{b}	33.71 ± 2.4^{c}	$1,74_{\pm0,1a}$	$0,43_{\pm0,01c}$	$0,28_{\pm0,002d}$	$0,79_{\pm0,08ab}$
		N-60	1.26 ± 0.1^{b}	36.8 ± 3.4^{bc}	$1,82_{\pm0,08a}$	$0,76_{\pm0,05b}$	$0,95_{\pm0,08a}$	$0,49_{\pm0,05bc}$
		N-100	1.14 ± 0.04^{b}	36.1 ± 1.4^{bc}	$1,55_{\pm0,02a}$	$0,42_{\pm0,03c}$	$0,58_{\pm0,02c}$	$0,52_{\pm0,02bc}$
S2	Culture pure	N-30	2.37 ± 0.1^{c}	39.92 ± 2.1^{c}	$0,61_{\pm0,04c}$	$0,47_{\pm0,02b}$	$0,42_{\pm0,02bc}$	$0,60_{\pm0,03c}$
		N-60	3 ± 0.2^{b}	60.03 ± 2.5^{b}	$0,86_{\pm0,09b}$	$0,92_{\pm0,05a}$	$0,49_{\pm0,03bc}$	$0,69_{\pm0,03b}$
		N-100	2.87 ± 0.1^{bc}	46.60 ± 1.7^{bc}	$0,69_{\pm0,06c}$	$0,47_{\pm0,03b}$	$0,97_{\pm0,03a}$	$0,98_{\pm0,1b}$
	Association	N-30	2.65 ± 0.04^{bc}	43.80 ± 0.9^{c}	$1,87_{\pm0,09a}$	$0,63_{\pm0,05ab}$	$0,37_{\pm0,01c}$	$0,68_{\pm0,05b}$
		N-60	3.88 ± 0.2^{a}	76.84 ± 2.5^{a}	$1,68_{\pm0,1ab}$	$0,75_{\pm0,04ab}$	$0,95_{\pm0,04a}$	$1,13_{\pm0,09a}$
		N-100	2.79 ± 0.07^{bc}	70.16 ± 2.9^{ab}	$1,39_{\pm0,08b}$	$0,51_{\pm0,03b}$	$0,56_{\pm0,02b}$	$0,79_{\pm0,07b}$
S3	Culture pure	N-30	3.82 ± 0.3^{b}	44.67 ± 2.7^{c}	$0,32_{\pm0,04d}$	$0,71_{\pm0,01a}$	$0,90_{\pm0,1a}$	$0,42_{\pm0,02c}$
		N-60	4.63 ± 0.2^{ab}	56.71 ± 2.5^{bc}	$0,82_{\pm0,01bc}$	$0,79_{\pm0,08a}$	$0,51_{\pm0,06b}$	$0,77_{\pm0,01bc}$
		N-100	4.04 ± 0.1^{ab}	60.17 ± 2.3^{bc}	$0,80_{\pm0,08bc}$	$0,54_{\pm0,05a}$	$0,84_{\pm0,02a}$	$0,80_{\pm0,03b}$
	Association	N-30	3.57 ± 0.2^{b}	71.70 ± 1.5^{b}	$0,50_{\pm0,009c}$	$0,43_{\pm0,02a}$	$0,53_{\pm0,03b}$	$1,05_{\pm0,1b}$
		N-60	4.93 ± 0.3^{a}	111.12 ± 2.1^{a}	$1,80_{\pm0,08a}$	$0,75_{\pm0,05a}$	$0,92_{\pm0,04a}$	$1,66_{\pm0,05a}$
		N-100	3.54 ± 0.08^{b}	47.81 ± 1.3^{c}	$1,05_{\pm0,04b}$	$0,68_{\pm0,07a}$	$0,96_{\pm0,09a}$	$0,93_{\pm0,08b}$

l'amélioration du rendement et de l'accumulation de N confirmée pour les faible apported'azote (N-30) ou modérée (N-60) (Tableau 2) en accord avec les travaux de Latati et *al*; (2019). Le pois chiche obtient un NNI>1 uniquement en culture intercalaire au stade de la floraison dans tous les cas d'application faible et modérée de N dans tous les sites d'expérimentation (Tableau 2), constat confirmer par Latati et al. (2016a), Kaci et al. (2018) sur différent cultures associé et pour le blé en culture intercalaire sous application modérée de N en période de récolte.

Selon Yong et al.(2018) la floraison est la principale étape phénologique au cours de laquelle la légumineuse fixe la quantité maximale de N par la fixation symbiotique de N2, une forte disponibilité de N diminue significativement la fixation de N_2 par les légumineuses. Un NNI>1 en culture associé demontre l'opportunité d'une utilisation complémentaire de l'azote entre les deux espèces. Les resultats peu performant de la culture intercalaire sous forte application de N (N-100) dans des conditions de faible pluviométrie (S1 et S3) peuvent probablement être dû à un déficit en eau qui réduit la demande en azote. Resultats coroborer par Gonzalez-Dugo et *al*.(2005). L'avantage du blé pour le rendement en grain reflété de manière significative par le calcul de l'indice CR (tableau 3), Où le rendement du blé CR_{grain} et CR_N sont plus élevés que ceux du pois chiche en S3, avec une tendance contrastée pour les deux espèces cultivées en association en S1 et S2. En vu des donnees du LUE (tableau 3) il est claire que la culture intercalaire s'est avérée plus efficace dans l'utilisation des terres que la monoculture, en particulier dans le cadre d'une application d'une faible et modérée dose d'azote pour les parcelles de culture intercalaire qui reçoivent une pluviométrie modérée (S1) ou faible (S3).

4. Conclusion

La principale nouveauté de cette étude concerne le diagnostic intégratif (c'est-à-dire la biomasse, le rendement, le rendement et la dynamique de croissance) du statut de l'azote dans les cultures intercalaires dans des conditions pédoclimatiques et de fertilisation azotée contrastées. Les résultats indiquent que la culture intercalaire est plus avantageuse lorsque l'azote est suffisamment élevé pour maximiser la fixation symbiotique de N2 tout en contribuant à la nutrition de la culture céréalière,aussi que le pois chiche doit être le composant le plus dominant de la culture, à condition que cette dominance soit modérée. La compétition interspécifique entre les deux especes dur est affectée par les changements de conditions climatiques ou d'engrais N, le blé intercalaire était plus compétitif que sa légumineuse respective dans des conditions de faible pluviosité et d'application d'azote, Cependant, l'estimation d'indices économiques complétera et améliorera l'évaluation des avantages des cultures intercalaires.

Tableau 3. Valeurs LUE et CR calculées a la récolte et pour l'absorption d'azote pour la combinaison (site × N)

Sites	N level	$LUE_{recolte}$ (%)	$LUE_{N\text{-}grain}$ (%)	CR-rendement pois chiche	CR-rendement blé	CR-N-$_{pois\ chiche}$	CR-N-$_{blé}$
S1	N-30	$85,5_{\pm9.03abc}$	$119,5_{\pm15.88ab}$	$2.46_{\pm0,2ab}$	$0,41_{\pm0,03c}$	$3.92_{\pm0,3a}$	$0,25_{\pm0,0017d}$
	N-60	$110,5_{\pm5.81ab}$	$120,5_{\pm13.59ab}$	$3.13_{\pm0,3a}$	$0,32_{\pm0,03c}$	$2,91_{\pm0,47ab}$	$0,36_{\pm0,069d}$
	N-100	$56_{\pm0,52c}$	$59_{\pm2.62bc}$	$1.03_{\pm0,08bc}$	$1.03_{\pm0,19bc}$	$1,94_{\pm0,3bc}$	$0,53_{\pm0,08d}$
S2	N-30	$115,5_{\pm15.4ab}$	$112_{\pm14.26abc}$	$1.25_{\pm0,4bc}$	$0,86_{\pm1.77c}$	$1,13_{\pm0,21cde}$	$0,95_{\pm0,2d}$
	N-60	$126,5_{\pm8.53a}$	$122_{\pm7.35a}$	$1.17_{\pm0.16bc}$	$0,88_{\pm0,11bc}$	$1,76_{\pm0,1cde}$	$1,35_{\pm1,67d}$
	N-100	$120,5_{\pm14.55a}$	$137_{\pm7.04a}$	$2.28_{\pm0,75ab}$	$0,52_{\pm0,13c}$	$1,68_{\pm0,57bcd}$	$0,72_{\pm0,18d}$
S3	N-30	$103_{\pm6.3abc}$	$142_{\pm10.67a}$	$0,3_{\pm0,01c}$	$3.38_{\pm0,22a}$	$0,09_{\pm0.004e}$	$10.13_{\pm0,42a}$
	N-60	$64,5_{\pm15.63bc}$	$139,5_{\pm23.93a}$	$0.6_{\pm0,07c}$	$1,7_{\pm0,2bc}$	$0,13_{\pm0,004c}$	$7,27_{\pm0,22b}$
	N-100	$65_{\pm1.9bc}$	$51,5_{\pm2.19c}$	$0,53_{\pm0,18c}$	$2,42_{\pm0,82ab}$	$0,4_{\pm0,16de}$	$3,33_{\pm1,02c}$

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Les enjeux de l'agriculture périurbaine dans l'espace périurbain de Bled Béja

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1. Introduction

Les paysages agraires de Bled Béja sont parmi les paysages les plus diversifiés et les plus fragiles de la Tunisie. L'occupation humaine du territoire et son utilisation agricole est très ancienne. L'agriculture classique est caractérisée par son système de production agro-sylvo-pastoral, axé sur les grandes cultures, la foresterie et l'arboriculture. Les approches de développement expérimentées dans la région apparaissent inefficaces et insuffisantes (Faizî, 2021). Elles ont engendré des situations contrastes. L'évolution de l'agriculture a conduit à l'émergence de zones relativement plus dynamiques et productives d'une part et des zones aux systèmes de production beaucoup plus traditionnels d'autre part.
La présente contribution tente d'identifier les systèmes de production et de mettre en lumière les transformations de l'agriculture dans l'espace agricole périurbain. L'identification des trajectoires d'évolution des systèmes de production nous permettra de connaitre la viabilité des dynamiques des exploitations agricoles et les conditions d'un développement local dans le contexte des enjeux environnementaux, économiques et socio-territoriaux auxquels est confrontée la région.

2. Matériels et méthodes

Par sa situation géographique stratégique, au niveau national et à l'échelle internationale, la région d'étude constitue le point d'articulation entre les régions du Nord-Ouest, les régions du Nord-Est et la région du Grand Tunis et s'ouvrant sur l'Europe par la Méditerranée tout au long d'un littoral de 26 km. Elle s'étend sur une superficie de 374 mille hectares, répartie notamment entre une superficie urbaine de 6842 ha et une superficie agricole de 339630 ha, soit 90 % de la superficie totale du territoire de la région. La région regroupe douze communes. Sa population était estimée en 2014 à 303032 mille habitants.
L'agriculture contribue pour 6.7 % de la production nationale et la valeur de la production agricole est de 770,96 Million de dinars (ODNO, 2017). Malgré, ses fortes potentialités, les indicateurs sociodémographiques et économiques (taux d'accroissement de la population, taux d'urbanisation, taux de pauvreté, taux de chômage, soldes migratoires, etc.) révèlent une situation fragilisée.

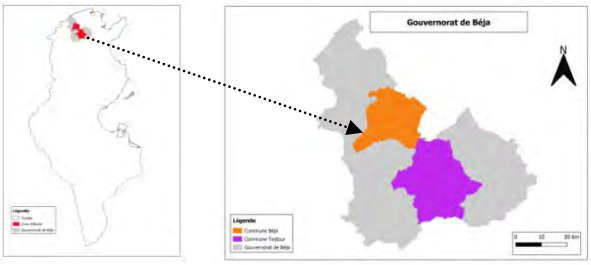

Figure 1 : Situation géographique de la région d'étude.

L'approche adoptée pour appréhender les mutations dans l'espace agricole périurbain est une approche combinée : l'approche spatiale, utilisant le SIG et le QGIS, pour analyser la dynamique de l'espace agricole périurbain ; l'enquête auprès des agriculteurs pour décrire les systèmes de production, identifier les différentes formes d'agricultures et de souligner les contraintes qui empêchent l'expansion de cette activité. L'analyse des résultats de l'enquête est faite par le logiciel XLSTAT et la méthode utilisée est une ACM couplée à CHA. Cette

approche est complétée par une recherche documentaire, une analyse des statistiques agricoles et une prospection du terrain.

3. Résultats et discussion

L'espace agricole périurbain dans la région a connu des changements spatiaux clairs. Ceux-ci se manifestent par une périurbanisation affectant les terres agricoles de haute qualité agronomique, parfois des périmètres irrigués.
Le paysage agricole périurbain à Bled Béja est caractérisé par l'importance des grandes propriétés foncières et l'abondance de petites propriétés foncières. Cette inégalité foncière se reflète aussi dans les modes d'exploitation. Le mode de faire-valoir direct dans la région constitue 89 %.
L'espace agricole dans la région de Bled Béja est dominé par les grandes cultures. Les céréales et l'arboriculture représentent la principale orientation agricole dans l'espace périurbain. Des petites parcelles reliques d'olives et de maraichage, notamment des légumes verts se trouvent à l'intérieur du périmètre urbain (figure 2).

Figure 2 : La pratique de l'agriculture dans l'espace urbain dans la région de Bled Béja.

L'agriculture dans l'espace périurbain subit des mutations. Les résultats des enquêtes nous a permis d'identifier une diversité des formes, des orientations, des systèmes de production, des profils d'agriculteurs et des stratégies d'adaptation au nouveau contexte urbain.
Trois formes d'agricultures ont été identifiées dans l'espace agricole périurbain de Bled Béja :
L'agriculture paysanne : C'est une forme classique, elle constitue pour les agriculteurs *Béjaois* la principale et la seule activité professionnelle. La polyculture constitue une caractéristique fondamentale du système de production.
L'agriculture compétitive : Elle est développée par une bourgeoisie urbaine sur des parcelles de grandes tailles. Elle est bien organisée sur le plan professionnel, technique et commercial. C'est une agriculture entrepreneuriale.
L'agriculture spéculative : C'est une forme d'agriculture pratiquée par des paysans spéculateurs. Le système de production adopté par ces paysans spéculateurs leur a permis de réaliser de profit, mais cela a été aux prix d'une réduction de la durabilité de l'espace. A terme, ce système d'adaptation précaire ne pourra pas subsister.
D'autres formes sont représentées dans l'espace avec des signaux faibles, son développement est intimement lié à des initiatives privées, des associations et des clubs.
Cette diversité des formes reflète une multifonctionnalité de l'agriculture périurbaine à Bled Béja. Cette agriculture fournit une diversité des sources d'approvisionnement et garantit une sécurité alimentaire. Elle procure aussi d'autres fonctions économiques, services écosystémiques (gestion des eaux urbaines, protection contre les inondations), social (événements), touristique, culturelle, etc. Toutefois, cette agriculture périurbaine se heurte à diverses contraintes, notamment foncières, techniques, institutionnelles, commerciales et climatiques. Dans cette situation, les agriculteurs *béjaois* adoptent différentes stratégies.
- Des stratégies qui reposent sur la diversification de l'activité agricole et sur le renforcement du capital financier pour augmenter la rentabilité de l'exploitation.
- Des stratégies qui se basent sur la multiplicité des activités extérieure pour maintenir l'activité agricole.
- Des stratégies qui reposent sur le développement des circuits courts et des ventes directes.

4. Conclusion

L'agriculture périurbaine dans le contexte *béjaois* prouve sa multifonctionnalité, mais cette multifonctionnalité reste encore peu mobilisée par les acteurs du territoire. Dans cette situation, il est nécessaire que les acteurs des territoires inventent des nouveaux outils d'organisation des territoires pour assurer la durabilité de cette agriculture sur laquelle repose l'équilibre du territoire régional. L'agriculture périrubaine, dans le contexte béjaois, devrait être pensée en tant que stratégie et projet territorial. Dans ce cas, il faudrait favoriser l'approche du projet « agriurbain », qui concilie la préservation de l'environnement, l'essor économique, équité sociale et la qualité du cadre de vie. C'est un long processus, mais ce n'est pas difficile quand il y a une volonté politique.

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Les anciennes palmeraies et les cultures sous-jacentes : peuvent-elles garantir la sécurité alimentaire au Sahara ?

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1. Introduction

La palmeraie ou verger phœnicicole est un écosystème très particulier, souvent à trois strates. La strate arborescente et la plus importante est représentée par le palmier dattier : *Phoenix dactylifera* L. ; la strate arborée est composée d'arbres comme le figuier, grenadier, citronnier, oranger, vigne, mûrier, abricotier, acacias, tamarix et d'arbuste comme le rosier. La strate herbacée est constituée par les cultures maraîchères, fourragères, céréalières, condimentaires…etc. Ces différentes strates constituent un milieu biologique appelé milieu agricole. En outre, nous pouvons également distinguer deux autres milieux biologiques différents : les drains et les étendues d'eau correspondants aux zones d'épandage des eaux de drainage, c'est le milieu aquatique. Et en dernier lieu, le milieu souterrain qui comprend une faune et une flore particulière et présentant une préférence vis-à-vis des facteurs édaphiques (Idder, 2002). Les anciennes palmeraies de la région d'Ouargla ont connues un délaissement et une dégradation remarquables ces dernières années (Faci, 2017).

A partir des enquêtes du terrain nous proposons, dans un premier lieu, des actions pratiques pour préserver cet œkoumène. Dans un second lieu, on a suivi le comportement de cinq espèces condimentaires à l'intérieur et à l'extérieur de la palmeraie, dans le but de diminuer les importations alimentaires en Algérie, de minimiser le gaspillage de l'eau d'irrigation (par submersion) et d'encourager l'agriculture familiale.

2. Matériel et méthodes

2-1- Zone d'étude

La wilaya (département) d'Ouargla se situe à environ 800 km au Sud-Est de la capitale Alger (Figure 1). L'expérimentation a eu lieu au niveau de la station de l'Institut Technologie de Développement de l'Agriculture Saharienne (ITDAS) de Hassi Ben Abdellah, située à environ 30 km à l'Est de la ville d'Ouargla (ITDAS, 2021). Elle est située dans une cuvette de sable couvrant une superficie de 32 ha, dont 3 ha du palmier dattier.

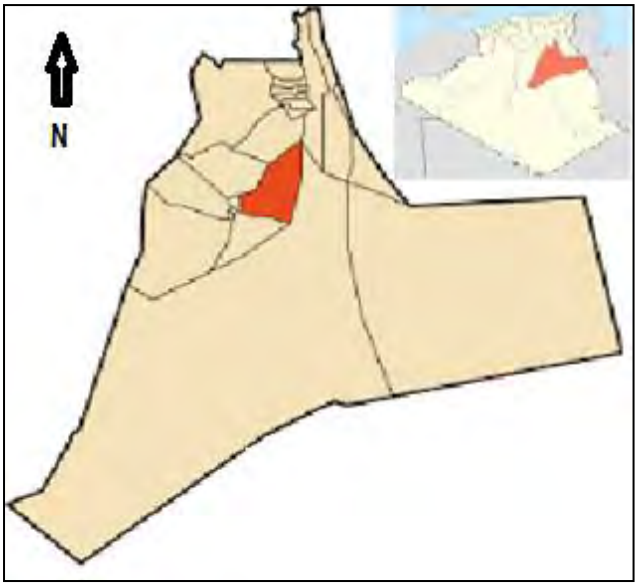

Figure 1 : Localisation de la zone d'étude sur la carte d'Algérie.

2-2- Enquêtes de terrain

Les enquêtes, au nombre de 120, sont déroulées dans les anciennes palmeraies d'Ouargla. La plupart des exploitations visitées ont été choisie aléatoirement, sauf pour quelques-unes, dont leurs propriétaires sont des responsables des forages et/ou qui connaissent l'historique des palmeraies et détiennent une masse d'information importante, ils sont considérés comme des personnes ressources incontournables pour la réussite de l'étude.

2-3- Matériel végétal

Un condiment est toute chose qui fait couler la salive dans la bouche, cela est considéré comme le dénominateur commun entre toutes les espèces condimentaires. Les condiments ne sont pas resté des additions pour améliorer le gout des aliments, mais aussi pour protéger contre certaines maladies, ou pour calmer quelques effets secondaires (Anonyme, 1998).

Les espèces utilisées dans notre expérimentation sont : l'Anis vert, la Coriandre, le Fenugrec, la Nigelle et le Vélar.

3. Résultats et discussion

Nos propositions d'amélioration des anciennes palmeraies sont regroupées en quatre axes :

- Axe des techniques et pratiques culturales.
- Axe environnemental.
- Axe économique.
- Axe social.

Chaque axe comprend plusieurs propositions, utiles pour préserver l'antique oasis, et qui pourront être une base pour améliorer la situation actuelle.

Pour l'expérimentation des plantes condimentaires, nous avons suivi quinze paramètres, où nous citons à titre d'exemple :

- La faculté et la vitesse de germination.
- La croissance.
- La floraison.
- La durée du cycle.
- Le rendement.

Dans le Tableau 1 une comparaison entre les rendements enregistrés dans notre zone d'étude et les rendements moyens dans le monde.

Tableau 1. Rendements en graines (qx/ha).

Espèces	A l'extérieur de la palmeraie	A l'intérieur de la palmeraie	Rendements moyens dans le monde
Anis vert	0,19	0,84	5-7,5
Coriandre	7,03	3,33	7-9
Fenugrec	19,73	13,32	8-15
Nigelle	0,84	0,70	4-8
Vélar	11,71	3,76	15-20

4. Conclusion

La palmeraie du ksar d'Ouargla est la plus dégradée par rapport aux autres palmeraies de la région, en plus de son état, elle est caractérisée par des spécificités décourageantes, qui vont dans le sens de sa disparition, surtout les parties périphériques de la ville qui connaissent une extension urbaine et industrielle.

Pour l'expérimentation, il ressort en général que les rendements en grains sont plus élevés dans les parcelles de l'extérieur de la palmeraie par rapport à celles de l'intérieur, sauf pour l'Anis vert qui a enregistré un rendement important à l'intérieur de la palmeraie. Cette dernière espèce et la Nigelle ont donné de très faibles rendements par rapport à la moyenne mondiale.

Le rendement du Vélar est proche de la moyenne mondiale en d'hors de la palmeraie ; par contre, il est très faible à l'intérieur. De sa part, la Coriandre a enregistrée de bons rendements à l'extérieur de la palmeraie, alors qu'ils sont faibles à l'intérieur. Le Fenugrec a fait l'exception, avec de bons rendements à l'intérieur et de très forts rendements à l'extérieur de la palmeraie.

Ainsi énuméré, si nous améliorons les conditions culturales au niveau des anciennes palmeraies, en association avec l'installation de cultures sous-jacentes adaptées aux conditions du Sahara, nous pouvons : i) exploiter les eaux gaspillées par le système d'irrigation par submersion, ii) assurer une source financière supplémentaire aux phœniciculteurs et, iii) garantir une autosuffisance locale des produits agricoles.

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Conceptual framework for defining options of crops-livestock integration under conservation agriculture using FarmDesign model

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1. Introduction

The desire for agricultural systems to produce sufficient and nutritious food without environmental harm, and going further to produce positive contributions to natural, social and human capital, has been reflected in calls for a wide range of different types of more sustainable agriculture (Beddington, 2011; T.G, 2015). In this context, the conceptual framework of agroecology seems relevant in meeting these goals. Gliessman et al. (1998) considered the agroecological system as 'the application of ecological concepts and principles to the design and management of sustainable agroecosystems. This definition best illustrates the concept of agroecology today: it captures its evolution both as a conceptual framework based on a set of principles and as a range of practices that can be used in different combinations to enhance the resilience and sustainability of farming systems. Integrated crop–livestock systems (ICLS) are considered an efficient design for sustainable, ecologically based farming systems (Bonaudo et al., 2014). The integration between crops and livestock is considered as highly needed for sustainable intensification thus allowing to achieve long-term agricultural productivity and sustainability (Naylor et al., 2005; Wilkins, 2008). In the North African countries, cereal-dominated crop-livestock systems are the predominant farming systems. In the context of CLCA project, the main technologies identified for scaling were No-Tillage (NT), the introduction of legume and legume-cereal mixtures in the cereal mono-cropping system in order to reach more sustainable system. The aim of this research is to exploring the concept of crop livestock integration in dryland cereal sheep systems and showing farm configuration that aid sustainable and profitable integrated systems in Zaghouan using a farm design model.

2. Materials and Methods

To measure the current level of farm integration, and to explore the effect of the integration on the economic and environmental performances of farms, a FarmDESIGN model was performed. FarmDESIGN model supports iterative cycles of learning and adaptation of the structure of a mixed farm. The optimization process in FarmDESIGN is based on objectives, constraints and decision variables. Decision variables determine the parameters which may be altered and to which extent. The objectives show the direction of the optimization towards the goals (table1). Lastly, the constraints avoid unfeasible configurations or undesirable outcomes of the model (Farming Systems Ecology Group, 2018). The optimization helps to generate a clear image of arising trade-offs and synergies between objectives. To analyse the crop livestock integration (CLI) in the sheep cereal system in the governorate of zaghouan, first a typology was made to get insight on the diversity of farming systems. These farm types were served as input to the farm design model. Second, once filled of data and calibrated for each farm type, the farm design model allowed to choose an optimization "objective" (direction) among a list of possible objectives, and then provides all possible crop and livestock management options which could help reaching these specific objectives.

Table 1: objectives used by FarmDesign model

Objectives
Maximising the organic matter balance in the soil
Minimizing N loss
Maximizing farm operating profit
Maximizing self-sufficiency feed supply of energy
Maximizing the area of CLCA crops

3. Results and discussion

PCA and hierarchical clustering resulted in 5FTs (table2). Results from farm design help to get insight in the current performance and shortcomings helps is deducing strategies for successful CL integration. FT 2 and 5 which have the highest external input characterized by the highest quantity of OM balance. Whilst farm type 4 has the lowest quantity of OM. FT with relatively large croplands compared to the density of livestock herd FT 3 scored higher on nutrient use efficiencies. FT 3 also, have an efficiency of more than 100% as the flows of nitrogen which go out of the farming system are larger than the flows going in. For FT 2, the N-balance was higher, indicating a larger risk of pollution, together with a relatively low efficiency of nitrogen use. For FT 2, and 5 the P-balance was higher compared by the others types. The gross margin of the cropping activities was higher than the animal husbandry for the five farm types.

Table 2: description of farms types

FT1	**Small and low integrated farms**: 24.2% of farmers of our sample. The average of farm size is about 1.75ha, 53% of which is cultivated by barley, characterized by the lowest number of livestock in the farm.
FT2	**Relatively large and well-integrated** farms: formed by 19.2% of farmers. The average farm size of 6.3 ha, characterized by a high number of sheep and chicken and the lowest number of days of grazing in the common pasture.
FT3	**Large farms dominated by crop production**: include 12.1% of farmers. The average of farm size is about 9.9 ha, 40% of which is cultivated by barley, 24% is cultivated by wheat, 18.4% is cultivated by other fodder crops other than barley and 15.2% is cultivated by olive trees. Farmers in this group use relatively a medium quantity of concentrate, barley and bran as feed for their livestock.
FT4	**Intensive integrated farming system dominated by sheep breeding:** formed by 24.7% of farmers. The average farm size of this group is about 5.1 ha, have the highest average of number of sheep about 34 head. The concentrate, bran, straw, hay, and barley constitute the main source of feed.
FT5	**Extensive farming system with medium level of integration**: this group of farms contain 19.7% of farmers. The average of farm size is 1.7 ha, 40% of which is cultivated by barley. Farms have the highest number of goats, chicken, and number of days of grazing on the common pasture.

The relation between objectives results shows that, the clearest relation can be seen for soil N balance and soil OM balance for the five farm types. Moreover, a synergic relation is also clear between the CLCA crop frequency and the OM balance which indicate that CLCA crop introduction results in farms with higher organic matter balances for the fives farm types. Furthermore, CLCA crop frequency and feed self-reliance showed a clear synergic relation for fam types 2 and 5. CLCA crops frequency also show a clear synergic relation with operating profit for the five farm types. These two results serve as an argument to encourage farms in the region of Zaghouan to integrate fodder mixture in the farming system as a practice of CA. Trade-offs are apparent especially between operating profit and other objectives. Correlation between the decision variables and the objectives showed that the parameters related to more intensive livestock production (number of sheep and feed inputs), are negatively correlated with the indicators of N loss, OM balance and feed self-sufficiency and positively with the profitability. Especially the increase of the sheep herd shows a clear positive relation with profit. The quantity of stubble kept on the soil coming from the CLCA crops: vetch, vetch-oat, vetch-triticale and meslin are positively correlated with the organic matter balance. Based on the optimized case study, results suggested a combination of management and configuration can improve multiple objectives to enhance the farming systems. For the majority of farm type olive area is often smaller than the current state whereas, barley area changes only on FT4 and FT5. The number of sheep increase for all the farm type except for the farm FT2. The quantity of barley stubble kept on soil is very low. FT1, FT2, FT4, and FT5 show an increase in the self-feed sufficiency. CLCA crops also were introduced with a different percentage for each farm type in the optimized case study.

4. Conclusion

This research demonstrates that integrating crops and livestock has potential for the improvement of profitability and sustainability of cereal-sheep farming in Zaghouan. Moreover, selected optimized solutions, could deduct beneficial strategies for farmers Increase the number of sheep in the farm is one of the strategic practices that can improve soil fertility. Introducing the CLCA crop mixture also is advised, as it can serve diversification, climate adaptability, integration and soil N and OM building.

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Influence du sol et de l'altitude sur le profil phénolique de quelques huiles d'olives algérienne

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1. Introduction

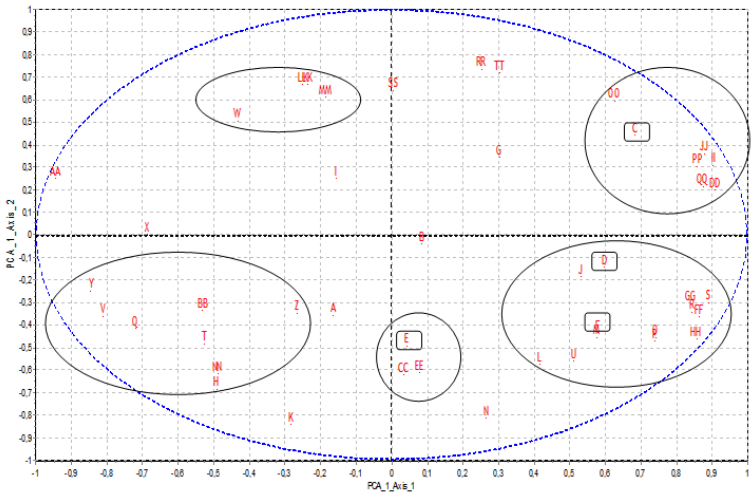
Parmi les secteurs ayant bénéficié d'un soutien financier et technique, il existe en Algérie une oléiculture qui représente actuellement 4% de la superficie agricole utile et 40% de la superficie totale arboricole. La production d'huile d'olive a été la plus élevée des quinze dernières années, atteignant plus de 900 000 hl à travers le pays, en hausse de 25% par rapport à la campagne précédente. La teneur de l'huile d'olive en composés phénoliques dépend de plusieurs facteurs, comme la variété, les conditions climatiques, le degré de maturation des olives et la technologie d'extraction de l'huile (Servili *et al*, 2004). Nombreux travaux de recherche sont consacrés à l'étude de l'influence des ces différents facteurs sur la fraction phénolique de l'huile d'olives. D'autres études se sont focalisées sur la détermination du profil en composés phénoliques de l'huile d'olive vierge par différentes techniques d'analyse, notamment par HPLC. La présente étude est effectuée pour étudier l'effet de la composition du sol et de l'altitude sur la qualité des sept huiles d'olive de l'ouest algérien

2. Materials and Methods

Deux variétés dominantes dans l'ouest algérien à savoir (Sigoise et Chemlal) et une variété sauvage (Oléastre) on fait l'objet de cette étude. Sept échantillons d'olive ont été récoltés à la main durant le mois de (décembre 2016) dans les régions de Zenata, Bordj Arima, Bensekrane, Sidi Belabbes, Sebra et Sig. Les quantités d'olive récoltées sont environ 20 Kg pour chaque échantillon. Les échantillons en été récoltés au mois de décembre. Les fruits sont rapidement transportés dans des caisses en plastique pour l'extraction. Les paramètres de qualité (acidité, indice de peroxyde, K_{232}, K_{270}), l'analyse des tocophérols, la composition en acides gras et le profil en composés phénoliques par HPLC et l'analyse pédologique sont déterminés. Le traitement des données est fait à l'aide de l'analyse multivarié (ACP).

3. Results and discussion

Le cercle de corrélation des variables dans le plan des composantes principales PC1 et PC2 révèle que le premier groupe des composés phénolique (biophénols totals, biophénols naturels, ligstrosides, lignanes, dérivées de l'oleuropéine, secoiridoides et oléocanthal) à des affinités avec un paramètre du sol qui est l'argile et le paramètre géographique qui est l'altitude des oliveraies. Le deuxième groupe composé des (flavonoïdes, tocophérols, acide palmitique, acide palmitoléique, acide heptadécénoique) à des affinités avec le taux de la matière organique des sols et leurs pH, à coté de ce groupe ont distingue les acides phénolique et l'acides lignocérique qui ont une affinité avec le taux du calcaire du sol. Selon Demnati (2008), la nature du sol, le pH et la composition chimique influencent la qualité de l'huile Ainsi, des terres grasses produisent des huiles moins aromatiques que les terres maigres. De plus, les huiles provenant des sols calcaires ont une acidité plus basse que celles des sols argileux.



Sable : A, limon : B, argile : C, pH : D, calcaire : E, matière organique : F, Altitude : G, acidité : H, IP : I, K_{232} : J, K_{270} : K, delta tocophérol : L, gamma tocophérol : M, beta tocophérol : N, alpha tocophérol : O, tocophérol totales : P, C14 :0 : Q, C16 :0 : R, C16 :1 : S, C17 :0 : T, C17 :1 : U, C18 :0 : V, C18 :1 : W, C18 :2 : X, C18 :3 : Y, C20 :0 : Z, C20 :1 : AA, C22 :0 : BB, C24 :0 : CC, lignanes : DD, Acides phénolique : EE, flavonoïdes : FF, lutéoline : GG, apigénine : HH, biophénols : II, biophénols naturels : JJ, alcools aromatique : KK, hydroxytyrosol : LL, tyrosol : MM, oleuropéine : NN, dérivées d'oleuropéine : OO, ligstrosides : PP, oléocanthal : QQ, acides scoiridoide : RR, acide decarboxymethylélénolique : SS, acide élénolique : TT.

Figure 1: Cercle de corrélation des variables dans le plan des composantes principales PC1 et PC2

Ainsi la qualité de l'huile d'olive est affectée par l'altitude, notamment sa composition en acides gras et la teneur en polyphénols. Cetinkaya et Kulak, (2016) aussi ont révélés que le taux de calcaire du sol et la matière organique ont une influence sur le taux de quelques acides gras des huiles d'olive des cultivars turques. Dans les travaux de Ranalli *et al*, (1999), sur l'influence de la région sur la qualité des huiles d'olive italienne des variétés (Leccino, Frantoio et Moraiolo) ont constatent que les phénols, les tocophérols, les composés aromatiques volatils et les acides gras sont influencées par les facteurs pédologiques. Selon Laincer *et al*, (2016) La composition fine d'une huile d'olive, en plus d'être fortement dépendante du cultivar utilisé pour sa production, est influencée par plusieurs autres facteurs comme le climat, les conditions du sol et les pratiques agricoles. Les travaux de Douzane *et al,* (2012), montrent qu'il ya un effet significatif de la variété sur la qualité de l'huile d'olive.

4. Conclusion

D'après l'ensemble des résultats obtenus, nous pouvons conclure que les sept échantillons étudiées on montré une qualité intéressante en matière de composées phénolique et d'acides gras et ils ont fournis beaucoup d'information sur la qualité des huiles d'olives de l'ouest algérien. Les résultats ont montré aussi que les teneurs des composées phénoliques et des acides gras sont dépendantes de la variété, du changement de l'origine géographique, de l'altitude et de la composition du sol.

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Influence de la date de récolte sur la germination d'un porte-greffe des agrumes *Citrus volkameriana* Pasq.

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1. Introduction

D'un point de vue économique, les agrumes se classent au premier rang en termes de production mondiale de fruits et de valeur commerciale internationale (Lacirignola & D'Onghia, 2009). En 2019, la production mondiale des agrumes a enregistré plus de 150 millions de tonnes, réparties sur une superficie de plus de 9.8 millions d'hectares (FAOStat, 2021). Leurs principales zones de production comprennent entre autres la région méditerranéenne (Hill, 2008).
Les agrumes ont de nombreuses utilisations, en plus des fruits frais et des jus de fruits frais (Spiegel-Roy & Goldschmidt, 1996). A titre d'exemple, ils ont utilisés comme aliments des animaux (Kimball, 1999), en plus de leurs multiples bénéfices médicaux (Singh & Rajam, 2009 ; Kelebek, 2010).
Le porte-greffe a un effet important sur la vigueur et la taille des greffons, la taille des fruits, le rendement, la qualité des fruits et des jus ainsi que sur la tolérance au sel, au froid et à la sécheresse (Spiegel-Roy & Goldschmidt, 1996). Le porte-greffe *Citrus volkameriana* Pasq. produit des arbres vigoureux et il n'est pas sensible au *Citrus tristeza virus* (Agustí *et al*., 2014).
Les porte-greffes d'agrumes sont généralement multipliés par graines (Chilembw *et al*., 1992 ; Rouse & Sherrod, 1996).
Idéalement, les graines devraient germer rapidement et donner naissance à des plantes uniformes (Chilembw *et al*., 1992). Cependant, la viabilité des graines des agrumes est plutôt faible car ce sont des graines récalcitrantes (Ortiz *et al*., 2002). Le taux de la germination des semences chez les agrumes varie selon les espèces, les variétés et la saison (Khopkar *et al*., 2017). La germination des graines d'agrumes à des fins de porte-greffe a préoccupé les pépiniéristes, qui ont souvent des difficultés à obtenir suffisamment de plants pour les variétés commerciales (Al-Rawi, 1958). Les problèmes de croissance des plants ont conduit à des études sur les facteurs qui affectent la germination et la croissance des semences (Rouse & Sherrod, 1996).
Dans ce contexte, notre étude a pour objectif la détermination de la date de récolte la plus appropriée des semences de *C. volkameriana*, qui permet l'obtention du taux de germination le plus élevé dans la région de Skikda (Algérie).

2. Matériel et Méthodes

Notre travail a été réalisé au niveau de la ferme de démonstration de l'Institut Technique de l'Arboriculture Fruitière et la Vigne (ITAFV), commune d'Emjez Edchich, Wilaya de Skikda (Est algérien).
Pour nos essais concernant l'influence de la date de récolte sur le taux de germination, nous avons utilisés des semences locales d'un porte-greffe d'agrumes largement utilisé en Algérie qui est *Citrus volkameriana*. Ces semences proviennent de fruits récoltés à partir d'arbres semenciers déterminés. Les fruits sont récoltés périodiquement, à un intervalle hebdomadaire en général, entre 27/12/2012 et 05/02/2013. Après une extraction manuelle, les graines ayant un aspect normal sont ensuite mises à ressuyer à l'ombre. Les graines sont traitées avec un fongicide avant d'être semées sous serre. Le substrat utilisé est constitué d'un mélange de 1/3 de fumier bien décomposé, 1/3 de sable d'oued et 1/3 de terre fine. Nous avons semé cinquante deux (52) graines par date de récolte à raison de deux graines par sachets. Les graines sont semées à une profondeur de 0.5 à 1 cm.
Nos observations hebdomadaires ont porté sur l'évolution de la levée de ces graines, ensuite les différents paramètres liés à la germination (période de latence, durée maximale de germination, énergie germinative et la capacité de germination) sont déterminés.

3. Résultats et discussion

La Figure 1 montre la dynamique de la germination et de la levée des graines à chaque date de prélèvement.
Les résultats montrent une phase d'évolution active de la germination des graines, durant laquelle un nombre important de graine germent. Cette période qui a duré 16 jours pour le 3ème et 6 ^{ème} prélèvement, 21 jours pour le 1er, le 2ème et 5ème prélèvement et 27 jours pour le 4ème prélèvement.
Par ailleurs, le tableau 1 nous montre l'influence de la date de récolte sur le comportement des six prélèvements. Ainsi le temps de latence (qui représente la durée nécessaire pour la levée des premières graines) diminue au fur et à mesure que les dates de récolte s'évoluent dans le temps. En effet, il passe de 40 pour la première date à 36 jours pour la dernière. Nos résultats montrent aussi que la durée maximale de germination varie entre 59 et 87 jours. En outre, l'énergie germinative (qui représente le nombre de graines levées pendant une semaine) varie entre 7.42 et 10.95 graines/semaine ; alors que la capacité de germination (le pourcentage des graines levées) a enregistré des pourcentages entre 84.61 et 100 %.

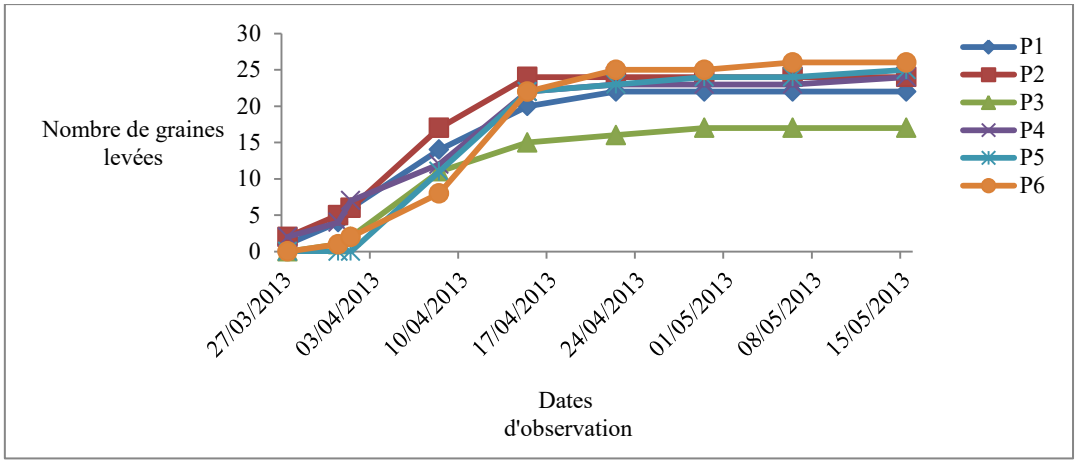

Figure 1. Evolution du nombre de graines levées de *Citrus volkameriana*

Prélèvement	1	2	3	4	5	6
Temps de latence (j)	40	40	42	38	44	36
Durée maximale de germination (j)	66	59	71	87	87	72
Capacité de germination (%)	84.61	92.30	88.46	92.30	96.15	100
Energie germinative (graines/semaine)	8.97	10.95	8.72	7.42	7.73	9.72

Tableau 1. Temps de latence, capacité et énergie germinatives des graines de *Citrus volkameriana*

En effet, le dernier prélèvement montre de bonnes valeurs des critères recherchés, avec la plus faible durée de temps de latence (36 jours), la meilleure capacité de germination (100 %), une énergie germinative de 9.72 graines/semaine et une durée maximale de germination de 72 jours.

De même, Al-Rawi (1958) a montré dans son étude que la phase de maturité ou le temps de récolte des fruits de certains porte-greffes d'agrumes a un effet considérable sur le pourcentage de germination des graines qu'ils contiennent. Egalement, il a été prouvé que la date de récolte a une influence sur les paramètres de germination chez d'autres espèces végétales (Melie Feyem *et al*., 2016 ; Nodehi *et al*., 2021)

4. Conclusion

Nos résultats ont montré que dès les premières récoltes, la maturité physiologique des pépins de *C. volkameriana* est atteinte, mais il est préférable d'attendre le début février pour que ces semences donnent un taux de germination maximal.

Par conséquent, la date de récolte semble avoir un certain effet sur le comportement germinatif. Cependant, nous pensons qu'à des dates choisies selon les phases de maturité des fruits (avant, à maturité, à maturité complète), nous pouvons mettre en évidence l'effet réel que peut avoir la date de récolte sur la levée.

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Comprendre la place de la diversification des moyens de subsistance comme stratégie de résilience climatique des petits agriculteurs : cas de la vallée du Souss au Sud du Maroc

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1. Introduction

L'agriculture est un secteur clé dans la région Souss Massa constituant 20% du PIB régional (HCP, 2016). La région occupe des rangs avancés au niveau national dans la production agricole et dispose de grands marchés d'exportation. Or, plus de 90 % des agriculteurs de cette région sont de petits propriétaires terriens disposant de 5 à 10 ha (Walters, S.A., 2018). Si les exports sont assurés essentiellement par les grandes exploitations de la région, les petits agriculteurs de subsistance essaient de maximiser la productivité des cultures et du bétail sur une superficie limitée et participent par voie de conséquence à assurer une part non négligeable aux cultures maraîchères qui nourrissent la population (Walters, S.A., 2016).

Les projections climatiques indiquent que d'ici 2050, le climat en Afrique du Nord-Ouest deviendra probablement plus chaud et plus sec avec une diminution des précipitations d'environ -10,6 % et une augmentation de la température de +1,2 % ◦C (Milewski et al., 2020). Ainsi, les agriculteurs du Souss vivront au rythme du changement climatique (CC): sècheresse récurrente et de plus en plus longue, température en hausse, inondations, etc. Aucun secteur n'est épargné, toutefois les impacts sont d'autant plus palpables dans l'agriculture dépendant plus des ressources affectées par le CC et dont la vulnérabilité est plus prononcée.

Les conséquences du CC dans la région ne tardent pas à se faire sentir sur tous les systèmes productifs agricoles, notamment pour les petits agriculteurs, plus vulnérables et moins pourvus en ressources. Les facteurs de stress auxquels sont confrontés ces ménages ruraux réduisent les options de subsistance et portent atteinte à leur qualité de vie et bien-être. Le stress climatique constitue une menace sérieuse pour leurs moyens de subsistance, et devient tellement préoccupant que la région Souss Massa a initié son Plan Territorial de Lutte contre le Réchauffement Climatique en 2018.

Les moyens de subsistance des petits agriculteurs ruraux, dépendant de l'agriculture pour une bonne part de leurs moyens de subsistance, sont fragilisés par la dégradation des zones agricoles et la raréfaction des ressources hydriques, entraînant même une reconversion des petits agriculteurs en ouvriers agricoles (Bouchelkha, M. 2009). Toutefois, il existe de petits exploitants qui, tout en gardant une certaine activité agricole sur leurs propriétés, diversifient leurs moyens de subsistance en vue d'améliorer leur capacité d'adaptation au CC. En faisant appel au cadre des moyens de subsistance, ce travail de recherche essaie d'identifier quelle place occupe la diversification utilisée par cette catégorie de ménages agricoles dans la vallée du Souss, en tant que stratégie pour sécuriser leurs moyens de subsistance et renforcer la résilience.

La capacité de s'adapter, base de la résilience, est un processus dynamique qui dépend de plusieurs déterminants. Les communautés pauvres seront naturellement les plus vulnérables du fait de leurs capacités d'adaptation limitées et leur grande dépendance des ressources à forte sensibilité climatique. A l'avenir, ce phénomène ne manquera pas d'apporter aux économies agraires des pays en développement, notamment les petits agriculteurs, un ensemble de défis complètement nouveaux.

Il y a de plus en plus de preuves empiriques que la meilleure façon de transformer les ménages agricoles ruraux est d'identifier, de comprendre et d'apprécier leurs stratégies et pratiques existantes (Mudhara et al., 2016). Cela signifie que comprendre les liens de causalité entre la diversification des moyens de subsistance et les indicateurs de bien-être tels que la sécurité alimentaire est essentiel. En fait, la littérature nous enseigne qu'en réaction aux effets pesants du changement climatique, la résilience des petits agriculteurs se renforce par l'adaptation dans un cadre de relation sociétés-environnement à l'échelle locale. L'adaptation est vécue comme une épreuve individuelle mais aussi collective dont le coût, les modes et les effets s'apprêtent mieux à être observés au niveau local et territorial (Di Falco et al. 2011).

En raison de leur vulnérabilité globale et élevée, le CC a un fardeau lourd pour les petits exploitants des PVD (Morton, 2007). La littérature existante explore divers aspects de la diversification pour les petits agriculteurs, y compris l'élevage, les cultures et la diversification hors ferme (Asfaw et al. 2018) , ce qui contribue à renforcer leur résilience. Owusu et al. (2011) ont constaté que la diversification des moyens d'existence avait un effet positif et statistiquement significatif sur le revenu des ménages et la sécurité

alimentaire. En outre, un rapport de la Banque mondiale (2007) et Loison (2015) ont précisé que la promotion de la diversification des moyens de subsistance contribue à éradiquer la pauvreté et contribue à la croissance économique.

Les liens entre l'adaptation au changement climatique et la résilience à l'insécurité alimentaire des petits agriculteurs du Souss, notamment par une diversification des moyens de subsistance motivent l'objet de ce travail de recherche. Face aux énormes défis auxquels est confrontée la production agricole des petites exploitations agricoles dans un milieu semi-aride comme le Souss, l'adoption de la diversification des sources du revenu du ménage agricole contribue à la durabilité des moyens de subsistance et crée de la résilience de ces systèmes productifs vulnérables. C'est l'une des problématiques les plus inquiétantes, mais les moins récurrentes dans la littérature de l'économie du développement.

Pour tout ce qui précède, on peut formuler la question suivante qui cadre ce travail de recherche :

" *Dans un contexte de changement climatique, avec la raréfaction des ressources qu'il conditionne, en quoi la diversification des moyens de subsistance des ménages des petits agriculteurs du Souss contribue-t-elle à améliorer la capacité d'adaptation et à renforcer la résilience ?* ".

2. Matériels et méthodes

Concernant le volet empirique de notre recherche, nous avons mené (opération toujours en cours) une enquête auprès d'une centaine de ménage de petits producteurs agricoles dans la vallée du Souss ; l'une des zones les plus exposées aux effets néfastes du CC au Maroc. Le but de cet exercice est de mesurer la résilience, comme indexée sur la sécurité alimentaire en tant que déterminant de bien-être (RM-TWG, 2014).

Le traitement des données se fera au moyen de la méthode RIMA, largement testée dans des terrains de recherche similaire en Afrique (d'Errico et Di Giuseppe 2018; d'Errico et Pietrelli 2017; d'Errico et al. 2017). Cet exercice comporte deux principales étapes. Premièrement, les quatre piliers de la résilience (l'accès aux services de base (ABS), les actifs (AST), les filets (ou réseaux) de sécurité sociale (SSN) et la capacité d'adaptation (AC)) seront calculés à partir des indicateurs collectés au niveau des ménages. Deuxièmement, nous estimerons un modèle à causes multiples à indicateurs multiples (MIMIC) (Bollen 1984; Bollen et Davis 2009) sur la base des modèles d'équations structurelles. Les quatre piliers seront utilisés pour créer la variable latente nommée indice de capacité de résilience (ICR) tout en liant simultanément la variable latente à un ensemble d'indicateurs de résultats (indicateurs de sécurité alimentaire).

3. Résultats et discussion

Bien que le processus de collecte de données soit toujours en cours (il prendra fin vers le 20 juin), nous pouvons déjà soutenir l'idée que la diversification des moyens de subsistance des petits agriculteurs agricoles du Souss par des revenus non agricoles stimule l'adoption de stratégies d'adaptation. Un tel résultat, qui cadre par exemple avec celui relevé chez les riziculteurs du sud-ouest du Nigéria (Ojo and Baiyegunhi, 2019), mérite d'être approfondi et mieux contextualisé.

Il semble ainsi que le travail salarié constitue l'une des formes les plus répandues de diversification du revenu des petits agriculteurs du Souss. Ces opportunités de diversification font que la résilience de ces personnes pourrait même aboutir à un abandon du secteur agricole (FAO, 2016). En conséquence, de par sa nature de plus en plus imprévisible, l'agriculture est devenue pour eux une source de revenus peu fiable.

4. Conclusion

La résilience des ménages des petits agriculteurs de la vallée du Souss constitue un sujet d'importance non négligeable pour la recherche en sciences sociales. Dans un contexte dominé par une dégradation de l'environnement naturel et un stress hydrique, ces ménages, de plus en plus vulnérables, ont été amenés à soulever le défi de la survive. La diversification des moyens de subsistance reste l'une des stratégies les plus valorisées dans la littérature et les plus utilisées dans notre espace de recherche pour améliorer la capacité d'adaptation et renforcer la résilience de ces agriculteurs.

Une fois achevé, notre travail de recherche apportera une petite contribution qui permettra d'abord d'enrichir le cadre d'analyse de cette question, et ensuite de mieux saisir la compréhension d'un tel système productif agricole pour mieux concevoir les politiques publiques de développement les plus appropriées.

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The potato in the Souf region: a new agrosystem in the Algerian Sahara

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1. Introduction

The upward trends in food imports, on the one hand, and the decline in oil revenues, on the other hand, are leading Algeria to a big defeat, which is food security.

The food bill is very high ($ 11 billion in 2014 and $ 9.3 billion in 2015). To cope, Algeria has developed 2 million hectares until 2019; to reach 8.5 million hectares of farmland.

2. Materials and Methods

The production of potatoes in the Souf region (south-east of Algeria) has climbed in a visible manner in recent years. The installation of this crop started during the 1991/1992 farming season, to arrive at a production of more than 11 million qx in 2016, on an area of 34 000 ha.

In order to know the causes of this jump, we analyzed the different influencing factors, through:

- Available documents and statistics,

- Field surveys, at:

* new farms,
* input and machinery markets,
* markets for fertilizers and plant protection products and insecticides,
* seed markets.

3. Results and discussion

The potato culture continues to grow in the Souf region, in terms of areas and production. Likewise, the input market has experienced great development.

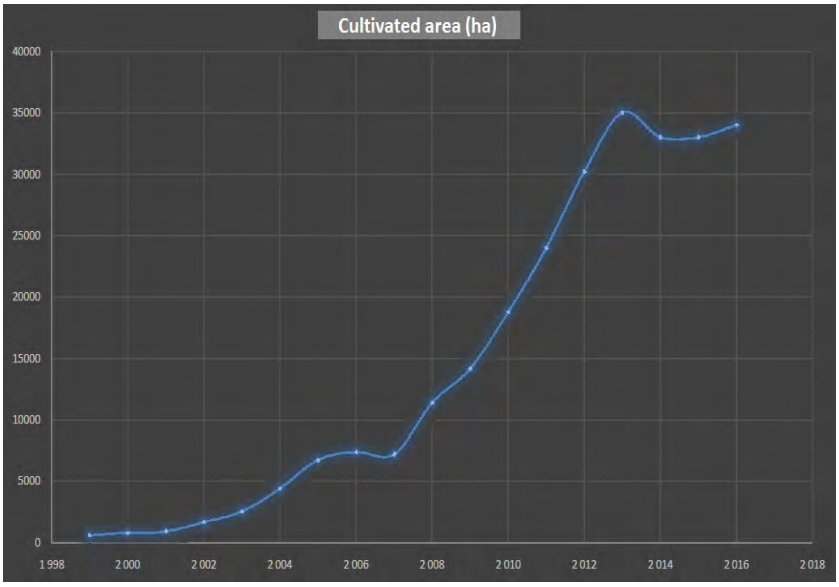

Figure 1: Development of cultivated areas.

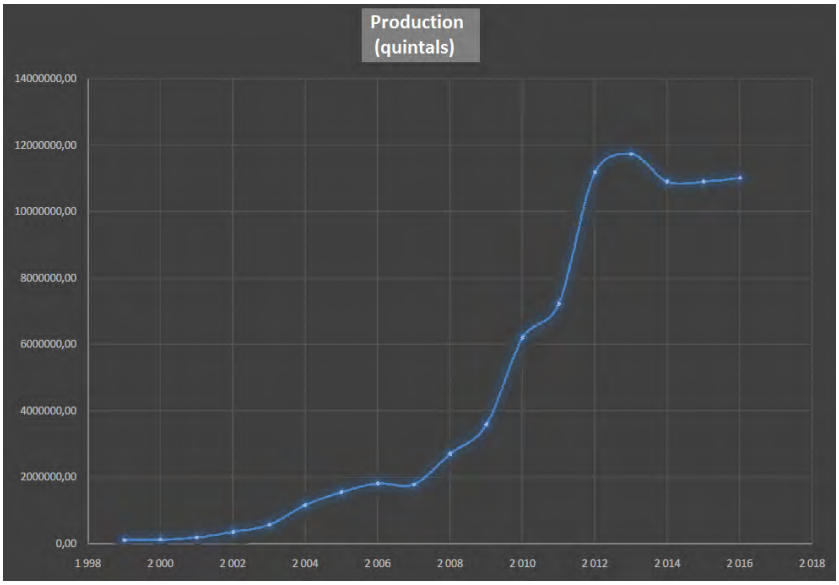

Figure 2: Production development.

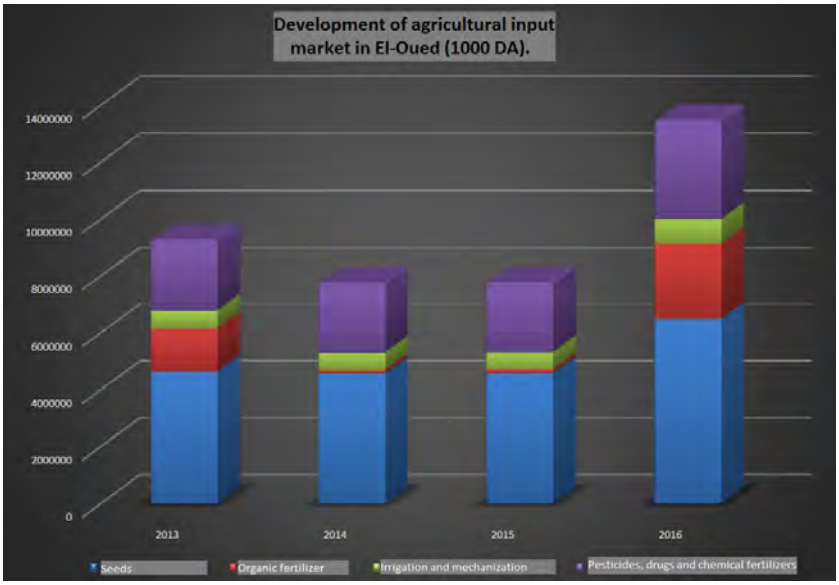

Figure 3: Development of inputs.

In 2019, production stabilized at 8.6 million quintals; on the other hand, the area increased to 37,000 hectares, operated by 7,600 farmers.

4. Conclusion

Potato production represents 17% of market garden products in the Souf region, zone characterized by silting sand (invasion of mobile sand) and by the rise of the water table. It covers more than 30 wilaya (states), especially by early production.

The main factors in the development of this agrosystem are:

i) good agricultural yields, recorded in the wilaya over the past few years, which have encouraged citizens to install new crops;

ii) the facilities granted by the public authorities;

iii) mastery of irrigation techniques, especially through the local manufacture of sprinklers and pivots (cover an area of one hectare). These pivots are adapted to the pedoclimatic conditions of the region and at low cost (around 1000 €);

iv) the dynamics of the input sector (seeds, fertilizers, materials, etc.) and agricultural trade. In general, the potato sector input market increased by more than 50% between 2013 and 2016;

v) the appearance of small businesses and partnerships, which are interested in Saharan agriculture.

This model deserves to be extended to other regions of Algeria, and for other agricultural products.

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Natural saline pasture, a potentially sustainable feed alternative for lambs in Mediterranean coastal lands

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1. Introduction

Mediterranean agriculture is threatened by harsh environments, particularly by climate change producing biodiversity loss, freshwater overuse, soil degradation (Aguilera et *al*., 2020) and salinity increase. Grassland-based sheep production systems are of historical, social, environmental and economic importance throughout the Mediterranean areas (Cosentino et *al*., 2014), however this natural vegetation remains green for a short period. The future prosperity depends on the use of marginal resources. In saline areas, halophytes could be promising feed resources, since these plants are distributed from coastal zones to deserts and can grow in saline to extremely saline habitats (El Shaer, 2010). These potentialities do not go far as several constraints are limiting. The main constraints hampering the efficient integration of these halophytes in livestock feeding was their richness in salts and anti-nutritional factors which could compromise the animal's growth (Ben Salem et *al*. 2010).Thus, the aim of this study was to evaluate the botanic composition of natural saline pasture for two years and to investigate the effect of this pasture on growth and carcass performances of grazing female lambs.

2. Materials and Methods

The experiment was carried out in the locality of El Attaya of Kerkennah archipelago located in the east coast of Tunisia (the Gulf of Gabes) and elevation of 0.5 m above the sea level. The study was conducted on 12 ha of natural saline pasture during spring (march to may) through two consecutive years (2018-2019). The average annual rainfall is 187.5 and 231.1 mm, respectively in 2018 and 2019. Electrical conductivity of the soil was 23.89 mS/cm. Botanic composition was studied according to the method of mixed line-surface survey described by Daget and Poissonet (1971). For forage shrubs, 60 quadrats of 400 m^2 were determined and the contribution of each species was calculated. For the herbaceous vegetation, 45 linear surveys of 20 m and 45 quadrats of 1 m^2 were realized. Coverage rate, specific richness and herbaceous biomass were calculated.
Weaned 5.6 months old female Queue Fine de l'Ouest (QFO) lambs with an average body weight of 23.63 ± 4.33 kg were reared on pasture until reaching a fixed body weight of 32 kg. They received as a supplement 300 g/head/day of concentrate. Lambs were weighed every 21 days to calculate the average daily gain (ADG). Eight lambs were slaughtered. Cold carcass and red viscera were weighted to calculate yields. Leg, shoulder and loin were weighed to calculate high-priced joints percentage.
The effect of the year on performances was analyzed using STATISTICA (version 12, Stat Soft, USA). SEM was used as the error term. Differences between means were considered significant when $P < 0.05$.

3. Results and discussion

Botanical composition of fodder shrubs (table 1) was dominated by halophytes: 61.76 and 65.61%, respectively in 2018 and 2019. For 2019, 14 shrubs are observed, 8 of them are halophytes: *Suaeda mollis*, *Salsola longifolia*, *Reaumuria vermiculata*, *Atriplex lindleyi*, *Zygophyllum album*, *Arthrocnemum macrostachyum*, *Limoniastrum guyonianum* and *Juncus acutus*.
Floristic inventories showed that the year influenced herb composition. Thus, herbaceous plant cover was improved in 2019 (82.60%). This result was close to the value (84.78%) reported by Hamdi et *al*. (2019) for natural pasture in the semi-arid region of Tunisia (450 mm). Specific richness in 2018 varied from 10 to 23 species/m^2. While for the year 2019, specific richness varied from 7 to 27 species/m^2. Herbaceous cover was mainly composed of *Medicago littoralis*, *Bupleurum semicompositum*, *Cynodon dactylon*, *Gasoul nodiflorum*, *Trigonella maritime* and *Sporobolus virginicus*. However, Majdoub-Mathlouthi et *al*. (2015) found during the spring a dominance of natural shrubs and an absence of herbaceous species due to rainfall scarce (100 mm) for a rangeland located in the center of Tunisia. The average herbaceous biomass was higher in 2019 (1.055 tonne DM/ha) than in 2018 (0.702 tonne DM/ha). Similarly, Chemmam et *al*. (2009) observed for a pasture in the south-eastern region of Algeria that the herbage biomass was significantly different between years. Differences were mainly associated to rainfall (Tarhouni et *al*., 2007).

Table 1: Effects of year on botanical composition and biomass of saline pasture

	2018	**2019**
Halophytes shrubs (%)	61.76	65.61
Coverage rate (%)	66.11	82.60
Specific richness (species/ m^2)	14,77 ± 2,68	16,20 ± 4,68
Herbaceous biomass (tonne DM/ha)	0.702	1.055

For the two years, rearing lambs on saline pasture allows acceptable growth performances. In 2019, despite lesser initial body weight and fattening period, lambs reached the same final body weight compared to those of 2018 (Table 2).This result is due to the higher ADG (177 g/d; P<0.0001) related probably to a higher intake of pastoral flora which was more abundant in 2019. It was also higher than the growth rate (90.5 g/d) observed by Hajji et *al*. (2019) for QFO lambs reared indoor or on pasture in the sub-humid region of Tunisia. El Shaer (2010) reported that a mixture of halophytes could dilute the adverse effects of their anti-nutritional factors and improve animal performances.There were no differences in cold carcass weight and commercial yield between groups (P > 0.05). Red offals and high-priced joints proportions were acceptable (Table 2). These results were similar to those found by Hamdi et *al*. (2016) for lambs slaughtered at similar weight and grazing rangeland in semi-arid region of Tunisia.

Table 2: Effects of year on growth and carcass performances of female QFO lambs reared on saline pasture

	2018	2019	SEM	P values
Growth performances				
Number of lambs	20	15		
Stocking rate (lambs/ha)	3.3	3.7		
Initial body weight (kg)	25.60± 4.52	21.00±2.20	0.961	0.001
Initial age (d)	152.10	191.73	6.747	<0.0001
Final body weight (kg)	32.90	30.47	1.108	0.106
Fattening period (days)	83	63		
ADG (g/d)	89.2	177.0	7.598	<0.0001
Carcass traits				
Number of lambs	8	8		
Slaughter weight (kg)	31.00	29.25	0.761	0.128
Cold carcass weight (kg)	14.54	13.24	0.488	0.082
Commercial yield (%)	46.87	45.34	1.263	0.407
Red offals (%)	4.12	3.86	0.185	0.351
High-priced joints (%)	64.98	60.33	1.173	0.014

SEM: Standard error of means; Red offals: Herat + Lungs + Liver + Kidneys; High-priced joints: Leg + Lumbar region + Shoulder

4. Conclusion

In the studied region, pasture yield varied with the year in relation to the rainfall. Furthermore, grazing saline rangeland during spring at an average stocking rate of 3.5 lambs/ha and with a moderate concentrate supplementation, lambs are able to achieve a satisfactory growth performance and carcass characteristics. Overall, these results support that grazing pasture rich in halophytes could promote sheep production systems, increase farmer's incomes by overcoming feed shortage and increased prices of conventional feed and improve consequently environmental conditions in the saline coastal lands. However, for the other seasons, pasture flora can vary essentially the herbaceous cover. Therefore, current measurements must be extended for longer periods.

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Impact of climate change and saline water on the physiological performance of olive tree (*Olea europaea* .L) in an arid climate

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1. Introduction

The Mediterranean region is expected to have, an overall reduction of annual precipitation of 39.1±55.1mm and an increase of air temperature of 1.57±0.27°C (from 0.84 to 2.31 °C) inducing an increase of annual reference evapotranspiration of 92.3± 42.1mm (Saadi et al., 2015). Drought is the most significant environmental stress in agriculture and is known to induce many physiological changes in plants (Trabelsi et al., 2019). Tunisia is among countries with limited water resources and agriculture faces enhanced land and water resources degradation; over-extraction of groundwater, soil salinization and erosion (Ghrab et al., 2008). An irrigation experiment was conducted in Sfax region (southern Tunisia) to evaluate the combined effect of drought and irrigation with saline water on olive trees.

2. Materials and Methods

The experiment was conducted in an orchard owned by Olive Institute in the region of Sfax (34°43'N, 10°41'E), southern Tunisia. Three irrigation treatments were installed in March 2015 and modified an experimental design installed in 2003 (Ghrab et al., 2013; Trabelsi et al., 2019) by adding irrigation with freshwater (EC=2.46 mS/cm): i) Rain-fed: 10 olive trees grown under Rain-fed conditions. ii) FI: Fully irrigated that applied daily 100% of crop evapotranspiration (ETc) with saline water (EC=7.5 dSm^{-1}) on 10 olive trees. iii) TW: Fully irrigated that applied daily 100% ETc with tap water (EC=2.46 dSm^{-1}) on 10 olive trees.The mean annual precipitation and reference evapotranspiration (ETo) were 220 and 1383 mm, respectively with marked dry summers. The experiment was carried out in an olive orchard with twenty-six years old Chemlali olive trees (*Olea europaea* L.) planted at 4m x 4m spacing (625 trees ha^{-1}) and drip irrigated.
Measures were taken after severe drought of 10 months in 16 July 2016 and one month after heavy rain of 68.8mm in 24 October 2016 for adult and young leaves. Three replications were taken per treatment at each sampling date. Leaves were taken all around the trees and five shoots for every tree were selected to be similar in potential yield and canopy and considered for the different measurements, surveys and quantifying the effect of drought and salinity on the evolution of gas exchange parameters (Pn), plant water status (RWC, EL).

3. Results and discussion

The analysis of photosynthetic parameter (Table 1) was affected by drought. Net photosynthesis (Pn) was highly altered in rainfed trees as compared to irrigated ones. In fact, a significant ($p \leq 0.05$) decrease was recorded in rainfed plants about 3.92 µmol of CO_2 $m^{-2}s^{-1}$. The decrease in photosynthetic rate due to water stress (Guerfel et al., 2009 ; Trabelsi et al., 2019). In fact, the stomatal limitation of photosynthesis, through stomatal closure, can be considered as a primary event followed by respective changes of the photosynthetic reaction as drought severity intensifies. After re-watering, water stress persistently affected photosynthetic activity. Indeed, the increase of the assimilation rates of rain-fed trees, after re-watering, indicated the improvement of intercellular CO_2 concentration which was associated with a gradual recovery of photosynthetic capacity. However, this recovery was limited to 55% as compared to FI and TW. Thus drought caused permanent damages to leaf photosynthetic capacity. In addition, during drought and even after rewatering FI mature leaves were not able be as efficient as TW ones. However, young leaves had the same photosynthetic capacity independently from the treatment. This indicated that initially all the leaves had the same capacity even for plant suffering drought or salinity.

Table 1. Net photosynthesis (Pn) (µmol of CO_2 m^{-2} s^{-1}), for mature and young leaves of the three treatments: Rain-fed conditions (Rain-fed), Full Irrigation with saline water (FI) and Full Irrigation with tap water (TW), evaluated during drought and after rainy periods.

	Drought			After rainy period					
				Mature leaves			Young leaves		
	Rain-fed	FI	TW	Rain-fed	FI	TW	Rain-fed	FI	TW
Pn	3.92±2.3 aA	15.47±0.03 aB	19.41±2.56 bB	10.09±2.59 bA	17.09±3.3 aB	21.9±4.75 bB	12.15±5.16 bA	12.33±2.79 aA	12.46±2.8 aA

Nevertheless, leaf RWC was low in rainfed trees as compared to irrigated ones that maintained the same values. Further, maintaining RWC at 66.64% in rainfed trees, under severe drought, should allow olive to maintain minimal cell turgidity, reflecting a great capacity of osmotic adjustment. Indeed, this state will induce simultaneous gas exchange and Pn decline. Moreover, Pn and RWC were significantly correlated. This illustrated the response of Pn to decreasing RWC induced by decreasing the water supply to the roots. So, decreasing RWC decreased Pn, although at a small value of RWC, Pn may continue to decrease (Boussadia et al., 2008).

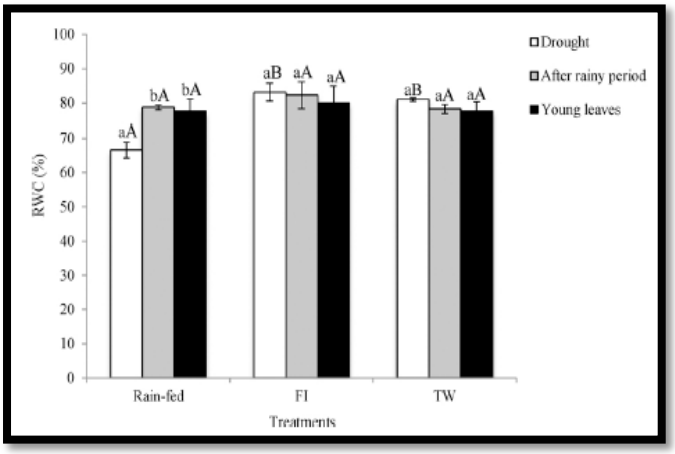

Figure 1: Electrolyte leakage (%) in olive trees cv. Chemlali Sfax under three treatments: Rain-fed, FI and TW evaluated during drought, after rainy period for adult and young leaves. Different letters (a, b and c) indicate significant differences at the 5% level between periods within the same treatment. Capital letters (A, B and C): indicates significant differences at the 5% level between treatments within the same period.

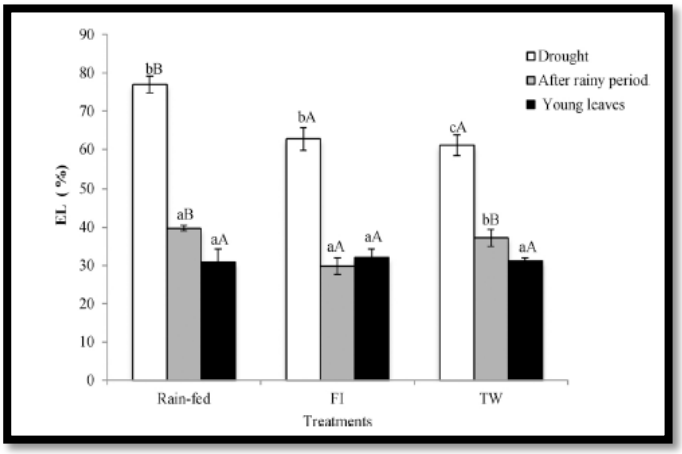

Figure 2: Electrolyte leakage (%) in olive trees cv. Chemlali Sfax under three treatments: Rain-fed, FI and TW evaluated during drought, after rainy period for adult and young leaves. Different letters (a, b and c) indicate significant differences at the 5% level between periods within the same treatment. Capital letters (A, B and C): indicates significant differences at the 5% level between treatments within the same period.

RWC was relatively high for all the treatments during drought with significantely lower values for rainfed treatment. After rewatering, all the treatments had the same values indicating for both cases a good cell water status. (Joly and Zaerr, 1987) explained that more elastic cell walls can shrink more easily when subjected to stress, helping to maintain a higher turgor pressure and protecting cell walls from rupturing. This was confirmed by EL of 76.96, 62.75 and 61.08% for rain-fed, FI and TW respectively under severe drought. After rewatering, EL was reduced to a range between 29.82 and 39.74 for all treatments. Additionally, cell membrane stability has been widely used to express stress tolerance, and higher membrane stability could be correlated with abiotic stress tolerance (Bajji et al., 2001).

4. Conclusion

Rainfed olive trees showed declines in photosynthetic rate during a drought period. After rewatering, rainfed trees recovered only 55% of photosynthetic activity as compared to tap water while that of trees irrigated with saline water kept the same gap as compared to trees irrigated with tap water. Thus, drought caused permanent damages to photosynthetic capacity up to 45% while irrigation with saline water reduced this gap to 20% without variation due to rewatering. Conversely, olive trees maintained a good water statusand relative water content.

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Etude préliminaire d'intégrer l'aquaculture dans le domaine agricole à partir d'étude de la diversité et la distribution de la faune benthique d'Oued Abiod Nord – Est d'Algérie

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1. Introduction

Les macro-invertébrée benthique s'occupent différents milieux aquatiques. Ces organismes habitent les rivières, les marais au fond boueux sédimentaire, les lacs, les cours d'eau sous les substrats rocheux ou vaseux... Ils recherchent des endroits où ils peuvent s'agripper, se nourrir, se cacher et dans certains cas se reproduire (Djamai S 2020). Le benthos est l'ensemble des organismes vivant au fond des eaux, stagnantes ou courantes. Il est en majorité constitué par les macro invertébrés, les champignons, les bactéries et algues (Tenkiano N., 2017). Bien connaître les milieux aquatiques est une étape indispensable pour les protéger et atteindre leur «bon état». Les dispositifs de surveillance, permettent de suivre l'évolution de la qualité des milieux aquatiques et d'orienter les actions à mener. Notre étude pour l'objectif de la connaissance des faunes benthiques qui forment une partie importante des écosystèmes d'eau douce ils sont reconnus pour être de bons indicateurs de la santé des écosystèmes aquatiques.

2. Matériels and Méthodes

Le bassin versant de l'oued Abiod, drainant une superficie de 1300 Km², est situé dans le massif de l'Aurès (Fig.1). Il fait partie du bassin versant endoréique Chott Melghir. La longueur de l'oued est de 85 km depuis son origine dans les montagnes Chelia (2326 m de haut) et Ichemoul (2100 m de haut). Après avoir traversé Tighanimine, il se jette progressivement dans les canyons des gorges de Rhoufi et M'chouneche, puis ouvre un chemin vers la plaine jusqu'aux gorges sahariennes de Foumel Gherza.

Tableau 1. **Caractéristiques des stations prospectées à oued El Abiod**

Alt. Altitude ; Lat. Latitude ; Long. Longitude ; Lar. Largeur ; Pr. Profondeur ; Vég. Végétation ; Sub. Substrat ; Vit. Vitesse du courant]

Stations	Taghit	Tiflfel	Ghassira	Baniane	Mchounche	EL habel
Code	St1	St2	St3	St4	St5	St6
Lat.	35°,151629''N	35°11'78''32N	35°07'40.4''N	35°,00'52''.34N	35°,00'18,8''N	34°50'55'' N
Long	6°,24'27.21''E	6°23'36''06E	6°14'21.6''E	6°02'43'',1E	6°02'43,1'' E	05°55'04''E
Pr (cm)	6	7,6	5,55	10,28	14,81	5,72
Alt	886	799	757	455	307	224
Vit d/t	0,72	0,39	0,49	0,45	0,14	0,01
Végé	Arbre fruitier Grenadin Herbacéé	Arbuste Arbre fruitier grenadine	Herbacée	Palmier Arbre fruitier	Palmier	Palmier algue herbacé Les algue
Subs	L'argile Pierre	L'argile Pierre Gravie	L'argile Pierre Gravier	Gravier Bloc Dalle	Bolc Gravies Roche Dalle	Sable L'argile

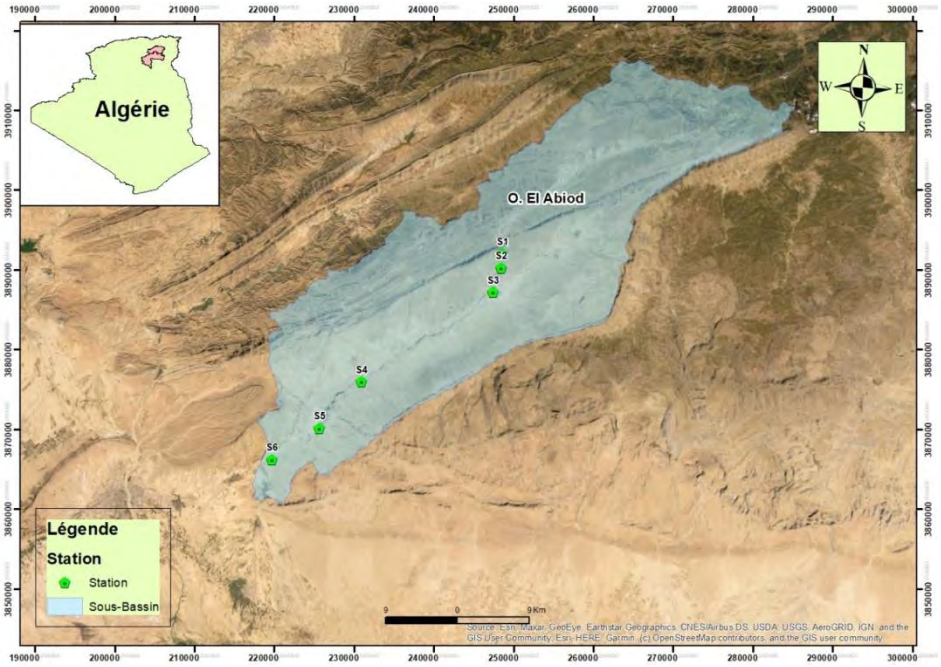

Figure 1: site d'échantillonnage des macro -invertébrés dans l'Oued Abiod

3. Résultats et discussion

Le résultat issu à partir de l'étude préliminaire de diversité et la distribution spatiale de la faune benthique dans le cours d'eau de l'Oued Abiod (nord-est d'Algérie) et la richesse taxinomique montre des fluctuations entre les stations étudiées. Les macros invertébrées aquatiques recensées dans cette étude se composent de 27 familles appartenant à 05 groupes zoologiques (Fig .1) les Diptères, Trichoptère, coléoptère, Hemiptère et les Ephéméroptère. Les macro-invertébrés constituent d'excellents témoins de la qualité des habitats où ils se rencontrent et reflètent particulièrement bien l'état écologique du cours d'eau en réagissant très vite aux changements survenant dans leur environnement notamment les changements climatiques ou bien les effets anthropiques. Le monde animal est très vaste, les macro-invertébrés benthiques vivent au fond des ruisseaux, rivières, lacs ou marais. Ce sont principalement des vers, des crustacés, des mollusques et des insectes. Les macro-invertébrés benthiques forment une partie importante des écosystèmes d'eau douce. Ils servent de nourriture à nombre de poissons, d'amphibiens et d'oiseaux (Moisan J., 2006). C'est un groupe très diversifié, et notre étude a pour objectif d'un inventaire quelques groupe zoologique des macro-invertébré benthiques qui forment une partie importante des écosystèmes d'eau douce d'une part ils sont reconnus pour être un élément principale de l'équilibre des écosystèmes et d'une autre part la recherche préliminaire réalisée au niveau de l'Oued Abiod la période de printemps(2018) jouent un rôle très important dans le domaine agricole au future par intégration de l'aquaculture dans le domaine agricole. La production animale ou végétale en milieu aquatique. L'aquaculture se pratique dans des rivières ou dans des étangs, en bord de mer. On parle dans ce cas de « cultures marines ». D'une part elle fournissait dans le monde un nombre important des poissons d'eau douce, des mollusques, des crustacés et des poissons d'eau de mer recouvrent les besoins des marches et les consommations par l'homme. D'une autre part la lutte biologique certains pays d'Aise utilisent les poissons comme des prédateurs contre les invertébré ravageur de riz.

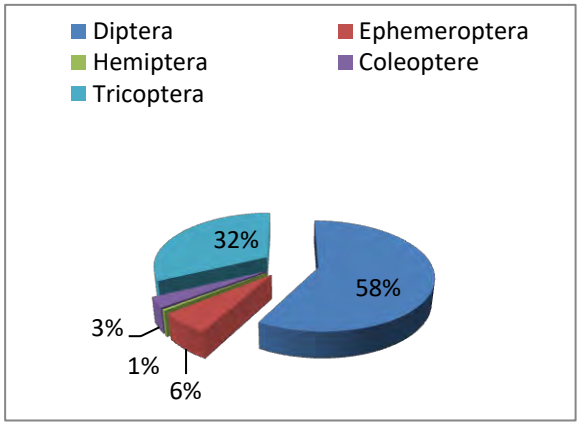

Figure 2: pourcentage des groupe zoologique récence

4. Conclusion

Les travaux entrepris dans le cadre de ce travail, nous ont permis d'apporter quelques précisions quant à la caractérisation physico-chimique de l'eau du l'Oued Abiod en tant que milieu écologique. L'étude des paramètres écologiques des macro invertébrés benthiques d'une part et leur distribution spatiale d'une autre part.

Six stations situées de la longueur du l'Oued Abiod ont fait l'objet de prélèvements des macro- invertébrés benthiques pendant la période 2018 - 2019. Cette étude a conduit les scientifiques à utiliser ces animaux pour évaluer la qualité de l'eau. Dans un cours d'eau en bonne santé, on va retrouver toutes les espèces.

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Identifying Drivers of Inequalities that Induce Food Insecurity and Nutrition with a Food System Approach: Case Study of Ghana

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1. Introduction

Enough food is produced worldwide to feed up to 10 billion people when there are only about 7.5 billion. This fact shows how inequality and inequity in food systems persist, as all do not people have the right to have adequate food that not only meets the minimum requirements for survival but also nutritionally adequate for health and well-being. Agriculture in West Africa is becoming more industrialized and food products more processed, shifting the food systems from traditional to more modernized, this phenomenon is often called the "quiet revolution". Modern food systems are characterized by intensive agriculture and food production that increasingly supplies urban and peri-urban supermarkets. Ghana presents characteristics of transitioning food system as it shows trends of high urbanization rates, increasing population rates, and in middle-income class due to economic growth. These trends are leading to more demand for processed foods, and changes in the retail sector which push food producers and actors in the supply chain to "modernize" their production system. In this case, value chains have vertical coordination, large-scale processing, and higher capital, leaving in some cases, the small-scale food producers at disadvantage.
Many challenges persist as food systems are facing a "triple challenge", which are to ensure food and nutrition security for a growing population, provide livelihoods for people working in food supply chains, and build environmental sustainability while adapting to and helping to mitigate climate change. The triple challenge sometimes creates opportunities for synergies as integrating excluded people in vulnerable food conditions in transportation, processing, and distribution—the expanding "hidden middle" of the food supply chain— can promote inclusion of the rural poor (SWAC/OECD, 2021), but often trade-offs are difficult to foresee. To understand and resolve such trade-offs, it is required to recognize that food systems are dynamic and rapidly changing, and a way to do so is by conceptualization that current food systems as complex, heterogeneous over space and time and replate with linear and non-linear feedbacks (Béné et al., 2019). This research aims to present the drivers of inequalities that induce food insecurity and nutrition in Ghana food systems with a system thinking approach that shows casual dynamics and relationships, by identifying indicators systematically for each section of the system, and analyzing the linkages and interconnections to assess inequalities defined as actors in the food system in vulnerable conditions, using the sustainable food system framework from the High-Level Panel on Food Security and Nutrition (HLPE). This research is part of the European HealthyFoodAfrica project cities funded by Union Horizon2020 programme which aims at more sustainable, equitable and resilient food systems in 10 African cities.

2. Materials and Methods

The sustainable food systems framework from HLPE allows to analyze the food system interactions and determine food security and nutrition as outcomes, and therefore to identify the link to inequalities and equity. Using Ghana as a case study, the food system was assessed using indicators with available information from secondary data and literature, which allowed to identify trends of food systems, the main characteristic of supply chains, food environments, consumer behaviors, and diets, and later on the analysis of the interlinkages from the different component of the systems, and to identified the drivers in inequality as outcomes using food security and nutrition concept.
The definition for each indicator was obtained from secondary data obtained through open data sources such as FAOSTAT, the World Bank, Eurostat, UNICEF Division of Data Research, and Policy, Economist Intelligence Unit, National Statistics, Child Growth Database, and the (NCD) Non-communicable disease database. The selection of indicators was done using the sustainable food system framework from HLPE (2020), the Food System Dashboard from Johns Hopkins University (2020), and literature from (Allen et al., 2019; Fanzo et al., 2020; HLPE, 2020; Kennedy et al., 2020; van Berkum et al., 2018). For the case of Ghana, most of the indicators were compared with the Western African region or with time evolution to perform the analysis. For the case study, 7 crops were considered; cassava, maize, millet, plantains, sorghum, rice, and yams, as these are the main staple foods in Ghanaian diets in order to compare trade and production indicators, and understand the import dependency in the supply chain.
The selection of indicators for a food systems assessment are oriented toward the goal of better-quality diets, reflect the situation at a national scale, rather than sub-national, have a standard method used for data collection and a standardized formula for

construction to enable cross-country comparisons (Kennedy et al., 2020), and the data used to construct the metric/indicator had to be routinely collected updated publicly-accessible database.

3. Results and discussion

Drivers of food systems influence activities related to food, actors, and outcomes. The sustainable food system framework recognizes biophysical and environmental, technology, innovation and infrastructure, political and institutional, socio-cultural and demographic components as drivers of the system, together drivers lead to trends that define the way food is produced, traded, and consumed. For the analysis of the drivers 20 indicators and 27 variables were selected using the criteria found in the literature that affects inequality conditions in the food system. Following the food system framework, 15 indicators with 33 variables were selected to analyze the supply chain that is integrated by food production, storage and trade, packing and processing, and retail and marketing, making special emphasis on the processes and interaction of the actors. For the consumer behavior component, 2 indicators with one variable each were selected to understand the knowledge, attitudes, motives, and practices of the consumers in the food system. For the diet component, 4 indicators were selected to analyze adequacy, diversity, moderation, and safety, with 7 variables in total.

In this framework, food environments directly interact with supply chains, consumer behaviors, and diets. Individual consumers' awareness and decisions are focused on where and what foods to acquire, prepare and eat; they shape diets in terms of quantity, quality, diversity, safety, and adequacy of food (Downs et al., 2020). As a result of individual awareness and decisions, nutritional and health outcomes take place. Those outcomes creates feedback into food systems by influencing people's ability to work and to exercise agency within the system. Ultimately, these outcomes are shaped by the drivers that influence food systems as trends, as well as policies that respond to it.

As an example, migration to cities is argued to be one of the leading factors of food systems transformation in West Africa. Ghana has one of the highest growing urban migrations rates in this region, and as it is over-urbanizing without planning poverty rates increase. Migration to cities also changes the food supply dynamic as food needs to be transported to cities as a consequence of the growth of demand for perishable foods, at the same time food losses increase as a consequence of deficient agricultural infrastructure and roads connecting rural to urban areas. This has an effect at some level on food environments and behaviors as diets changes when people moved to cities, increasing the demand for processed foods. This dynamic is reflected by the high overweight rates in cities, and underweight, and vitamin and mineral deficiencies in rural areas, leading to food security and nutrition problems which creates a feedback loop on inequalities in the food system.

4. Conclusion

Using the sustainable food system framework, and the indicators and variables selected, it is possible to present the drivers of inequalities that induce food insecurity and nutrition in Ghanaian food systems. Casual dynamics and relationships are shown as trends, which allowed to identify the inequalities along with the system. As food systems transform raptly in Africa's the main drivers such as urbanization, population growth, economic growth, and ecological and environmental, present new challenges for vulnerable agricultural producers and consumers. Natural resources scarcity, migration to cities, poor agricultural infrastructure, food loses, gender inequality, dependence on commodity markets, market imbalances, and nutrition, are recognized as problems derived from these trends that lead to more inequality, as often creates loops that make vulnerable actors from the food system to escape from poverty and exert the right to food. The framework built by the HLPE shows great consensus for analysis among the scientific community, but often in literature the indicators used differ from one research to another, and also accessible data are not harmonized across countries as it is mainly built for national scale analysis. Regional or local level cross-comparison of food systems often are difficult to make with this framework. Using the sustainable food system framework with a more dynamic approach like system dynamics could facilitate the assessment of the sequencing of the dynamics and the specificity, as the negatives or positive feedbacks and effects can have more specify.

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Social capital and rural territories: the impact on local cooperation Case study of Albania

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1. Introduction

This study analyzes the social capital and examines its impact on the territorial capital of a rural territory.

Territorial capital is a concept borrowed from the territorial economy which combines the tangible and intangible resources of the territory (Lacquement et Chevalier., 2016). These resources can constitute either assets or constraints on the territory. Territorial development policies must above all help the territories to develop their territorial capital (Camagni, 2006). The coordination capacity of actors, to mobilize the resources of the territory, generates development and marks this territory.

The success of a territorial system does not depend only on material resources, but also on the wealth of cognitive elements (Camagni, 2006). The active participation of local communities is considered today as one of the main factors at the origin of economic development, while contributing to the creation of links and trust between members of social groups. All these links developed between local agents are defined as social capital. Social capital is defined as a collective asset in the form of norms, values, beliefs, relationships of trust, networks, social relationships and shared institutions that facilitate cooperation and collective action for mutual benefit (Lin, 1995).

In our study, we present natural capital and social capital, one tangible and the other intangible, as two main capitals of our territory.

2. Materials and Methods

In this research we study structural and cognitive social capital and the interactions between these types of social capital at the community, household and institutional level. We have taken into consideration the tools used by the World Bank on the measurement of Social Capital. SCAT (Social Capital Analyzes Tools) is a method that measures the opportunities and constraints of individuals and groups by focusing on the assets and social networks that determine their access to resources. The goal of this case study is to shows the type of relationship (bonding, bridging and linking) developed between local actors which lead to determine the social capital.

Figure 1: Social capital measurement indicators

Source: Adapted to Krishna, 1999

3. Results and discussion

Our territory is characterized by an abundance of natural resources and a natural capital composed of quality pastures and suitable for livestock activity. The exploitation of this natural capital poses a problem because there is no clear legislation for the use of pastures. The actors cannot invest because the access contracts are reduced to 6 months or one year. It is difficult to use this natural capital properly because of the inefficiency of local institutions: the municipality in charge of these issues since the implementation of decentralization in 2015 is not yet operational on these issues of rules of access to pastures.

In relation to social capital, two types of social capital and three types of social relationships are distinguished. Structural social capital represents the social networks and people that an individual knows and can rely on to obtain benefits such as information and assistance. This type of capital is measured by variables such as: organizational density, social ties and collective action. This type of capital in the study area is almost non-existent because the variables that constitute this capital are very weak. Cognitive social capital represents the shared language and codes that form the basis of communication. It consists mainly of a set of shared norms, values, attitudes and beliefs. This type of capital is measured by variables such as: trust, solidarity, reciprocity and cooperation. The results show the presence of cognitive social capital but in a narrow level, which means, it is in the level of the same community.

In the "linking" relationship, we considered the relationship between the community and the local state institutions. The results show little exchange between the institutions and the community. The community is not represented in the institutions and lacks trust in the institutions. The lack of linking means little communication between the community and the local government, which increases transaction costs, attempts at corruption and hinders the activity of local authorities. The lack of linking also hinders the implementation of development projects in the study area.

Bridging is the exchange of information and sharing between heterogeneous actors and different communities. A low level of bridging means a closed society in a narrow group. The lack of this type of social capital has a negative impact on the level of cooperation. Therefore, societies that do not develop bridging relationships are less willing to cooperate with each other.

Bonding represents the close relationships that exist between individuals, such as relationships between family members, between friends belonging to the same group or community. The strong presence of bonding leads to a lack of innovation in the region. Also, bonding can stimulate corruption and/or criminal activity. A society influenced by a strong bonding relationship is less willing to cooperate with outside family or friendship group members.

4. Conclusion

The results reflect a lack of trust between local communities. This mistrust among rural actors is primarily related to the lack of credible institutions in Albanian communities. However, where trust is low, as in the case of Albania, people save little, invest little in skills development, and do not realize the productivity gains from effective cooperation. The lack of confidence in the functioning of institutions, hinders the breeders and rather the producers to cooperate with each other. Moreover, there is a poor exploitation of natural capital, even though it offers a great potential for development in the study area. In this stage we ask if we can develop the regions that are endowed with natural capital but lack the will of cooperation and collective action (social capital) between local actors (bottom-up approach).

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Factors influencing innovative circular business models in the Mediterranean olive oil value chain

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1. Introduction

The production of olive oil generates vast quantities of waste (wood, branches, leaves) and by-products (olive pomace, olive mill wastewater, olive stones) (Roselló-Soto et al., 2015; Berbel and Posadillo, 2018) that imply risks of natural resource depletion, phytotoxic effects, and water pollution (Azbar et al., 2004, Paraskeva and Diamadopoulos, 2006). Such risks can influence the environmental protection and resilience to climate change crisis and water scarcity, being some of the core Mediterranean challenges[1]. Thus, the enterprises involved in olive oil production are facing multiple stimuli for a transition towards circular business models and better waste management, pushed institutionally by the regulations (and especially regarding water), societal demands, and resource scarcity. Waste and by-products from olive oil production should not only be considered from a mere 'management or treatment' point of view. Still, they can offer opportunities to be valorised, i.e. to be converted into new value-added and marketable ingredients and products, potentially leading to additional farmers' incomes and a more sustainable and environmentally resilient olive oil value chain.
Business models explain the way an enterprise works and "articulate the logic, the data and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value" (Teece, 2010). Circular business models are a subcategory of business models, which incorporate circular economy principles as guidelines, aiming to fully close product or material loops (Bocken *et al.*, 2019; Donner, Gohier and de Vries, 2020), proposing the creation of value from waste or providing functionality instead of products (Bocken *et al.* 2014). Suchek et al. (2021) suggest business model innovation as one of the topics in their future research agenda for circular economy advance research.
The objective of this work was to understand the factors that influence enterprises to switch to circular business models by valorising olive waste and by-products (for food and non-food applications). We aimed at enterprises from the olive oil sector, either involved in olive oil production or specifically creating value from olive waste and by-products, utilizing multifunctionality of the olive tree and enhancing alternative performance within and beyond the traditional patterns for value creation. Our hypothesis was that these enterprises are influenced by a set of internal and external success factors and barriers.

2. Methods

The methodological approach for this study was qualitative content analysis. Firstly an online search for olive oil company websites was performed to mark the ones with indications of waste or by-product valorisation, which resulted in a database of 41 enterprises of interest. Snowball sampling was employed to get referrals from COLIVE project partners and experts in the olive oil sector to contact the enterprises. The criteria for selecting the enterprises were the diversity of countries and their contexts; diversity of types of initiatives (but, e.g. specialized in waste valorisation vs. non-specialized, family business vs. cooperative, small – large-scale); and business model elements – i.e. the diversity of resources and value propositions. The search resulted in ten cases of entrepreneurial initiatives from the following Mediterranean countries: Tunisia (2), Morocco (1), France (1), Spain (1), Italy (2), Greece (3). For each case, as a preparation, the data available online was compiled (website, videos, articles), and further, semi-structured interviews were conducted with the responsible persons from the enterprises. For the two cases in Tunisia, a field visit was done. Interviews were conducted in English, French, Spanish and Italian language. The essential data of each case was synthesized as follows: name and type of initiative, country and region, principal or side activity, context and background of the enterprise, type of resource valorised, valorisation pathway, and outputs (products) including the enabling and hindering factors and socio-institutional context. The specific focus was on enabling and hindering factors, socio-institutional context, and the role of public policies.

[1] https://www.iamm.ciheam.org/en/about/ciheam/strategic_agenda_2025/challenges

3. Results

Results indicate that two types of enabling and hindering factors influencing the implementation of circular business models exist, internal and external factors.

The principal internal enabling success factors are an environmental concern, resource availability, knowledge about waste valorising technologies and markets, and long-term presence in the sector. The olive oil enterprises can be characterised by their involvement in the circular economy, caring for the environment, especially in the context of water, its scarcity and toxicity of wastewater, and whose enterprise managers are convinced that for the continuation of their activity, there is a need for more sustainable practices, and logistics (territorial synchronized collection of waste has to be well organized and the proximity between the waste generation site and waste valorisation site has a crucial role). The external factors enabling successful implementation of circular business models are legislation and public subsidies, the consumers' role, and circular economy embeddedness in the territorial agenda. Legislative obligations, in particular for the treatment of wastewater and regional norms for the preservation of landscapes, are another push for enterprises to adopt circular economy principles.

Two important hindering factors or challenges for the enterprises are both strong managerial implication (internal factor) and (financial) support from experts, policy and decision-makers (external factor). Firstly, even though the olive oil sector urgently needs subsidies for investments in waste valorising activities, the enterprises do not have any specific support measures. The role of waste management activities is recognized but not supported in practice. Secondly, the much-needed collaboration between enterprises and research centres or universities is rather complicated.

4. Conclusion

Utilizing waste and by-products from the olive oil-producing activity is a long-lasting practice, considering that soap and pomace oil are produced for centuries already. The pioneers in the field are now well-established enterprises showing success also in further innovation in circular business models. The entrepreneurial initiatives involved in olive oil waste and by-product valorisation are using multiple olive tree resources, employing different valorisation pathways, and are an example of an alternative performance of existing olive tree resources both in the olive plantation field and in the processing facilities, providing alternative resource use, and enhancing the economic and environmental resilience of the olive oil value chain.

The sustainable image of an enterprise and its resilience over time is often a driving factor for a further transition towards sustainable and circular business models to keep the promise to clients for engagement in environmental sustainability. The enterprises implementing circular economy business models are driven by a commitment to the environment, in particular, because of the unused high amounts and partly environmentally harmful residues (Donner and Radić, 2021). Mainly in the countries of the north side of the Mediterranean region, legislative obligation, particularly for the treatment of wastewater and regional norms for the preservation of landscapes, is undoubtedly a push for enterprises to engage with a circular economy transitioning towards circular business models. A common feature observed among all the cases is territorial embeddedness as a motivation for implementing circular activities and as a success factor. The most critical discrepancy among the cases regards external support and partnerships.

Despite the positive trends among businesses, olive waste and by-product valorisation, especially for higher added-value applications, is not yet well-established. The question is why. The knowledge transfers from the research level to the implementation in the field and the articulation of needs for research from the enterprises' side represent challenging tasks. More public-private partnerships or multi-stakeholder collaborations, e.g. via joint projects, are needed for further shifting to a circular economy.

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Geographical Indications and Sustainable rural development: possible paths from PDO honey in Italy to Albania

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1. Introduction

In the last twenty years consistent research has underlined the connection between Geographical Indications (GIs) and economic benefits for rural areas, with particular regard to food products; GIs spread not only as an important tool of intellectual and cultural property protection, but also as a considerable agricultural development factor. GIs can be divided into PDOs and PGIs products according to the criteria embedded in production protocols.

The European Union has increasingly assessed the importance of these recognized products for marginal rural areas, connected with the qualities and reputation that each place of origin is capable of guaranteeing (Brunori, Rossi, 2000). The concept of rural development for the European Union could be summarised in three keywords: endogenous, integrated and sustainable (Pacciani, Belletti et al., 2011). As a marketing tool, GIs contribute to raising the economic value of agricultural products, creating a unique identity, the reputation itself. Furthermore, they have positive effects on the so called multifunctionality of agriculture, including tourism as part of a wider sustainable tourism sector, and on the spread of consciousness of citizens about territorial natural resources. As argued by Lamy, in fact, geographical indications are *a wealth multiplier*; they play a fundamental role as a resource and a collective right, which expressly *belongs to communities* becoming a "collective intellectual property". Moreover, they encourage a more balanced distribution of wealth derived from the added value embedded in each product. Therefore, for the European Union, it is important to spread the knowledge about this tool not only in those countries where it is already well known and developed, such as Italy or France. Among agricultural products, honey is certainly one of the most consumed foods in Albania, and beekeeping, especially in the area of Malesa e Madhë, is relatively developed. The consumption of honey per capita is close to one kilogram per year (in Italy it is about half a kilo) and the price of honey, at the time of production, is around 8 euros per kg. The production of honey faced a crucial time of transition in the '90s when it increased by 800%. On the other hand, Italy managed to develop three PDO-certified honey such as ***Miele della Lunigiana D.O.P., Miele delle Dolomiti Bellunesi D.O.P., Miele Varesino D.O.P.*** which can be an example of bottom-up rural development that can be applied to Albania.

2. Materials and Methods

The present contribution **stems from a consistent field research conducted in Albania in 2018-**2019**, within the framework of a Dissertation in Geography of Development; the field work was further backed by an in depth analysis of** Albanian traditional food products supported by Regione Puglia, Slow Food Albania and VIS Albania. The initial results were published within the project "Territories, Sustainability and Universities" (Home Page (geographicalsalad.com). The mentioned field work, in view of the consistent research activity conducted in the past years related to typical products and Certification of Origin, has been strongly enhanced by a sound and updated bibliographic research regarding scientific and institutional sources. Both quantitative and qualitative data and indicators will be used to conduct an in depth analysis of both contexts, to draw up a SWOT analysis and to suggest a possible roadmap for the broadening of the scope of Italian PDO recognized honey to Albanian realities.

3. Results and discussion

The consumption of honey per capita is close to one kilogram per year (in Italy it is about half a kilo) and the price of honey, at the time of production, is around 8 euros per kg and the production faced a crucial time of transition the '90s when it increased by 800% (De Meo G., 2004).

In Albania, honey production is currently concentrated in the north, especially in the areas of **Zadrima**, **Tropojë**, **Reç**, and **Pukë**. These areas are characterized by inaccessible routes and poorer connections than the ones in central and southern areas, but their proximity to the border with other Balkan countries (e.g. Montenegro, the main candidate to join the EU on its next enlargement) could lead to precious advantages. These are indigenous productions and, therefore, possible candidates for the PDO recognition. **Chestnut honey** from Tropojë and Reç already holds a good reputation in Albania, though production certainly needs more support not only for the domestic market but also, above all, for what concerns exports, bearing in mind that, in general, certified honey has a doubled price compared to an uncertified one. In the **forests** of Tropojë, it is also possible to find the so-called "chocolate honey", a chestnut honey characterized by a particularly **dark colour** and a marked sweet taste, mainly produced in June.

Regarding the honey from Pukë, it draws its essence from the different **medicinal herbs** present in this area; it is produced in the entire district and above all in Pukë (13.6 t/year), Gjegjan (12.9 t/year), and Luf-Qerret (12.1 t/year). Weaknesses in the production relate to the fragmentation of production (very small size of companies), the lack of adequate communication routes

(especially to reach the mountains), and the price to pay for investing in the latest technologies to make the sector competitive. Nevertheless, strengths relate to the increased production, as it is already possible to find this type of honey in the markets of Tirana or Durrës. An important impulse is given by the association AgroPuka, founded in 2001, including around 60 farmers from the Pukë region and devoted to promote traditional products with the participation in national fairs and specific events (Mitrovic, 2012).

In the described context, the application of production protocols envisaged for the three mentioned Italian PDOs, together with related economic policies at territorial level, holds a strong potential for the development of rural areas in Albania, in line with the UN SDGs 2030.

4. Conclusion

Geographical Indications for food products play a wide array of functions; the current production protocols of the European Union are not easy to reach, but this can also be seen as an important challenge to improve the entire Albanian agricultural sector. The scenario is diversified; in the northern part, the research and the institution of PDO and PGI marks are more advanced, above all thanks to local NGOs and associations, which have already established a sort of Disciplinary of Production for some products, such as chestnuts and honey. The main weakness is represented by the lack of adequate technologies and the shortage of good local infrastructures for transport; furthermore, the nearest harbor (in Durrës) is not easy to reach from most production villages. Nevertheless, these counties and districts are nearer to the borders with Montenegro and Kosovo, which is, in many cases, an advantage. Broadening the scope of PDO best practices in Italy represents an important and interesting tool to assess the potential of the described sector in Albania, and to draw a road map towards the reach of SDGs at local level.

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By-product valorization strategies implemented by small Mediterranean olive oil farmers

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1. Introduction

Olive oil is one of the most important agri-food products in the Mediterranean, the region that supplies most of the worldwide production (Donner & Radi´c, 2021). In the growing sector of Mediterranean olive oil, commercialization is dominated by a few big manufacturing companies and retailers, which are generally the ones that reach the final consumer and determine the price of olive oil (Rodríguez-Cohard & Parras, 2011). However, most of the production of olives and olive oil still remains in the hands of small farmers, often organized around agrarian cooperatives and social mills (Karanikolasa et al., 2018).
As it is the case with most agri-food sectors, the growth in Mediterranean olive oil production is tied to intensification in all stages of the production chain, a strategy that yields serious negative environmental externalities (Donner & Radi´c, 2021). The waste generated by olive oil production, particularly the by-products of the milling process, is challenging to manage, as it might be phytotoxic, and it has created an environmental problem in the region (Pantziaros et al., 2021). However, current research indicates that olive oil by-products can also be a source of valuable uses if handled with circular economy practices that valorise them (Souilem et al., 2017). These uses range from applications such as bioenergy, animal fodder and biofertilizer, to products for human consumption, such as food or cosmetics (Berbel & Posadillo, 2018; Donner & Radi´c, 2021). A big part of the bioeconomy debate on olive oil by-products focuses on the necessary technological resources, such as the extraction of phenols, needed for their valorisation (Berbel & Posadillo, 2018; Donner & Radi´c, 2021; Pantziaros et al., 2021). On the other hand, some studies also show the potential benefits that implementing by-product valorisation practices could have for small olive oil farmers. The different potential uses of olive oil by-products could be an extra source of income for small farmers and make the farm more resilient and sustainable by re-circulating internal resources (D'Adamo et al., 2019; Pardos i Jordana & Alamon i Beas, 2018; Rodríguez Cohard et al., 2017).
In this paper, we look at what by-product valorisation strategies are implemented by small olive oil producers in the region of Terres de Ponent (Catalonia – Spain) and how these farmers perceive these practices in the context of their farm.

2. Methodology

This research project is part of the EU 7th Framework Programme project COLIVE – *Collective marketing strategies and circular business models for valorizing local food, agro-waste and by-products: example of the olive oil chain*. Fieldwork was done in the region of Terres de Ponent (Catalonia – Spain), which is one of the most relevant olive oil producing regions in the Spain. We chose the potential informants based on the size of their farms and the diversity of the farmers. We established that in this geographical context, a small olive oil production means a farm with less than 100ha dedicated to olive trees. Within this guideline, we looked for different approaches to farm management and the economic activities that complement olive oil production.
We applied a descriptive statistics analysis and a qualitative analysis (using a QDAS) to the data we obtained. We focused on how the small olive oil farmers in the sample manage the most relevant olive oil by-products; olive tree pruning biomass (OTPB), olive pomace and olive stones (Berbel & Posadillo, 2018). The assessment of the strategies and by-product uses implemented by farmers is based on previous studies that indicate that uses for human consumption have a higher value, while uses such as bioenergy or biofertilizer have the lowest value (Donner & Radi´c, 2021).

3. Results and discussion

In the studied sample, the olive oil by-product most commonly valorised by farmers is OTPB. The valorisation of olive oil pomace is also widely implemented in the sample, while olive stones are valorised less frequently. To properly contextualise these results, it is important to note the access to milling infrastructure highly determines what olive oil by-products farmers need to manage. While all the farmers in the studied sample produce olives for olive oil, not all of them incorporate the manufacturing process in their farm's project. In our sample, only 52% of olive oil farmers can fully control the manufacturing process and have

to deal with the waste related to olive and olive oil production. Of the remaining farmers, 17% of them sell their olives unprocessed and 31% commercialize their own olive oil but outsource the milling process, which means they only need to manage olive production by-products.

The main by-product in olive production is OTPB, the waste resulting from the yearly pruning of olive trees and made of branches and leaves. While the traditional practice in the area is to simply burn OTPB, this is changing and 72% of the olive oil farmers of the sample choose to valorise it. The most common use for OTPB is to shred it with special machinery and either leave it in the fields as soil coverage or incorporate it as organic matter. Some farmers value this strategy as a more sustainable approach to fertilizing, while for others shredding OTPB is an alternative to burning now that the regulations for burning on field have gotten stricter in the area. In both cases, most farmers supplement the added organic matter of OTPB with other sources of fertilizer.

As indicated in literature, we have found that the main by-products being valorised out of the olive oil making process are olive pomace and olive stones. Olive pomace is the resulting paste of extracting the oil, made out of olive pulp, skins, stones and water. 40% of the farmers in the sample valorise olive pomace (Berbel & Posadillo, 2018). By far, the most common strategy to use olive pomace is selling it as raw matter to an oil refinery, but some olive farmers also add part of it to the soil as biofertilizer. The farmers in the sample express that they sell olive pomace out of necessity, since it is a type of waste they cannot manage in their own facilities, and not because of the added value it brings. The price of olive pomace is very low and it fluctuates every year (Sanz Cañada & Macías Vázquez, 2005), to the point that some years the money farmers make barely covers the cost of transporting the olive pomace to the refinery. Because of that, they don't perceive this practice as a valuable source of income, but rather as a waste management strategy. Using olive pomace as biofertilizer would be an alternative, but this practice is highly limited by agriculture regulations and it is implemented by only 10% of the farmers.

Circular uses for olive stones are not as widely implemented, but it is an upward trend among the olive oil farmers in the sample. Currently, only 12% of the farmers in the sample valorise olive stones; with special machinery, part of the milling infrastructure, the stones are separated from the wet olive pomace and then let to dry. Later, the olive stones are used as bioenergy for the heating in the milling facility or sold locally for domestic boilers. Even the farmers that don't implement such strategy, look at it favourably as an added resource. However, they express that the equipment to separate stones from olive pomace is an expensive investment.

4. Conclusion

Small olive oil farmers incorporate several strategies to valorise the by-products of olive and olive oil production. Among the different strategies we found, using shredded OTPB as organic matter for the soil and selling olive pomace to oil refineries are the most widespread and solidly established practices in small olive oil farms. Other practices, such as the use of olive stones for bioenergy or olive pomace as fertilizer are less common but gaining acceptance among farmers for their benefits in terms of by-product management. However, all the uses implemented in the studied sample could be defined as low value uses. Using olive pomace to make olive pomace oil, that is, for human consumption, could be defined as a higher value use, but small olive oil farmers perceive it differently. Because of the low price of olive pomace and difficulty to manage it, small olive oil farmers don't perceive any added benefit from valorising it. Overall, the valorisation of olive oil by-products tends to be viewed by small olive oil farmers in Terres de Ponent (Catalonia – Spain) as waste management practices rather than as sources of income or value.

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Panorama of the apple sector in Lebanon: structure and constraints

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1. Introduction

The fact of economic liberalization and globalization, adhesion to the WTO, and the decreasing international trade barriers associated with the creation of free zones of exchange must enhance emerging countries to enforce their capacities in production, sales and exports. Furthermore, in a competitive market where demand is segmented, the ability to create value and secure the benefits while reducing costs requires relevant policy choices. Moreover, in the economic stakes, the issue of quality has increased and the challenges of having in place a real system to guarantee it are required.

Lebanon, amid the emerging countries, with its advantage of water availability and its agricultural potential, has followed a strategy of intensification of fruit production to meet the demand of Arabic countries (Riachi, 2012). At the international level, Lebanon was ranked 47th in 2016 among the producing countries and 20th among the exporting ones (FAO, 2018). It has a self-sufficiency ratio that covers twice the national need, resulting in a significant dependence on exporting its production.

However, several studies revealed that the apple sector in Lebanon, despite its natural advantage, is experiencing difficulties in its operation and coordination (Montigaud et al, 2003; Hssein, 2005; USAID, 2014; Médawar et al, 2008; Aoun et al, 2015; Abi Tarabay et al, 2018) that leads to the situation of non-conformity to international standards, therefore contributing to financial losses for farmers. Hence, the issue of sustainability and survival of households is no longer secured.

Although many interventions were provided by the Lebanese government to encourage actors to use quality standards at the technical level of production as installing the GAP standards and the IP guide, the initiatives are still in the awareness phase.

These difficulties were the driving factors behind this article and will lead to propose our methodology to determine the main constraints and result in proposing several recommendations that might address these problems.

2. Materials and Methods

Our methodological approach combined a questionnaire survey and interviews. The former was carried out between February and June 2017 with 107 producers selected from the Governorate of Mount Lebanon and it covered 6 districts (Baabda, Chouf, Jbeil, Kesserwan, Maten, Aley) whereas, the latter was undertaken through a series of interviews with the associated institutions notably the 6 agricultural regional responsibles of the extension services in Mount Lebanon, and Kafalat Agricultural Credit Officer. The combination of these two tools was completed by "snowball effect", to identify the constraints beyond the simple technical difficulties, and to collect the recommendations of the main actors involved. The first step of our methodological approach was to build a sampling frame. Our sample was constructed on the basis of 3 classes, based on farm sizes (<1ha; 1ha <between <4.5 ha;> 4.5 ha). The survey covered a sample of approximately 10.96% of the total area of apple holdings in Mount Lebanon. The results were analysed through the Excel program and our research was based entirely on the declarations of producers and not supported by precise figures.

3. Results and discussion

The results concerning **the technical conditions of production** reveal that the apple sector is confronted with significant constraints which weaken the sector at the local as well as at the international market level. The cultivation system of apple production in Lebanon mainly reflects traditional practices which are no longer considered to fit the best practices of international standards. The technical itinerary for conventional production, GAP and Integrated Production of apples were prepared by the MoA and distributed to producers, but the problem lie in the difficulty of the farmers' conviction to adopt these standards.

The use of inputs by the small farmers are negatively impacted by the high cost of working force and the high prices of chemicals. Several production limitations were encountered due to inherited low level of experience of apple production, narrow plural activity in other arboreal production, insufficiency and/or inadequacy of logistical and technical actions, inadaptable new varieties to pedoclimatic conditions of the region and presence of wild boars and rats which causes significant damage.

The outcomes of the field survey show that farmers are more or less middle age generation. They are mostly considered to be monoculture holdings (76 %), specialized in apples, the other 24% are multi-skilled and promote the sale of apples through a widened range of agricultural products sales and consequently diversify their sources of revenues.

The majority of farmers are simple producers, their adhesion to cooperatives and syndicates or to CCIA is still embryonic. 82% of the apple producers inherited their land from their ancestors; an inheritance system that leads to the fragmentation of lands.

The share of family labor in the total permanent workforce is around 50% for all farm sizes. The salaried workforce is constituted mainly of Syrians both permanent and seasonal with very low level of education. There is no specialization according to the types of work between family and seasonal foreign nationalities work except for the pruning issues.
Investments in production and farm equipments are generally rudimentary at the farm. The majority of the farmers surveyed opted for 100% self-financing. Those who search other financing sources use USAIDS donations, or borrow via kafalat. The reasons behind the reluctance of farmers in applying for any loans from such institutions are due to the disparity/discrepancies between the terms/conditions of available loans and farmers' capacities. Bank loans to agricultural enterprises represent only 2% of bank credit. Despite the limited credits reported by farmers, Kafalat declares that 25.5% of the employment of their resources in the agricultural sector is allocated to Mount Lebanon, while they have difficulty to be refunded due to the indebtedness of the producers and/or delay to get profits of their resources. A fact that incited small and medium sized farmers to borrow money from traders and consequently narrowed their income margin. **The financing constraints of the investments** causes the agricultural sector to stay traditional and without innovations.
In Lebanon, **extension, research and education** *are integrated* into the agricultural development triangle of the MoA and its affiliated institutions. However, agricultural research is not applied in the extension process, with the exception of the subject of remedies against apple diseases despite the donation supports from the EU and other developed countries.

D. Proposed recommendations

In light of the above, to overcome the technical, and the socio-economic difficulties of the structural and institutional constraints; the proposed recommendations shall be defined in four support initiatives:
- Fostering the emergence of cooperative.
- Promoting an organizational model tool known as Company Networks and market its trademark/tradename for exported apples and labelling them with the geographical reference "Product of Lebanon" to enable firms to collaborate with each other and at the same time guarantee their own independence and autonomy.
- Solving the problem of access to credits by financing the investments through facilitating and moderating the administrative procedures and finalizing the census of Mont Lebanon of landownership in parallel with the establishment of a bank for agricultural credits facilities.
- Fostering the coordination of all actors in a cluster to support the needed changes that rebuild sustainable, economically viable production systems.

4. Conclusion

Despite its undeniable socio-economic weight in mountainous regions, the apple sector is experiencing many difficulties related to technical, economic and social conditions of production. The purpose of this work was to identify precisely these constraints through the examination of some indicators of the structure of the sector in the governorate of Mount Lebanon.
According to the results of the survey, we identified the main constraints that can be resumed in two main headings: structural constraints arising from investment and financing problems and institutional constraints.
This study is not exempt from limitations, and overcoming them could be a line of work for future studies. The analysis was limited to only one region and one crop of the country with little influence from the international policies. In spite of the limitations linked in particular to the regional specificities of apple production, our work opens up three promising research perspectives. The first perspective is to respond to the government's policy of adopting sustainable development for the coming years. The second perspective is related to the analysis of the articulations between the different actors as an "industrial organization" analysis of the sector. The third perspective is more about the effects of niche markets; biological production, and exports.

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Répondre au manque d'inclusion des jeunes dans les systèmes agroalimentaires en valorisant les chaines de valeurs territorialisées
Cas des filières huile d'olive et ovin-lait au Nord-Ouest Tunisien

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1. Introduction

En Tunisie, les jeunes souffrent d'un taux de chômage élevé, avec une tendance à la hausse suite aux retombées de la Covid 19 avec un taux de 40,8% pour la tranche d'âge 15-24 ans, contre une moyenne nationale de 17,8% au premier trimestre de 2021 (INS, 2021). L'insertion des jeunes, et notamment des diplômés, dans l'économie est ainsi une priorité pour assurer le développement et la cohésion sociale de la Tunisie. Les secteurs agricole et agroalimentaire (SAA) pourraient jouer un rôle clé dans l'absorption de la main d'œuvre juvénile, comptabilisant 13,3% du PIB en 2020, mais également 85% de l'emploi informel (INS, 2020). Les SAA, hautement stratégiques et complexes à la fois, nécessitent des investissements importants et un renouvellement générationnel de la main d'œuvre et des chefs d'exploitations afin de faire face aux défis de compétitivité et de transformation durable. Cependant, malgré un cadre de dispositifs publics importants, la mise à disposition de services financiers et un cadre institutionnel dense, le financement des investissements privés dans le SAA se base principalement sur l'autofinancement. La proportion d'agriculteurs bénéficiant de prêts bancaires ne dépasse pas 7% et la part des jeunes et des femmes est encore plus faible. En effet, sur le total des investissements approuvés par l'APIA entre 2011 et 2018, 19,8% des projets approuvés sont lancés par des jeunes de 30 à 40 ans et 8% des projets sont initiés par des jeunes de moins de 30 ans (APIA, 2019).
Par conséquent, il est urgent et nécessaire de concevoir une nouvelle approche qui permettra l'adoption de l'innovation, capable d'absorber l'enthousiasme juvénile, et susceptible de stimuler l'investissement. Le Laboratoire d'économie rurale de l'Institut national de la recherche agronomique de Tunisie (INRAT) a réalisé un diagnostic visant à identifier les principales lacunes et opportunités pour stimuler et pérenniser les investissements des jeunes dans les SAA entre 2019 et 2020, avec l'appui de la FAO, et en collaboration avec l'Agence de promotion des investissements agricoles (APIA) et la Haute école spécialisée bernoise (HAFL). Cette analyse a permis de démontrer que l'insertion des jeunes dans les SAA nécessite une approche novatrice, focalisée sur des filières territorialisées et leur plus grande capacité d'offrir des opportunités d'investissement et d'inclusion pour les jeunes.

2. Matériel et méthodes

La méthodologie utilisée dans notre étude est inspirée d'un outil innovant de planification stratégique proposé par l'équipe FAO/HAFL (Eiselen et Fiedler, 2020). Elle se base sur une approche progressive et itérative, exploitant aussi bien une approche descendante (Top-down) que celle ascendante et participative (Bottom-up) consistant en :

- (i) Une analyse des tendances en matière d'investissement et d'emploi des jeunes, et l'identification de régions et de filières à haut potentiel d'investissement ;
- (ii) un diagnostic de l'environnement entrepreneurial, dans un contexte national et régional ;
- (iii) l'organisation de trois ateliers régionaux participatifs réunissant des représentants des différentes catégories d'acteurs des deux filières retenues (ovin-lait et huile d'olive), débouchant en une identification des agents économiques et leur contribution à l'investissement des jeunes et, par la suite, une cartographie des acteurs au niveau des deux filières ;
- (iv) l'organisation d'un atelier national pour identifier une vision pour les jeunes souhaitant investir dans les SAA ;
- (v) la proposition et la validation de réformes proposées pour une meilleure implication des jeunes dans le cadre d'un deuxième atelier national.

3. Résultats et discussion

- **Le chômage des jeunes, le manque d'investissement et la sous-exploitation des potentiels des filières : un triple défi territorialisé**

Le taux de chômage est caractérisé par des disparités significatives selon les régions, le genre et le niveau d'instruction. A titre d'exemple, la moyenne nationale du taux de chômage atteint 23,8% chez les femmes et 28,3% chez les diplômés de

l'enseignement supérieur et peut atteindre 35% dans le Nord-ouest de la Tunisie pour cette dernière catégorie. La disparité régionale est aussi présente en matière d'investissement agricole : les gouvernorats de l'intérieur se trouvent en tête de liste en matière de nombre de projets avec des valeurs d'investissement relativement faibles, cependant les gouvernorats du littoral détiennent les valeurs moyennes des investissements par projet les plus importantes (APIA, 2019). Les projets approuvés dans les gouvernorats du Nord-Ouest tunisien, quel que soit leur nature et l'âge du promoteur, ne dépassent pas les 15% du total des investissements malgré le potentiel qu'ils offrent en termes d'investissement et donc de création d'emplois pour les jeunes (FAO et INRAT, 2020). Face à ces inégalités territorialisées, force est de constater que des mesures à visée nationale (tel que le prêt foncier) doivent être complémentées par des interventions ciblées à l'échelle des territoires.

- **Les défis et opportunités des « filières territorialisées »**

D'après Stamm et Von Drachenfels (2011), une approche « chaîne de valeur » est de plus en plus reconnue comme la réponse immédiate pour le développement économique durable, la création d'emplois et la croissance inclusive. Les résultats des analyses menées permettent de compléter ce constat en argumentant qu'une approche en termes de « filières territorialisées » pourrait contribuer à une insertion des jeunes en générant des emplois décents et une croissance partagée.

Au niveau de la région du Nord-Ouest, nous avons identifié plusieurs filières ayant un potentiel particulièrement intéressant en termes d'insertion des jeunes et de promotion d'un développement durable, dont les filières huile d'olive et ovin-lait. La filière huile d'olive (HO) connait une extension remarquable des superficies dans les gouvernorats de Kef et de Béja, elle y présente un grand potentiel de valorisation de la production par la qualité liée au territoire (l'huile de Téboursouk à Béja et label huile biologique de Bahra au Kef). Quant à la filière ovin-lait (OL), elle est considérée comme un moteur potentiel de développement territorial ; elle est émergente et attractive vu ses produits typiques et artisanaux à base de lait de brebis sicilo-sarde, pour lesquels le cahier de charge d'une AOC est finalisé (FAO et INRAT, 2020). Les indications géographiques et la mise en place d'un « panier de biens » territorial pourraient ainsi contribuer, d'une part, à rendre les filières plus attractives pour les jeunes grâce à une rente de qualité et, d'autre part, de créer des emplois dans la région.

Cependant, ces filières pâtissent de certains défis qu'il convient de surmonter. Premièrement, des problèmes organisationnels et de gouvernance (surtout pour la filière ovin-lait) ainsi que de faible collaboration entre agents économiques et entités d'appui opérant au sein des filières constituent des réelles barrières d'entrée pour les jeunes et limitent leur capacité d'accéder aux facteurs de production et aux marchés. Deuxièmement, malgré la disponibilité des programmes de formation sur la traçabilité et les labels de qualité, l'accès à des formations spécialisées, à la vulgarisation et au coaching est, selon les jeunes et particulièrement pour la filière HO, à renforcer. Le faible accès des jeunes à l'information, notamment sur les sources de financements et les formations disponibles, constitue un obstacle à leur inclusion dans les deux chaines de valeurs.

- **Des réformes pour une meilleure inclusion des jeunes dans un environnement entrepreneurial plus attractif dans le Nord-ouest tunisien**

Ainsi est-il urgent de compléter les interventions nationales par des mesures ciblant les territoires et les filières qui y sont ancrées. La pierre angulaire d'une telle approche consiste au renforcement de la collaboration et de la concertation entre acteurs opérant le long des filières à travers des activités de médiation et de mise en place de structures de coordination (clusters, plateformes). Des efforts d'organisation et de mise en réseau des jeunes sont aussi requises. La diversification et la promotion des paniers de biens et de services de terroirs pour tirer profit de la rente de qualité territoriale sont aussi nécessaires. Par ailleurs, il faudrait fournir aux jeunes promoteurs des programmes d'accompagnement spécifiques qui leur permettraient de tirer pleinement avantage des opportunités offertes par la rente territoriale. Enfin, il pourrait être utile de consacrer davantage de ressources dans la vulgarisation et la communication des dispositifs nationaux existants afin que ceux-ci soient pleinement compris par les jeunes.

4. Conclusion

Dans cette contribution, nous avons proposé une approche valorisant les filières territorialisées comme un moyen permettant de répondre au manque d'inclusion des jeunes dans les systèmes agroalimentaires et au chômage des jeunes tout en renforçant la cohésion territoriale et le développement inclusif. Il convient de souligner que cette approche doit être intégrée et complémentée par des interventions à visée nationale. On peut en citer à titre indicatif : le renforcement de l'accès au financement à travers la mise en place de fonds de garantie réservés aux jeunes promoteurs, l'encouragement des financements participatifs ou tripartites, la garantie d'un meilleur accès des jeunes aux terres agricoles, un amendement du cadre législatif en y insérant des avantages spécifiques aux jeunes et surtout les jeunes diplômés, la révision du cadre législatif des organisations professionnelles afin de leur donner plus d'autonomie et plus de capacité pour la médiation en termes d'accès au crédit et pour qu'elles soient plus attractives pour les jeunes. Toutefois, les mesures proposées pour une meilleure inclusion des jeunes dans le SAA et qui sont fondées sur une approche novatrice qualitative devraient être complétées par un approfondissement à plus grande échelle et dans des contextes différents.

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PRIX MEDFORUM 2021

PRIX DU JOUR / DAY AWARDS

6 JUILLET 2021

NEZHA MEJJAD

STATE AND PRESSURES ON ECOSYSTEM SERVICES OF AGRICULTURAL LAND IN THE MEDITERRANEAN AREA

JUDIT MANUEL MARTIN

BY-PRODUCT VALORIZATION STRATEGIES IMPLEMENTED BY SMALL MEDITERRANEAN OLIVE OIL FARMERS

The Enhancement of the Specialized Local Food System in Lebanon via Rural/Urban & Rural/Rural Linkages

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1. Introduction

In the midst of liberalism and massive global trade of food and commodities; food security is dependent on humongous systems that aim to deliver big quantities of food via the cheapest channels to masses of ever-growing populations. Local food systems are being deteriorated and the implications of this titanic system on producers, consumers, communities and eventually quality is affecting the social and economic status of small scale producers; the health and nutritional standards of end-consumers and the overall environment: “Not only does an adequate, varied diet contributes to individual health, but the way food is grown, distributed and eaten also profoundly affects the environmental, social, spiritual and economic well-being of the community”. (Feenstra, 1997)

Lebanon has an abundancy of rural small scale producers; covering several categories like Fruits and Vegetables, Provisions, Bakeries, Honey, Wine and Livestock. Their value chains are made out of components that affect directly and indirectly the livelihoods of said producers. This study aims to reveal the social, economic, cultural, psychological and political impacts of the existing value chains on the sustenance of rural small scale producers, while exposing the difficulties and opportunities they face in an ever variable market.

2. Materials and Methods

The literatures that covered the topics of food chains in rural development are infinite, and approaches discussing Alternative Food Networks(AFN) and nested markets that were discussed by the likes of Van der Ploeg and Zhengzhong Si, launched the debate from a generic point of view. While on another hand, Leventon and Laudan propose a direction towards global food security via local sovereignty, defining it as a “localist approach to meeting food security”. Ilbery & Maye channelled the debate into a more commercial level, emphasizing on the Short Food Supply Chain or SFSC, that aims at having producers reconstructing “links with their customer base and to maintain traditional modes of production”.
The aim of this study is to analyse economic practices, existing legislations, trends, evolutions, impact of financial meltdown and opportunities for small scale producers in Lebanon and identifying their willingness to change their operations while detecting shifts in nested markets. We have started with a baseline that clarifies the profile and characteristics of a Rural Small Scale Producer while attempting to study the effects that define their livelihoods and their relative resilience techniques between the Lebanese post-civil war era until the financial crisis of 2019. FAO’s definition of an ‘Agricultural Holding’ provides a global yet comprehensive approach. Nonetheless, our use of the Bosc findings in this study to present different types of family farms, helped us in differentiating between the Entrepreneurial Forms and the Family Forms when it comes to labour, capital, management, home consumption, legal status and land right status; giving us a more thorough context to work with.
Qualitative, quantitative and triangulation methods are employed via questionnaires with different actors contributing to the sector; a) rural small scale producers b) Ministries of Agriculture and Economy & Trade, and d) consumers. The analytical framework is a trilogy of a) the Sustainable Livelihood Framework developed by Chambers and Scoones (Scoones, 1998) (Karam, 2019), b) the empowerment framework advanced by Scheyvens (Scheyvens, 1999) – and c) the Business Model approach adopted by Le Courtois to enhance the induction of smallholders into markets, in her study for the FAO (Courtois, 2011).
The results trace the meticulous value chains and market accesses of farmers and food producers, while understanding the impact on their livelihoods and income repatriations. Furthermore, it focuses on challenges and limitations faced by this group of people, their relative adaption in the post-meltdown and the overall relation of AFNs with the conventional sector.
The study proceeds to describe trends in customer behaviours, and the level of the sector’s dependency on funding and subsidies, marking out the characteristics of usual beneficiaries and the fairness level of donors’ distributions.

3. Results and discussion

The results follow a chronological linear scheme that starts by describing the Lebanese local food system as we know it, then moves to talk about the disruption in the status quo caused by the crisis and COVID-19; to eventually reach signs and characteristics of an emerging new rurality. In order to achieve the, the objective is to create a diagnosis of the situation in order to start enhancing the performances via innovative solutions and affect the resilience of the sector. The below table details the major findings on with we can start building the solutions.

Table 1: Results based AFNs Stakeholders in Lebanon

Tackled Topics	Important Findings
Value Chains Assessment	- All categories share the same base of the value chain: Local Raw Material + Foreign Raw Material => Production => Direct Market Access (Farmers' Markets, Direct sales…) + Indirect Market Access (Specialty shops, Export…)
Impact	- Economic: Farmers' Markets highest sales medium (59%), Specialized shops second (49%) and direct sales third (44%) | Increase of 26.5% dependence on online sales during COVID-19 - Social: Livestock & Dairy engage the most women (58%) while alcohol the lowest, 67% of producers feel supported by their communities however on 30% participate in their Producers' Organization's decision making - Political: Higher negotiations advantages for producers in specialty shops than in supermarkets | Governance of the value chain is weak on the acquisition level as many raw material are controlled by big merchants - Psychological: Average 22/30 score on Rosenberg scale for producers, and that is due to appreciation of consumers (93%) and social interactions (95%).
Challenges	- Absence of standardized pricing mechanisms - Market price is set on the conventional level where economies of scale exist - Packaging is dollarized - Big last minute orders are hard to satisfy - Lack of proper logistics, transportation and distribution infrastructure - Lack of proper implementation in Quality Control mechanisms - Absence of import policies (protection for local produce) - Absence of unification of references within the government agencies
Consumer Behaviour	- Decrease in supermarket shopping from 76% to 43% while the online shopping increased to 73% - Question of quality is of utmost priority however 62% or respondents do not know who grew their food
NGOs Involvement	- Sector heavily subsidized, yet neglecting: acquisition, logistics, Quality Control, legal, packaging and export injections - Focus on Capacity Building and Machines

4. Conclusion

The Lebanese local food system, maintained by the rural small scale producers is in dire need to a reform that allows it to move from a neglected informal status, to a constructed semi-informal framework. And in order to succeed, this new framework needs to take into consideration the definition of agro-food smallholders, the logistical and intellectual needs/education that contribute to their business optimization and finally, the equity of subsidies distribution to make sure that even the ones not showing characteristics of entrepreneurship are benefiting.

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Contribution à l'étude des contraintes liées à la labellisation de l'huile d'olive marocaine

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1. Introduction

Bien que la filière de l'huile d'olive au Maroc soit plus développée que dans les années 80 et 90, elle le reste insuffisamment face à un marché mondial qui est devenu de plus en plus concurrentiel. Des recherches suggèrent que la valorisation des produits des terroirs constitue un des moyens pour créer des emplois (Giovannucci et al., 2009), créer des ponts entre les régions et les marchés (Fresno & Ramírez, 2009), contribuer à la pérennité des terroirs (Zago & Pick, 2004), et renforcer le développement économique des territoires (Bendriss, 2009; El Badaoui & Ait El Mekki, 2017; Marie-Vivien & Chabrol, 2014).
C'est ainsi que le Maroc s'est inscrit dans cette logique. En 2008, avec la réforme de la politique agricole dénommée Plan Maroc vert (PMV), les pouvoirs publics ont mis en œuvre une politique d'accompagnement tournée vers la valorisation des richesses locales de l'agriculture, avec notamment des stratégies d'agrégation, d'encadrement des petites exploitations, l'encouragement et le soutien aux pratiques agricoles modernes et à la promotion des produits du terroir. La situation actuelle montre que plusieurs contraintes persistent au niveau de toute la chaîne de valeur de la sous-filière oléicole labellisée, aussi bien au niveau de l'amont (production, transformation, valorisation), qu'au niveau de l'aval (commercialisation).
Dans ce contexte, il paraît utile, et même urgent de s'interroger sur les problèmes et les contraintes que connaît le développement de la sous-filière de l'huile d'olive labellisée. La problématique de cette recherche est la suivante : quels sont les problèmes et les contraintes au développement de la sous-filière d'huile d'olive labellisée au Maroc ? Pour répondre à cette question, nous avons opté pour des enquêtes auprès des accompagnateurs des services publics marocains chargés de la promotion et de la valorisation des produits des terroirs. L'intérêt de cette recherche est double : contribuer à combler le manque dans la littérature sur ce sujet, et proposer une lecture critique de certaines stratégies de l'Etat en matière de valorisation de l'huile d'olive par des politiques de labellisation. En effet, malgré les incitations du PMV, ce secteur reste embryonnaire. Ainsi il est crucial de bien identifier les points faibles pouvant entraver une stratégie de development des labels.

2. Materials and Methods

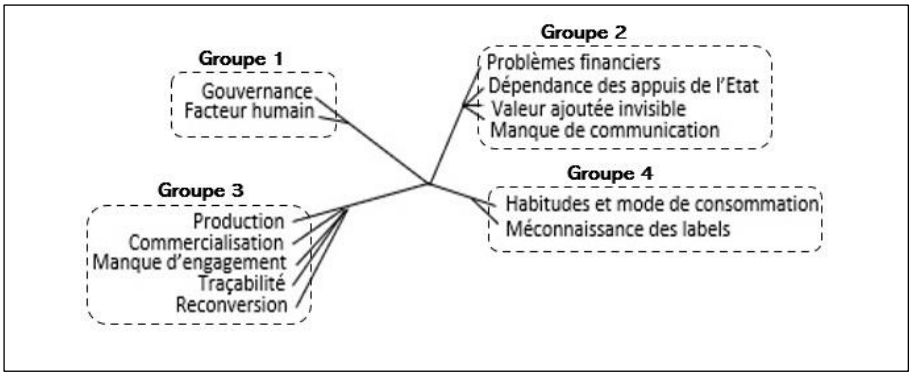
Dans cette recherche, nous avons opté pour une démarche exclusivement qualitative. Le choix de cette approche est adapté à notre objet d'étude dans la mesure, où elle nous permet d'avoir une profondeur dans la description des phénomènes (Ridder, 2012), et de mieux appréhender la complexité du phénomène (Moriceau & Soparnot, 2019). Pour la collecte des données, nous avons procédé par entretiens semi-directifs s'appuyant sur un guide d'entretien, triangulés avec des analyses documentaires. Au total, 12 entretiens ont été effectués dans cette étude. Notre guide d'entretien a été évolutif au fil des entrevues dans la mesure où l'on s'est appuyé sur nos premiers résultats auprès des répondants pour le compléter par d'autres questions émergeantes. Ce guide est structuré autour de deux axes : le premier concerne l'amont agricole (production, valorisation), le second porte sur la commercialisation.
Les entretiens ont été enregistrés et transcrits, de sorte qu'ils puissent être traités et analysés en adoptant la technique d'analyse de contenu (Bardin, 2013) à l'aide du logiciel Nvivo 10.

3. Results and discussion

Au total, nous avons identifié treize (13) contraintes concernant tous les niveaux de la chaîne de valeur de l'huile d'olive labellisée. Au niveau de l'amont agricole, nous avons identifié les contraintes suivantes : facteur humain, gouvernance, valeur ajoutée inaperçue par l'agriculteur, dépendances aux appuis de l'Etat, manque de communication, manque d'engagement, contraintes liées à la commercialisation, au financement, et à la production, reconversion de métier, traçabilité. Au niveau aval, nous avons identifié deux contraintes, à savoir : les habitudes et mode de consommation, la faible notoriété des labels agricoles.

Après l'étape de décontextualisation du corpus, nous avons regroupé en catégories les verbatims porteurs du même sens, et en étroite relation de façon à recontextualiser le corpus. Nous avons ainsi établi quatre groupes de contraintes sémantiquement liés (figure 1).

Figure 1 - Regroupement des contraintes identifiées après reconstruction du corpus.



Source: réalisée par l'auteur

4. Conclusion

Au total, treize facteurs contraignants ont été identifié dans le cadre de cette étude. Le facteur humain apparaît comme le chaînon le plus faible dans les trois domaines : production agricole, valorisation industrielle et gestion commerciale. Cette contrainte se résume à un capital humain insuffisant chez les OPA pour assurer de façon efficace ces trois activités de la chaîne de valeur. D'après notre enquête, il est clair que la plupart des OPA ne sont pas en mesure d'appliquer les bonnes pratiques de production et de valorisation, et ensuite, ils sont dans l'incapacité de mettre en œuvre une véritable stratégie marketing pour faciliter la commercialisation. Cette dernière nécessite un accompagnement de grande envergure pour développer chez les producteurs les compétences nécessaires telles que la gestion commerciale, la négociation, la gestion des aspects contractuels, la gestion logistique à l'export, le montage d'opérations professionnelles de prospection et de promotion. À notre sens, le développement du capital humain à tous les niveaux de la chaîne de valeur est un impératif incontournable pour la promotion des produits agricoles via la labellisation. En parallèle à cela, en matière d'organisation des producteurs, il serait important de dépasser l'approche classique de coopérative et GIE, et d'opter pour des structures avec des modes organisationnels dont le fonctionnement s'apparente aux pratiques d'une entreprise afin de développer un esprit entrepreneurial nécessaire pour conquérir des marchés.
Cette recherche soulève aussi la question des habitudes et du mode de consommation de l'huile d'olive chez les marocains. En effet, nos répondants ont souligné à l'unanimité la faible notoriété de l'huile d'olive labellisée auprès du consommateur marocain.

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Potential Impact of Marine Algal Extracts on Growth, Mineral Content and Essential Oil Composition of Salinity Stressed Fennel (*Foeniculum vulgare* Mill.) Plants.

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1. Introduction

Fennel (*Foeniculum vulgare* Mill.; Apiaceae), a medicinal plant that is native to the Mediterranean areas, has a long history of herbal use. Various parts of this plant can be used for several cosmetic, pharmaceutical, and food goals (Bahmani et al. 2015).

Salinity is one of the major abiotic stresses in worldwide unfavourably affecting plant production and leads to a series of molecular, biochemical, physiological and morphological changes that adversely affect plant development (Hafsi et al. 2007).

The application of exogenous growth-promoting compounds, including marine algae extracts, enables plant species to considerably lessen environmental stress effects, including salinity (Lakhdar et al. 2009). Marine algae live in harsh environmental conditions and synthesize several metabolites with diverse structures and interesting activities to many biotechnological purposes (Torres et al., 2014). Therefore, their cells possess strategies for rapid formation of secondary metabolites, which protect them against extreme conditions (Gonzalez et al., 2009). Thus, it is interesting to select the potential of algal extract for enhancing growth of salinity stressed plants and applying this technology for sustainable agriculture purposes.

Besides an increased demand for fennel due to its several beneficial uses, since it has been announced that fennel is a moderately sensitive plant to salinity (Semiz et al. 2012), it is needed to find a way to help this plant to tolerate salt stress condition. On the other hand, since Mediterranean region is one of the main producers of fennel and its most plant habitats and agricultural lands is saline soil, this study was conducted to investigate the response of fennel plants to different level of salinity, and Alleviating role of seaweed extracts in such conditions.

2. Materials and Methods

The fresh seaweed samples were homogenised in distilled water (1:1 w/v) then filtered through Whatman No. 1 filter paper. From the latter extract, 10% algal extract was prepared using distilled water. Fully ripened fennel seeds were surface sterilized then rinsed with sterilized distilled water and air-dried at an ambient temperature. This experiment was conducted in plastic pots using a randomized complete design with three replications under greenhouse conditions. The factors were salinity stress (0,40 and 80 mM) and Marine algae extract (MAE) application. Two leaf seedlings were separated in groups irrigated with a Hoagland's nutrient solution supplemented with different NaCl concentrations. For MAE foliar treatment, 10% MAE solutions were sprayed evenly over the seedlings to the dripping point. The growth traits were investigated 105 days after transplanting. Essential oil percentage was determined in the fruits by hydrodistillation using Clevenger apparatus. Sodium (Na), calcium (Ca), and potassium (K) contents of root and shoot were measured with a flame photometer. Analyses of the essential oil were performed using an Agilent 7890A gas chromatograph (GC) coupled to an Agilent 5972C mass spectroscopy detector with electron impact ionization (70 eV). All parameters were subjected to a one-way-analysis ($P < 0.001$) and compared using Tukey's test at 5% of probability.

3. Results and discussion

Table 1: Effect of interaction between biostimulant application and salinity concentrations on vegetative growth and mineral elements content of fennel *Foeniculum vulgarae* Mill at 105 days from transplanting.

	Standard solution			Marine algae extract		
	0 mMol	**40 mMol**	**80mMol**	**0 mMol**	**40 mMol**	**80mMol**
Plant height (cm)	56.25±1.93^{ab}	46.43±2.01^{cd}	41.94±0.58^{d}	60.10±2.84^{a}	58.22±2.99^{a}	52.01±0.59^{bc}
No. of branches	10.91±0.01^{b}	9.33±0.56^{c}	7.86±0.01^{d}	11.95±0.01a	10.80±0.01^{b}	9.06±0.08^{c}
No. of umbels	10.30±0.12^{c}	8.76±0.01^{d}	8.18±0.05^{e}	11.66±0.27^{a}	11.32±0.21^{a}	10.84±0.10^{b}

Fresh weight (g)	433.14±2.98^{b}	405.56±4.73^{c}	289.45±1.52^{d}	526.53±6.02^{a}	436.01±5.57^{b}	293.47±4.04^{d}
Dry weight (g)	61.78±0.59^{b}	45.16±2.98^{c}	30.51±0.05^{d}	65.86±3.53^{ab}	71.21±5.00^{a}	34.44±0.50^{d}
Fruit's weight(g)	8.51±0.36^{ab}	7.80±0.28^{c}	5.34±0.36^{d}	9.10±0.03^{a}	8,68±0.15^{ab}	8,17±0.13^{bc}
Na content (g/100g dw)	19.31±0.31^{e}	36.45±1.95^{c}	46.45±1.81^{a}	19.91±0.59^{e}	31.96±0.90^{d}	40.69±1.80^{b}
K content (g/100g dw)	25.65±0.35^{c}	27.12±1.47^{bc}	28.68±1.26^{bc}	30.95±1.75^{b}	29.75±0.61^{b}	37.74±2.17^{a}
Ca content (g/100g dw)	1.29±0.16^{a}	1.57±0.44^{a}	1.47±0.39^{a}	1.69±0.15^{a}	1.41±0.34 ^{a}	1.47±0.28^{a}

Table 2: Proportion (%) changes of essential oil yield and main components in *Foeniculum vulgarae* Mill seeds as influenced by salinity and Marine algae treatment.

Biostimulant	Salinity	Essential oil yield	Limonene	Fenchone	Estragole	*Trans*-Anethol
Standard solution without biostimulant	0 mMol Nacl	2.28±0.14^{d}	3.59±0.28^{d}	9.12±0.01^{c}	3.44±0.04^{d}	74.55±2.53^{ab}
	40 mMol Nacl	3.32±0.16^{c}	4.12±0.28^{cd}	9.36±0.04^{c}	4.58±0.26^{c}	70.24±0.01^{b}
	80mMol Nacl	3.89±0.06^{b}	5.52±0.34^{b}	10.11±0.08^{b}	6.52±0.01^{b}	60.61±0.04^{c}
Marine algae extract	0 mMol Nacl	2.52±0.10^{d}	4.06±0.08^{cd}	9.28±0.07^{c}	3.16±0.03^{d}	78.20±0.02^{a}
	40 mMol Nacl	3.37±0.07^{c}	4.26±0.13^{c}	9.33±0.02^{c}	7.78±0.11^{a}	70.49±2.50^{b}
	80mMol Nacl	4.16±0.13^{a}	6.43±0.06^{a}	12.29±0.17^{a}	7.79±0.14^{a}	62.85±2.52^{c}

Table1 showed that the fennel plants treated with different NaCl concentrations recorded a significant decrease in their growth parameters when compared with unstressed plants. The treated plants with MAE recorded a highly significant increase in all tested growth parameters when compared with untreated seedlings. Moreover, treatment plants with MAE reduced the repression effect of salinity stress by improving all growth parameters compared with "Control". Results showed that Na^{+} content of fennel shoots was significantly increased under all salinity levels. MAE induced a more accumulation of Na in salt-treated fennel plants, that was significant in some cases. According to the results, K content of shoot was decreased in salt-treated fennels compared to their corresponding controls. MAE induced an increase in the shoot K content of all salt-treated plants, compared to those not treated. Ca content of fennel shoots was not significantly affected by salinity stress and MAE did not significantly change shoot Ca content of salt-treated fennel plants (Table 1). Decreased plant growth under salt stress is due to the integrated destructive effects of nutritional disorders and ion toxicity in soil solution (Munns 2002). Stimulatory effect of MAE could be attributed to the existence of some bioactive compounds as ascorbic acid, auxins and gibberellins in this extract which mitigate the adverse effect of salinity (Nassar et al., 2016). Also, the presence of inorganic phosphate in MAE plays a crucial role in energy transfer, growth and protecting plants from salt toxicity. Significant changes of essential yield were observed among the different salt concentrations. Similar results were recorded for fennel (Semiz et al. 2012) seeds. Salinity improved the percentage of Estragole, Limonene and Fenchone compared to the control. However, the salt stress decreased the level of Trans-Anethol under the different NaCl levels. Thus, salinity and Marine algae treatments induced the modification of the essential oil composition and this change of essential oil and its constituents may be due to its effects on enzyme activity and metabolism (Bettaieb et al., 2015).

4. Conclusion

Our results confirmed that foliar treatment of plants with algal is an effective technology in solving one of the most widely serious problems in agriculture production. Consequently, study should continue to isolate the main active compounds that could be used in alleviation of salinity and determine the efficiency of these materials under natural field condition.

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Application of a traditional pre-treatment as a green method to improve the quality of raisins

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1. Introduction

In Tunisia, the production of table grapes accounted for up 140.000 tons in 2019 (FAOSTAT, 2019), of which the Italia variety presented more than 80%. However, fresh table grapes are rapidly perishable and must be delivered to consumers within less than 6 weeks after harvest. Otherwise, this production is considered as an over-production which cannot be conveniently and rapidly commercialized at the local market scale (Zemni *et al.*, 2017). Thus, turning grapes into raisins could be an alternative to overcome this surplus and decrease economic losses. In the present study, we aimed to evaluate the effect of different processing conditions including drying temperatures and pre-treatments on the quality of the obtained raisins. A traditional pre-treatment method inspired from a common practise by Tunisian local farmers was studied in the view to substitute chemical pre-treatments usually used in the raisin industry and produce healthier dried grapes.

2. Materials and Methods

2.1. Plant material and drying experiment

Grapes (*Vitis vinifera* L.) cv. Italia were collected at maturity from a vineyard in Mornag (North-Eastern Tunisia) during mid-September 2018. In this study, three kinds of samples were compared: grapes dipped into an alkaline solution of sodium hydroxide (SH), a chemical pre-treatment; traditional method of drying (Trad) in which raisins were obtained after cutting grape berries lengthwise but, with no other pre-treatment; and no pre-treatment whatever (control C). Drying of grapes was carried out in a convective oven at 3 temperatures (50, 60 and 70ºC) until the equilibrium in moisture content was reached.

2.2. Physico-chemical and organoleptic characterisation

Moisture content, proteins, ash, total soluble solids (TSS), total acidity and pH were determined according to AOAC methods (AOAC, 2000). Polyphenols were analysed using high performance liquid chromatography (HPLC). Volatile compounds were extracted by head-space solid phase micro-extraction (HS-SPME) and characterised using gas chromatography mass spectrometry (GC-MS). Sensory analysis was carried out by a trained sensory panel composed of 12 panellists which scored the raisin samples for the intensity of attributes using an unstructured line scale from "very weak =0" to "very intense=10".

2.3. Statistical analysis

Analysis of variance (ANOVA) was used to identify differences between treatments, at 2 factors (temperature and pre-treatment) given the global behaviour and at 1 factor (sample) to compare the 9 drying conditions together. Means were compared by the Tukey-Kramer's test, at a significance level of $p<0.05$ and correlations between parameters were performed using XLSATS 2019.4.2 (Addinsoft (2020), Paris, France).

3. Results and discussion

3.1. Physico-chemical, phenolic and aromatic characteristics

Table 1. Raisin physico-chemical characteristics

Sample	Moisture content (% w.b.)	Protein (g/100g D.W)	Ash (g/100G D.W)	pH	Total acidity (g tartaric acid/100g D.W)	TSS (%)
50_C	22.09 bc	1.92 ab	4.98 a	4.23 c	2.05 cd	38.37 ab
60_C	23.89 a	2.01 a	3.70 ab	4.13 e	2.68 b	39.80 ab
70_C	22.86 ab	1.61 ab	2.76 b	4.23 c	2.08 cd	37.03 ab
50_SH	21.80 bc	1.66 ab	2.55 b	4.26 b	1.99 d	37.80 ab
60_SH	21.12 c	1.95 ab	3.11 b	4.18 d	2.58 b	40.07 a
70_SH	21.65 c	1.62 ab	2.91 b	4.18 d	2.18 c	37.63 ab
50_Trad	19.30 d	1.60 b	3.13 b	4.46 a	1.62 e	39.70 ab
60_Trad	22.79 ab	1.98 ab	3.27 b	4.17 d	2.89 a	39.43 ab
70_Trad	19.23 d	1.65 ab	3.27 b	4.27 b	2.12 cd	36.37 b

Results outlined in Table 1 showed that both factors (temperature and pre-treatments) have a significant effect on the moisture content, pH and total acidity of Italia raisins (Khiari *et al.*, 2021). Our findings are in line with the results reported by Zemni *et al.* (2017). No real significant differences were noticed between the assays ($p>0.05$) for the protein content, ash and TSS.

Regarding phenolic compounds, nine polyphenols were identified (Table 2). Drying conditions led to the increase of phenolic acid concentrations, while levels of flavonoids and flavanols were decreased. In general, 60_Trad condition allowed the preservation of most polyphenols.

Table 2. Percentage of phenolic compounds of raisins compared to fresh grapes

Sample	% Caftaric acid	% Coutaric acid	% Fertaric acid	% Gallic acid	% Catechin	% Epicatechin	% Procyanidin B2	% Quercetin-3-glucoside	% Rutin
50_C	-48,83 e	-70,86 ef	2,54 e	107,99 c	-53,21 ab	-44,31 ab	-19,84 ab	-88,96 f	-100,00 d
60_C	-18,51 b	-49,17 b	46,33 b	175,19 b	-67,06 bc	-58,80 bc	-54,69 bc	-79,99 de	-86,42 c
70_C	-57,48 f	-73,73 f	1,84 e	228,17 a	-72,53 cd	-67,14 cd	-41,32 bc	-68,30 b	-79,46 b
50_SH	-42,29 d	-65,03 d	22,70 c	106,42 c	-57,60 ab	-50,73 abc	-28,45 abc	-74,69 cd	-100,00 d
60_SH	-20,99 b	-47,65 b	53,98 b	232,25 a	-81,23 de	-77,69 d	-62,63 c	-82,14 e	-87,86 c
70_SH	-47,41 e	-66,57 de	18,22 cd	245,78 a	-51,34 a	-39,29 a	-20,62 ab	-67,03 b	-70,51 a
50_Trad	-32,80 c	-58,11 c	6,64 e	76,63 c	-60,36 abc	-49,32 ab	-44,24 bc	-74,49 c	-100,00 d
60_Trad	21,94 a	-23,44 a	70,31 a	73,19 c	-59,38 abc	-52,45 abc	-39,33 bc	-58,46 a	-68,75 a
70_Trad	-59,88 f	-63,68 d	8,83 de	256,51 a	-90,83 e	-83,09 d	9,17 a	-76,09 cd	-79,23 b

The volatile compounds detected in the studied raisins include terpenes, acids, aldehydes, ketones, alcohols, furans and pyrazines. These latter components are generally produced during the process of drying as a result of the Maillard reaction (Wang *et al.*, 2020). The abundant aromatic series detected in our raisins were floral and fruity (especially in Trad_60 raisins), except in Trad_70 and 60_SH samples, which were characterised by the abundance of roasted flavours.

2.1. Sensory analysis

According to sensory analysis (Figure 1), panellists scored all raisin samples as sweet and firm with a little bit of sourness, astringency and bitterness. Flavour attributes the most perceived included fig, prune, red berry, caramel and quince. 60_Trad samples showed higher level in the perception of floral, lemon and Muscat wine flavours. The results obtained by sensory analysis were in accordance with the volatile profile. In fact, the mixture of aromatic compounds detected in this study were reported to strongly contribute to raisins characteristic like floral, fruity and roasted aromas (Wang *et al.*, 2020).

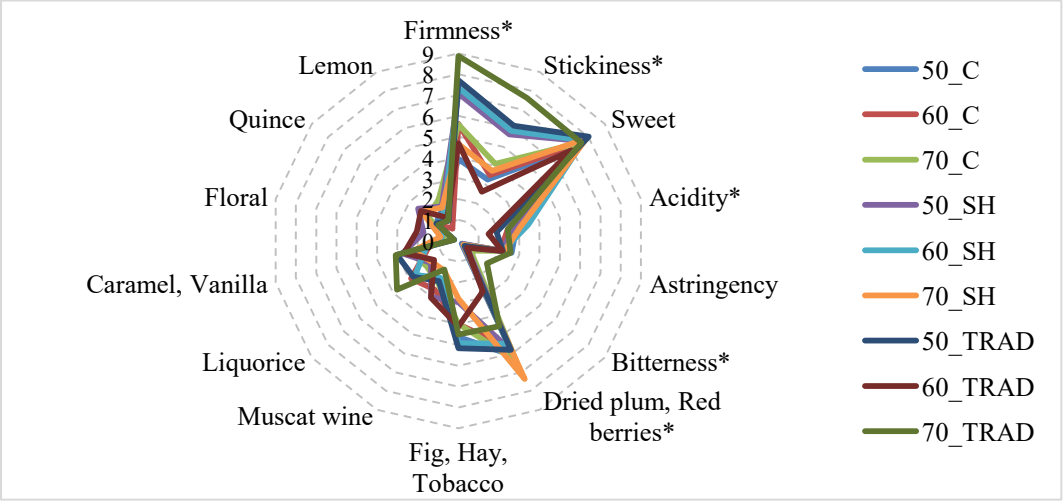

Figure 1: Description of raisin samples according to sensory analysis by trained panel. * means significant differences for the factor pre-treatment and/or temperature.

4. Conclusion

The present study showed that the application of both drying at 60°C and Trad pre-treatment allowed to produce raisins rich in protein, sugars and acids as well as polyphenols. According to sensory and aromatic analyses, 60_Trad samples were characterised by their floral and quince aromas as well as a lower firmness, while 70_SH raisins were differentiated by their fruity aromas. Our findings demonstrated that using traditional pre-treatment could be considered as a promising green method to substitute chemical pre-treatment and produce healthy and natural raisins.

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Nicotiana glauca Graham: an emerging threat to crop fields in Tunisia

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1. Introduction

Invasive species are major global change drivers and are considered as one of the most serious threats to the biodiversity (Linders et al., 2019). The tree tobacco *Nicotiana glauca* Graham (# NIOGL), a cosmopolitan invasive shrub, is native of Northwest Argentina and Bolivia (Issaly et al., 2020). It has become an environmental concern in many parts of the world because of its fast-growing in a wide range of habitats (Alharthi et al., 2021).
In Tunisia, introduced as an ornamental plant and for anti-erosion treatments (Le Floch et al., 2010), NIOGL is became naturalized, especially, in semi-arid regions where it started to colonize crop fields. The aim of this study is to update NIOGL status in Tunisia and monitor its spread in Chott-Meriem, a semi-arid region in which the plant has recently started spreading rapidly and has required control measures.

2. Materials and Methods

Field surveys were performed during June-July 2020, in the region of Chott-Mariem (35°90'-35°99' N and 10°50'- 10°60' E). Prospection was achieved following primary and secondary road networks to suruey the whole surface of the studied areas. NIOGL invasion is mapped as occurrences of populations using a handheld GPS (Garmin eTrex Vista, 12 channels). The plant distribution map is produced using the R software.

3. Results and discussion

We recorded a total of 20 NIOGL patches across the studied site. Field monitoring reveals that NIOGL has the ability to grow in a broad range of disturbed habitats, including roadsides and residential areas. Along roadsides, 7 linear and continued infestations were recorded along 5 km (Figure 1). Nevertheless, the plant is also frequent in agriculture areas and 30% of the plant occurrence is recorded in field crops (Figure 2), where it is growing as isolated patches. These findings show that, after more than five decades lag time, NIOGL has started invading agroecosystems and become a serious threat for agriculture areas.

Figure 1: *Nicotiana glauca* linear infestation along roadsides in Chott-Meriem, Sousse (Tunisia) in 2020

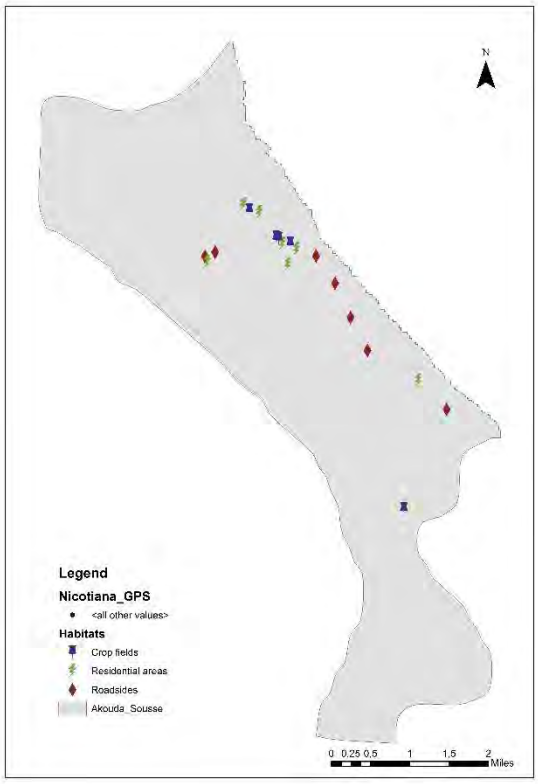

Figure 2: *Nicotiana glauca* distribution map in Chott-Mariem, Sousse (Tunisia) in 2020.

4. Conclusion

Our study results draw attention to the colonization potential of NIOGL. Its distribution mapping allows to i) characterize the plant distribution pattern in disturbed habitats, including roadsides, residential areas and crop fields, and ii) estimate its spatial extent which lead to predict future infestations. Furthermore, our findings suggest the implementation of a specific management plan for this species including local eradication and awareness campaigns.

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Soil Biostimulant Application on Tomato Seedlings

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Abstract

The aim of this work was evaluate the effect of soil biostimulant called Bio Humate®, based on humic substances, in the vegetative development of Justyne® hybrid tomatoes grown in the greenhouse.
The commercial soil biostimulant Bio Humate® is applied to three replicates of Justyne® hybrid tomatoes per treatments during two sampling stages (at 42 and 56 days after transplanting (DAT)) with application on every 14 days, starting at 7 DAT.
The soil application of the Bio Humate® biostimulant demonstrated in the best results of application in fresh vegetative parts while chlorophyll contents are the lowest at 56 DAT. In conclusion, the optimal utilization of Bio Humate® to hybrid tomato seedlings are 56 DAT for vegetative growth even the chlorophyll content is lowest.

Keywords: Tomato, *Lycopersicon esculentum* L., Biostimulant Bio Humate®, Justyne®

1. Introduction

The cultivation of tomato is an activity with great economic potential in the world as well as in Brazil. According to the IBGE-Brazilian Institute of Geography and Statistics, the tomato (*Lycopersicon esculentum* L) is planted on approximately 62,000 hectares in Brasil, with 4.5 million tons harvested in 2018 (IBGE, 2018). Among the various existing growing techniques for tomato cultivation in the more environment friendly is the use of cultivars that are more adapted to the climate and the region, as well as more resistant to certain pests and diseases. In this sense, the long-lasting, early to medium cycle, vigorous and indeterminate growth of Justyne® hybrid serves as an alternative (TAKII, 2018). In addition to that, the use of fertilizers with less environmental impacted components such as humic substances, during agricultural practices can result in higher agricultural productivity combined with higher quality. According to Calvo et al. (2014), humic substances can be considered as "biostimulants" (although there is no concept for the word, legally defined in Brazil) of plants for their growth promoting action due to increased roots and greater absorption of nutrients. The soil application of humic acid is stimulated photosynthesis (Baldotto et al., 2009; Ertani et al., 2011), respiration, protein synthesis (Nardi et al., 2002) and enzymatic activities (Nardi et al., 2007) in different cultivars. However, its combined application in biostimulants on tomato seedlings correct application period is not well defined for optimizing the vegetative growth and future productivity with definition of best concentration of it. Therefore, the objective of this study was evaluate the influence of soil biostimulant called Bio Humate®, based on humic substances, in the vegetative development of Justyne® hybrid tomatoes grown in the greenhouse.

2. Materials and Methods

The experiment was carried out in a greenhouse at the Tuiuti do Paraná University, located in the city of Curitiba, Paraná and its design was completely randomized with a two-factor factorial arrangement (4 doses of the product x 2 evaluation dates) applied to the commercial soil biostimulant Bio Humate® to three replicates of Justyne® hybrid tomatoes per treatments during two sampling stages (at 42 and 56 days after transplanting (DAT)) with application on every 14 days, starting at 7 DAT. The product used for the application was Bio Humate® (MAP No SP-80819 10067-4) with the following properties (weight / weight with a density of 1.20g mL^{-1}): 6.5% of total organic carbon; 0.15% N; 5.0% K_2O and 0.05% P_2O_5 including 36% of humic substances, derived from Leonardite, being 24% of humic acids and 12% of fulvic acids.

3. Results and discussion

The soil application of the Bio Humate® biostimulant demonstrated in the best results of application in fresh vegetative parts while chlorophyll contents are the lowest at 56 DAT. In conclusion, the optimal utilization of Bio Humate® to hybrid tomato seedlings are 56 DAT for vegetative growth even the chlorophyll content is lowest.

4. Conclusion

The application of soil biostimulant Bio Humate® fertilizer had a positive effect on the vegetative development of tomato Justyne® hybrid seedlings growth in the greenhouse.

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Chemical and functional characterizations of different cereal and pseudocereal flours: rice, maize, quinoa and chia

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1. Introduction

Pseudocereals are becoming a current trend in human diets with excellent nutritional value since consumers are more conscious towards the environmental and nutritional benefits of foods. They are a good source of starch, fiber, proteins, minerals, vitamins, and phytochemicals. Therefore, in the last decade, they are used not only in special diets for people allergic to cereals, but also in healthy diets. Thus, the objective of this study was the characterization of chemical and functional properties of different varieties of cereal and pseudocereal flours: rice, maize, white quinoa, red quinoa and chia. This study highlighted the importance of the use of these flours in the development of products with high nutritional value and interesting techno functional properties.

2. Materials and Methods

Raw pseudocereals were obtained from the National Institute for Research in Rural Engineering, Water and Forests (INRGREF). Rice was grounded into flours using a laboratory mixer (Cyclotec, Foss, Germany). Maize flour (Napolis brand, Tunisia) was bought from supermarket. Flour proximate composition was assessed by standard AOAC methods [1]. Total polyphenols and flavonoids contents were measured by the procedure of Dewanto et al. [2]. Condensed tannins content was evaluated using Sun et al. method [3]. The radical-scavenging activity of the analyzed methanol extracts was determined spectrophotometrically against DPPH radical [4]. Water absorption of different flours was measured by the centrifugation method of Sosulski [5]. Determination of oil absorption was performed using the method of Lin, Humbert, and Sosulski [6]. Least gelation concentration of flours was determined by the method of Sathe, Deshpande, and Salunkhe [7]. Emulsion properties of flours were evaluated according to Naczk, Dtosady et Rubin [8]. Foaming properties of flours were determined according to the method given by Lin et al. [9]. All analysis were done in triplicate (n=3). Statistical analysis of the results was performed using IBM SPSS statistics 25. Data were analyzed using one way ANOVA (Analysis of variance).

3. Results and discussion

Table 1 indicated changes in chemical composition of cereal and pseudocereal flours. Flour carbohydrate contents fluctuated from 32.86 to 75.25 g/100 g. The minimum value was observed for pseudocereals (Chia), whereas cereals (rice) had the highest carbohydrates value. Flour protein contents varied from 10.26 for rice to 22.304 g/100 g for chia while fat levels ranged from 0.401 for rice to 35.98 g/100 g for chia (Table 1). Ash contents varied from 0.71 to 4.14 g/100 g, the highest for chia flour and lowest for rice flour. Interestingly, total polyphenol contents were higher in pseudocereal flours (especially in Chia flour) in comparison with cereal flours. Flavonoid contents in different flours ranged between 0.18 mg CE/g and 1.83 mg CE/g, chia flour had the highest value. Condensed tannin contents varied from 0.28 mg CE/g to 1.68 mg CE/g. The highest value was for rice flour and the lowest for maize. Moreover, these data clearly showed higher antioxidant activity in pseudocereal flours, in particular for chia and red quinoa compared to studied cereal ones.

Parameters	Cereal		Pseudo cereal		
	Rice	Maize	White Quinoa	Red Quinoa	Chia
Ash (g/100g)	0.71 ± 0.03^{a}	0.95 ± 0.0004^{b}	2.02 ± 0.003^{c}	2.02 ± 0.02^{c}	4.14 ± 0.01^{d}
Protein (g/100g)	10.26 ± 0.62^{a}	10.42 ± 0.20^{a}	13.63 ± 0.37^{a}	14.54 ± 0.89^{ab}	22.304 ± 2.85^{c}
Fat (g/100g)	0.401 ± 0.03^{a}	4.15 ± 0.01^{b}	7.24 ± 0.66^{bc}	8.019 ± 0.99^{c}	35.98 ± 0.46^{d}
Carbohydrates (g/100g)	75.25 ± 0.63^{c}	71.90 ± 0.25^{bc}	66.84 ± 0.27^{bc}	65.22 ± 1.78^{b}	32.86 ± 3.36^{a}
TPP (mg GAE/g)	0.2 ± 0.01^{a}	1.04 ± 0.06^{b}	0.95 ± 0.03^{b}	0.83 ± 0.05^{b}	2.11 ± 0.08^{c}
Flavonoids (mg CE/g)	0.18 ± 0.01^{a}	0.21 ± 0.04^{a}	0.19 ± 0.06^{a}	0.31 ± 0.02^{a}	1.83 ± 0.16^{b}

CT (mg CE/g)	1.68±0.16^{c}	0.28±0.02^{a}	0.64±0.04^{ab}	0.79±0.03^{b}	0.58±0.04^{ab}
DPPH (%)	34.65±1.53^{a}	47.64±6.18^{a}	78.19±0.44^{b}	84.37±1.18^{b}	88.63±1.69^{b}

Table 1: Chemical characterization of the different flours
CT: Condensed tannins, TPP: Total Polyphenols, GAE: Gallic Acid Equivalent, CE: Catechin Equivalent.
Mean ± S.D. with different superscripts in a row differ significantly ($p < 0.05$).

Functional properties of the different flours were reported in Table 2. Pseudocereal flours had higher WAC than cereals especially chia flour. In addition, red Quinoa had highest OAC. The lowest LGC was observed in rice and white quinoa flours. Rice flour had the most important EA while white quinoa flour had the highest ES. Interestingly, white quinoa flour had higher foaming capacity and red quinoa flour had the most important foam stability after two hours of storage than the other flours.

Parameters	**Cereal**		**Pseudo cereal**		
	Rice	**Maize**	**White Quinoa**	**Red Quinoa**	**Chia**
WAC	0.94±0.11^{a}	1.45±0.15^{a}	1.73±0.007^{a}	1.61±0.01^{a}	7.39±1.15^{b}
OAC (g/g)	0.96±0.06^{bc}	0.79±0.005^{ab}	1.15±0.004^{cd}	1.18±0.01^{d}	0.75±0.03^{a}
LGC (%)	8	10	8	18	12
EA (%)	70.67±0.09^{b}	36.62±0.51^{a}	69.16±5.83^{b}	70.29±2.43^{b}	60.71±3.57^{b}
ES (%)	83.33±0^{b}	51.58±5.61^{a}	88.31±2.59^{b}	84.61±0^{b}	77.27±4.54^{b}
FC (%)	21.12±1.51^{b}	7±1^{a}	31.72±0.35^{c}	29.09±3.60^{bc}	4±0^{a}
FS (20 min)	19.20±1.55^{b}	3±1^{a}	26.89±1.40^{b}	29.09±3.60^{b}	2±0^{a}
FS (40 min)	19.20±1.55^{b}	1±1^{a}	22.4±1.38^{bc}	26.20±0.71^{c}	2±0^{a}
FS (60 min)	17.27±1,59^{b}	0±0^{a}	19.23±0,36^{b}	24.26±0.73^{c}	2±0^{a}
FS (120 min)	7.69±0.14^{ab}	0±0^{a}	8.71±3.05^{bc}	16.51±1.13^{c}	1±0^{ab}

Table 2: Functional characterization of the different flours
WAC: Water absorption capacity, OAC: Oil absorption capacity, EA: Emulsifying ability, ES: Emulsion stability, FC: foaming capacity, FS: Foam stability. Mean±S.D. with different superscripts in a row differ significantly ($p < 0.05$).

4. Conclusion

The results of this study showed that pseudocereal flours have high nutritional value. They are rich in Protein, minerals and phytochemicals. They had high antioxidant activity and low condensed tannins. They perform interesting techno-functional properties. Chia flour showed high WAC, red quinoa exhibited high OAC and foam stability, white quinoa had the lowest LGC, the highest emulsion stability and the most important foaming capacity. They can contribute to sustainable healthy diets, by biofortifying cereal products. Therefore, pseudocereal flours have a great potential to be used in food industry comparing to cereal flours. This result makes them as a serious ingredient for the purpose of formulating new products or for the replacement in food products made from various conventional flour sources.

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Amélioration de la qualité fonctionnelle et nutraceutique de cake par l'ajout de la poudre d'*Erodium glaucophyllum*

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1. Introduction

Les produits naturels sont des ressources inestimables, utiles dans la vie quotidienne comme additifs alimentaires, arômes, parfums ou colorants. Il est connu que les produits à base de la farine blanche sont considérés comme des produits raffinés ayant une faible capacité antioxydante. En raison de leur consommation généralisée dans le monde entier, ils pourraient être considérés comme un véhicule intéressant pour les compléments fonctionnels. Dziki (2014) a passé en revue les tendances actuelles en matière de renforcement de l'activité antioxydante des produits à base de blé en ajoutant des matières premières riches en antioxydants phénoliques. Cependant, peu d'études ont été consacrées à l'enrichissement du produit de pâtisserie en poudre de plantes. Dans ce contexte, on a visé par ce travail de valorisé une plante médicinale dans un produit alimentaire dans le but d'améliorer ses qualités fonctionnelle et nutraceutique

2. Materials and Methods

1- Matériel végétal

Erodium glaucophyllum a été collectée à partir de la région de Boughrara dans le sud-est de la Tunisie. La collecte a été effectuée au stade de floraison. La partie de la plante utilisée est les écorces de racines d'*Erodium*.

2- Teneur en fibres

La méthode adoptée pour doser les fibres solubles et insolubles est celle décrite par Prosky et al. (1988).

3- Teneur en protéines

L'azote est dosé conformément à la méthode standard de Kjeldahl

4- Teneur en matière grasse

L'extraction des lipides est effectuée conformément à la norme NF 03-713 (AFNOR, 1989).

5- Détermination de la teneur en polyphénols totaux

La quantité totale de polyphénols a été mesurée par la méthode de Folin–Ciocalteu, (Singleton et al., 1998)

6- Analyse par chromatographie liquide-électrospray ionisation spectrométrie de masse en tandem (LC-ESI-MS)

L'analyse LC-ESI-MS a été effectuée en utilisant un spectromètre de masse quadripolaire LCMS-2020 (Shimadzu, Kyoto, Japon) équipé d'une source d'ionisation par électrospray (ESI) et fonctionnant en mode d'ionisation négative (Jdir et al, 2017).

7- Activité antioxydante

L'activité anti-radicalaire est déterminée à l'aide du DPPH (Brand-Williams et al, 1995).

8- Préparation de cake

Les gâteaux ont été préparés dans un secteur de la pâtisserie locale (Industrie : pâtisserie -Masmoudi, Sfax, Tunisie). Le cake avec des concentrations variables de poudre d'écorce de racine d'Erodium ont été fabriqués à partir de mélanges contenant un mélange de farine de blé et de la poudre d'Erodium dans les proportions de 0% (témoin F1), 3% (F2), 5% (F3) et 10% (F4).

9- Mesure de la couleur

Les coordonnées CIE Lab (L*,a*,b*) de cake sont mesurées par un spectrophotocolorimètre Mini Scan MS/Y-2500 (HunterLab, Reston VA., USA).

10- Mesure de la texture

La dureté (N), l'élasticité (mm) et la masticabilité (N×mm) ont été mesurées à l'aide d'un texturomètre (Ayadi et al, 2009).

11- Évaluation sensorielle

Les propriétés sensorielles (couleur, odeur, goût, texture et acceptabilité globale) ont été évaluées selon la méthode de Murray (2001) par 60 panélistes.

3. Results and discussion [Times New Roman, font size 11, bold]

Les caractéristiques chimiques et fonctionnelles de la poudre des écorces des racines d'*Erodium* présentaient une teneur importante en glucides (50,74 ± 0,0g/100 g de MS), suivie des protéines (10,94 ± 0,14 g/100 g de MS), les cendres (6,20 ± 0,1 g/100 g de MS), alors que la matière grasse était la moins disponible (1,25 ± 0,21 g/100 g de MS). Les fibres alimentaires insolubles et solubles étaient respectivement de 32 ± 0,84 et 14 ± 0,26 g/100 g. Les teneurs ont polyphénols sont de l'ordre de

35,4 mg/g de poudre, ce qui pourrait être une excellente source d'antioxydant naturel. La poudre des racines d'*Erodium* présentait une capacité de rétention d'eau importante de 435 g d'eau/100 g et une capacité de retenir l'huile avec une capacité d'absorption de 251,35 g d'huile/100 g de poudre. La technique de LC-MS-MS a permis l'identification de 18 composés dans l'extrait éthanolique d'*Erodium*. Parmi lesquels l'acide quinique était le composé principal (1032,29 µg/g d'extrait).

Effet sur la texture du cake : Les données de ce tableau montrent une différence significative au niveau des caractéristiques texturales du cake, entre les échantillons enrichis en poudre de racines d'Erodium et le témoin.

Table 1. Effet de la poudre de racine d'*Erodium glaucophyllum* sur la texture du cake.

Niveau de substitution (g / 100 g de cake)	Dureté (N)	Élasticité (mm)	Masticabilité (N × mm)
F1	$5,74 \pm 0,11^{a}$	$8,09 \pm 0,02^{a}$	$9,85 \pm 0,21^{a}$
F2	$7,12 \pm 0,06^{b}$	$7,73 \pm 0,10^{a}$	$11,77 \pm 0,09^{b}$
F3	$9,83 \pm 0,04^{c}$	$6,59 \pm 0,14^{b}$	$12,79 \pm 0,09^{c}$
F4	$12,24 \pm 0,08^{d}$	$6,01 \pm 0,01^{c}$	$16,73 \pm 0,17^{d}$

Effet sur la couleur du cake : Une différence significative *($p<0,05$)* entre le cake témoin et les échantillons enrichis en poudre d'*Erodium*. Les cakes enrichis se sont avérés plus foncés que le produit témoin.

Table 2. Caractéristiques de couleur du cake enrichie avec de la poudre de racine d'E*rodium glaucophyllum*.

Niveau de substitution (g / 100 g de cake)	L*	a*	b*
F1	56,52 ± 3,18a	-0,54 ± 0,37a	22,49 ± 1,71a
F2	48,10 ± 1,37b	3,09 ± 0,77b	14,07 ± 0,54b
F3	44,42 ± 0,64c	3,68 ± 0,21c	11,55 ± 0,09c
F4	40,74 ± 1,22d	4,27 ± 0,09d	9,04 ± 0,35d

Evaluation de l'activité antioxydante du cake : Le cake témoin était attribué à la plus faible teneur en composés phénoliques et en activité antioxydante. Concernant la formulation F4, avec 10% de supplémentation en poudre de racine d'*Erodium*, le cake présentait la teneur la plus importante en composés phénoliques ainsi qu'en activité antioxydante.

Table 3. Teneur en polyphénols, Teneur en flavonoïdes et les propriétés antioxydantes de cake

Niveau de substitution (g / 100 g de cake)	Polyphénols	Flavonoïdes	DPPH	pouvoir réducteur deFe3 $^{+}$
F1	$9,89 \pm 0,04^{a}$	$4,01 \pm 0,03^{a}$	$5,29 \pm 0,08^{a}$	$0,01 \pm 0,01$
F2	$26,83 \pm 0,01^{b}$	$20,27 \pm 0,04^{b}$	$35,54 \pm 0,01^{b}$	$0,11 \pm 0,02^{a}$
F3	$44,85 \pm 0,03^{c}$	$37,47 \pm 0,03^{c}$	$57,25 \pm 0,02^{c}$	$0,25 \pm 0,02^{b}$
F4	$62,54 \pm 0,09^{d}$	$54,68 \pm 0,02^{d}$	$82,25 \pm 0,01^{d}$	$0,43 \pm 0,03^{c}$

Analyse sensorielle : Les résultats obtenus ont montré que le produit témoin et les différentes formulations testées présentaient des différences détectables dans leurs paramètres sensoriels. L'analyse sensorielle a mis en évidence l'effet important de la supplémentation en poudre d'*Erodium* sur l'amélioration de l'acceptabilité globale du cake.

4. Conclusion

Ce travail a permis de contribuer à la valorisation d'une plante spontanée du sud tunisien. Ces résultats ont été mis au profit d'une formulation alimentaire en collaboration avec l'industrie Pâtisserie Masmoudi (Tunisie). Les racines d'*Erodium* sont incorporées dans le cake à raison de 3, 5 et 10%. En comparaison à un cake témoin, l'ajout de la poudre influence de manière significative les caractéristiques fonctionnelles et nutraceutiques du cake.

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Ultrasonic microencapsulation of wild *Zizyphus lotus* L. fruit as source of natural antioxidants

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1. Introduction

Wild fruits, such as the jujube (*Zizyphus lotus)* are popular for their usage as vital food and/or traditional medicine. *Z. lotus* fruit is a rich source of phenolic compounds that exhibit a wide range of biological effects (Rashwan et al., 2020). However, these compounds are highly unstable in nature (Cheynier, 2005). Therefore, it would be better to protect jujube phenolic compounds from chemical damage before their industrial application by following suitable techniques. Micro and nanoencapsulation techniques might be a good method for overcoming these problems. This work aims to prolong the storage stability of phenolic compounds, obtained from *Z. lotus* fruit pulp, using an ultrasonic-assisted microencapsulation technique.

2. Materials and Methods

2.1. Preparation of jujube extract

Jujube fruits were obtained from wild plants, which were collected from the Southeast of Tunisia. Then the seeds were removed from whole fruit before to be grounded to obtain a uniform powder. An aqueous extract was prepared by adding 10 g of jujube fruits powder into 500 ml of water, and continuously stirring for 40 minutes at 50 °C. Extract was then filtered and lyophilized, and stored until analysis (Abcha et al., 2021).

2.2. Preparation of suspensions

Encapsulation of jujube extract was performed using ultrasonic-assisted technique described by Luca et al. (2012) with some modifications. The suspensions were prepared using a two-step homogenization. Different coating solutions containing were maltodextrin and gum arabic (MD 10%; MD 8%+GA 2% and MD 6%+GA 4%) were prepared before encapsulation and then added to the lyophilized extract of *Z. lotus* fruit pulp. The mixture of compounds was then followed by homogenization of the solutions using a homogenizer Ultra-Turrax (IKA, Ottawa, ON, Canada) at 5,000 rpm for 5 min. The obtained pre-suspensions were further homogenized using the ultrasonic probe (Qsonica sonicator, Fisher Scientific, ON, Canada) with a diameter of 3.8 mm by applying 160 W with 50 % pulse for 20 min. Each experiment was duplicated.

2.3. Characterization of microcapsules

The dried samples were ground using a mortar and pestle and the powder was packed in ambered colored glass vials until further analysis. The phenolics contents, antioxidant activity and particle size was determined during 15 days at 21°C.

3. Results and discussion

In this study, the effect of maltodextrin (MD) and gum Arabic (GA) concentrations on microencapsulation of wild jujube (pulp) phenolics through ultrasonication was investigated. MD/GA (8%:2%; v/v) retained higher phenolic content (37.47 ± 0.39 mg

GAE/g) and antioxidant activity (97.18 ± 0.03 mgTE/g) (Table 1) with homogenous coating on particle surface was observed (Figure 1). The obtained results showed that the particle size of all suspensions is in nano rang (Table 1; Fig.1).

Table 1 Medium diameter, total phenolic content (TPC) and antioxidant activity (DPPH) data for jujube aqueous extract (AE) and its capsules prepared with different MD and GA concentrations

Coating type	Medium diameter (d_m, µm)	TPC (mg GAE/g)	DPPH (mg TE/g)
Dried AE	2.46± 0.113	43.23± 0.026	96.78± 0.03
MD10%	0.546± 0.012	34.58± 0.039	94.64± 0.02
MD8%+ GA 2%	0.458± 0.016	37.17± 0.028	97.23± 0.03
MD6%+ GA 4%	0.486± 0.014	31.01± 0.033	94.99± 0.04

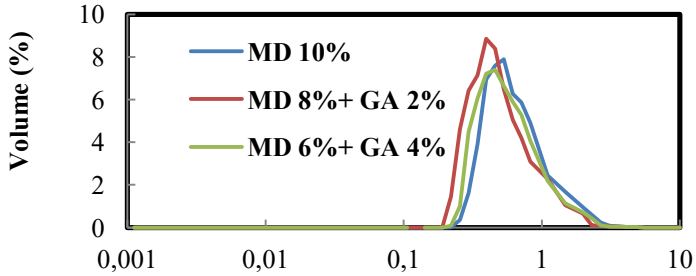

Figure 1: Particle size distribution of nanosuspensions prepared with different coating materials

The analysis of total phenolic content were carried out every 15 days, and the most stable submicron suspensions were achieved with maltodextrin prepared by adding gum Arabic to the wall material at a ratio of 8:2. The phenolic content loss rate was found to be in a range of 2–6.42 % depending on coating material **concentrations (Figure 2).**

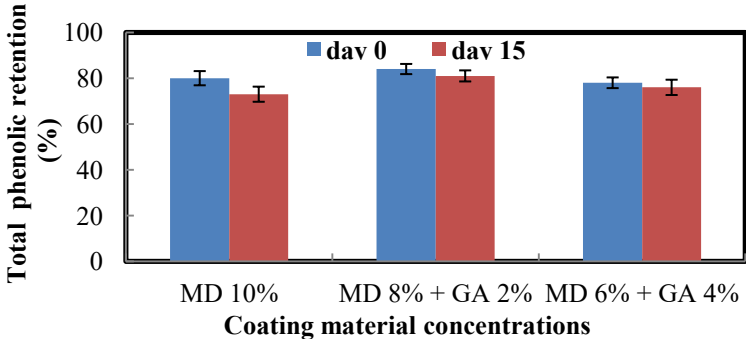

Figure 2: Total phenolic content retention in nanosuspensions prepared with different coating materials during storage at 21°C

4. Conclusion

In the present study, the high stable submicron suspensions of aqueous extract from jujube fruit (pulp) were successfully developed using ultrasonic-assisted technique and maltodextrin/gum Arabic as carrier. These submicron suspensions have strong antioxidant activity. These promising findings opened the doors to a potential application of naturally-unstable phenolic compounds extract from *Z.lotus* fruit (pulp) in the food/ nutraceutical industry.

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Relationship between litter size and body linear type traits in local goat population raised under arid conditions

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1. Introduction

Local goat population is normally used because of their adaptation to produce under harsh conditions of Tunisian arid region (Najari, 2005). Local goat breeds are famous for their walking ability, resistance to hydric restrictions and high temperatures and good fertility. However, these breeds are also characterized by a very small size and low productivity. This makes farmers tend to resort to using foreign selected breeds, which lack adaptation to harsh conditions. There is a little parameters regarding phenotypic and genetic performance for local goats' reproductive traits under low input production (Najari,2005). Such is known for animal quantitative traits, variation in body size is one of the criteria largely used for classifying and characterizing caprine breeds (Mellado et al.,2006). Very few studies have been carried out on the linear body measurements of Tunisian local goat and their possible use for estimating animal fertlility traits. Where genetic evaluation has still limited use in developing countries, identification of some linear traits may be useful and farmers' tools for selecting goats with desirable characters. A comprehensive description of phenotypic traits for differentiating the goats bearing single and multiple fetuses is thus urgently needed.
Therefore, our objectives were to study the changes in linear type traits in goats during pregnancy and to explore which traits would influence the litter size at kidding of local goats.

2. Materials and Methods

All studied animals belong to the goat experimental herd "ElGORDHAB" which is located in southeastern Tunisia. this region is characterized by an arid continental Mediterranean climate; with irregular precipitations with an average annual rainfall of about 100mm. The summer is normally the hottest and driest season with a maximum temperature of 47°C. The Tunisian local goat population is very polymorphic (Najari, 2005), but it is generally characterized by its small body size with an average height of 76 cm for the male and 60cm for the female (Aoui et al.,2018).
Records of 85 goats were used for this study. Animals were mated following a breeding system of one kidding per year. The main mating period was from June to August which corresponds to births in autumn. The season of kidding begins in October and continues until February, with a concentration during November and December. Goats were randomly assigned to bucks. Five phenotypic variables measured included **Body length (L1):** measured from the tip of the scapula close to the neck region to the pin bone of the tail region ; **Body weight (BW):** live body weight of the animal was obtained by placing them on the weighing scale ; **Heart girth (L2):** represented the circumference of the chest ; **Punch girth (L3):** circumference of the body was measured immediately after the abdomen just before the hind legs; **Withers height (L4):** measured at the highest point on the dorsum of the animal to the platform at the level of the forelegs while the animal was standing. All measurements were recorded on an individual data sheet from the goats weekly during pregnancy period. **Litter size (LSB)** was defined as the number of kid(s) born by each goat and considered at two levels : single and multiple births. The significance of the phenotypic variables was tested using the ANOVA procedure of the Statistical Package of Social Sciences (SPSS.20). Simple correlation coefficients between body measurements traits with litter size were calculated and tested for significance.

3. Results and discussion

Summary statistics for LSB and body linear traits are provided in Table 1. The litter size proportions for simple and multiple births were 62.5% and 37.5%, respectively. Our findings on multiple births, agree with the previous record of Hassan et al., (2007) who reported the incidence of 60.3% twinning births in Black Bengal goats in neighboring Bangladesh. The mean for LSB obtained in this study 1.31 was lower than that of some world prolific goat breeds including Nubian, Pygmy, American Alpine, French Alpine, Saanen and Toggenburg with the average litter size of 2.0, 1.9, 1.9, 1.7, 1.7 and 1.6, respectively (Amoah et al., 1996). Local goats'reduced litter size represents a genetic adaptation to natural environment of pastoral breeding in arid regions (Najari, 2005). The local goat was characterized by its small body size with an average height (L4) of 61.86 cm and an average body length (L1) of 64.71 cm. Small adult size is a characteristic of most breeds raised under arid conditions.

Table 1. Basic statistics for female litter size at kidding and body linear traits of Tunisian local goats.

Variable	Mean	Minimum	Maximum	SD	CV (%)
LSB (kids born)	1.31	1	3	0.45	34.35
L1(cm)	64.71	30	80	6.33	9.78
L2(cm)	62.54	57	70	2.55	4.07
L3(cm)	75.23	68	79.50	3.20	4.25
L4(cm)	61.86	18	98	5.66	9.15
BW (kg)	24.27	19.25	32	5.20	21.43

SD : std deviation ; CV : coefficient of variation.

Means and standard deviation for linear traits in pregnant goats is presented in Table 2. The measurements of most of the parameters were significantly higher (p<0.01) in goats bearing multiple foetuses than the goats bearing a single foetus during pregnancy. Except the L4 parameter, all phenotypic traits were positively correlated (p<0.01) with LSB. An inverse relationship between L4 and the likelihood of multiple fetuses suggests that phenotypic variation could be quite attractive for screening the goats bearing single or multiple fetuses. The BW present the high correlation with LSB compared to all other body measurements for discriminating between goats carrying one or two fetuses. An increase in measurement in various phenotypic traits in goats bearing multiple foetuses as compared to the goats bearing single foetus could be due to the enlargement of the body size to make room for more foetuses and provide more body strength to bear more foetuses by storage of more nutrients for mobilisation and meeting physiological demand of multiple foetuses during pregnancy. The different linear traits have been suggested to be valuable tools in breeding programmes for some likelihood of productive and reproductive traits in goats because of the moderate to high heritability of some linear traits (Mellado et al.,2006 ; Amoah et al.,1996).

Table 2. Correlation between linear traits and LSB in local goat population.

	LSB	L1	L2	L3	L4	BW
LSB	1	0.51	0.54*	0.63**	-0.22*	0.67*
L1		1	0.90	0.91*	0.91*	0.93**
L2			1	0.95**	0.83*	0.93*
L3				1	0.92*	0.92**
L4					1	0.92**
BW						1

r= correlation ; *significant

4. Conclusion

The present study also reveals substantial phenotypic variations among the goats bearing single and multiple. The body weight, the heart girth and the punch girth may be useful tools for the difference between the goats carrying multiple foetuses and the goats carrying single foetus and thus achieving more economic benefits out of multiple births by taking special care of females carrying multiple foetuses.

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Effects of a seaweed liquid extract (*Ulva intestinalis*) on photosynthetic pigments and water status of hydroponically grown purple basil (*Ocimum basilicum var. purpurascens* Benth.)-*Lamiaceae*

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1. Introduction

During recent decades, agriculture has faced countless emerging challenges such as climate change (FAO, 2016), water scarcity and soil depletion (FAO, 2011). In addition, there are many global crises that are worsening this situation such as overpopulation. In order to face all these challenges, agriculture has to evolve into a more modernised version of itself. Indeed, soilless culture such as hydroponics can be an alternative. Besides, the use of seaweed extracts is a common practice in agriculture thanks to their chemical constituents such as phytohormones and mineral nutrients that are responsible of their role as plant bio-stimulants (Battacharyya et al., 2015). Thus, the present work aims to evaluate the effects of a seaweed liquid extract obtained from the green algae *Ulva intestinalis* on the photosynthetic pigments and water status of a hydroponically grown purple basil (*Ocimum basilicum var. purpurascens* Benth.).

2. Materials and Methods

- **Plant material and growth conditions**

Purple basil (*Ocimum basilicum var. purpurascens* Benth.) seeds were produced by the Italian seed company "Emannuele Larosa Sementi". Seeds were sown under greenhouse conditions in December, 2018 and seedlings were then transplanted in cell trays filled with a mixture of peat and sand (50:50) in February, 2019. Finally, the plants were transplanted into the hydroponic system in April, 2019 under a controlled glasshouse at the National Agronomic Institute of Tunisia (Latitude 36°49'44''N, Longitude 10°10'51''E; Altitude 10 m).

- **Seaweed liquid extract preparation**

The green algae *Ulva intestinalis* (*Chlorophyceae*) was collected from the coastal area of Chott Mariem (Sousse, Tunisia). The seaweed liquid extract (SLE) was prepared according to Rama Rao (1990) method and kept at a temperature of -20°C until further use.

- **The hydroponic culture**

The hydroponic experiment was carried out by using the Nutrient Film Technique (NFT): The circulating nutrient solution is a slightly modified Coïc-Lesaint (1973) solution. For this purpose, two separate hydroponic systems were used and 60 plants were transplanted in each one.

- **Experimental design and treatment applied**

The experimental design was conducted as a complete random block with three repetitions and only one variation factor which is the SLE treatment. In this experiment, the SLE was prepared with the concentration of 10% by using distilled water and it was injected into the nutrient solution circulating in the first hydroponic system. A control hydroponic system (without injection of SLE) was also considered.

- **Chlorophyll and carotenoids content**

The photosynthetic pigments namely chlorophyll a, chlorophyll b and total chlorophyll as well as carotenoids were extracted by the technique of Torrecillas et al. (1984) and their contents were estimated according to Mackinney (1941) and Arnon (1949) equations.

- **Electrolyte leakage**

The electrolyte leakage was determined according to Lutts et al. (1996) method. For this purpose, leaves were placed in vials filled with distilled water and incubated during 24 hours before the measurement of the initial electrical conductivity of this solution. Samples were then autoclaved at 120°C and the final electrical conductivity was determined. The electrolyte leakage (%) was finally calculated using the Lutts et *al*. (1996) equation.

- **Relative water content**

The Relative water content (RWC) was assessed by the Schonfeld et al. (1988) method and by using the same authors' equation.

- **Statistical analysis**

Data were subjected to statistical analysis by using the Statistical Analysis System (Version 8.0 Cary, USA) program (SAS Institute, 1999). The one-way analysis of variance (ANOVA) followed by Duncan multiple range test were employed and the differences between individual means were deemed to be significant at $p < 0.05$.

3. Results and discussion

The effects of the SLE on the photosynthetic pigment contents of purple basil grown in hydroponic system were represented in Table 1. As shown in this table, the photosynthetic pigments were negatively and significantly affected by the SLE when this last

was injected into the nutrient solution. Indeed chlorophyll a (82.43 µg.mg^{-1}), chlorophyll b (37.85 µg.mg^{-1}) and total chlorophyll (144.92 µg.mg^{-1}) as well as carotenoids (18.39 µg.mg^{-1}) were lower in treated plants when compared to the control. Thus, the application of the SLE in the hydroponic system decreased the content of these photosynthetic pigments in purple basil plants.

Table 1. Effects of *Ulva intestinalis* seaweed liquid extract on photosynthetic pigment content in fresh leaves of hydroponically grown purple basil (*Ocimum basilicum* var. *purpurascens* Benth.)

	Photosynthetic pigments content (µg/mg)			
	Chlorophyll a	**Chlorophyll b**	**Total Chlorophyll**	**carotenoids**
Untreated plants (Control)	148.98 ± 117.92^{a}	126.92 ± 127.195^{ab}	322.35 ± 273.67^{a}	56.65 ± 64.5^{a}
Plants treated with SLE	82.43 ± 38.11^{b}	37.85 ± 27^{c}	144.92 ± 62.23^{b}	18.39 ± 17.04^{b}

*Means followed by the same letter (a-b) in each column are not significantly different at $p \leq 0.05$ based on Duncan's multiple range test

The effects of the SLE on the water status of purple basil grown in the hydroponic system were presented in Figure 1. As can be seen in this figure, the electrolyte leakage (EL) in treated plants is significantly higher (96.65%) in comparison to the control (84.04%) which is in contrast with the results previously reported by Beigzadeh et al. (2018) and who found that the EL value was lower when the highest dose of algae extract was applied in white bean. Additionally, the Relative Water Content (RWC) decreased slightly but not significantly in treated plants (79.48 %) when compared to the control (82.35%) as shown in Figure 1.

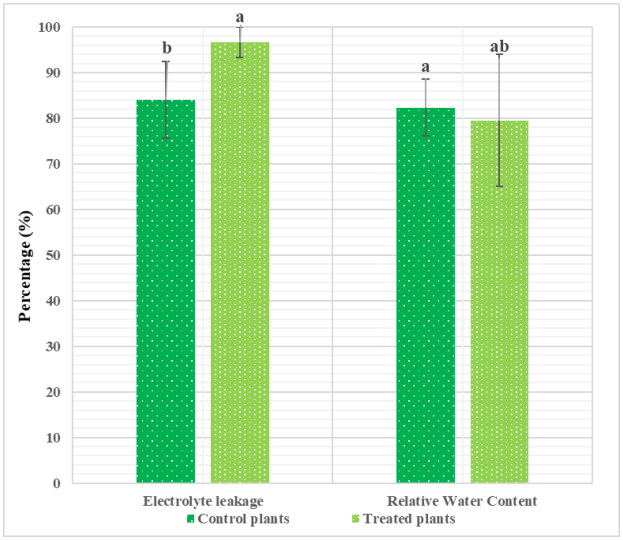

Figure 1: Effects of *Ulva intestinalis* seaweed liquid extract (SLE) on the electrolyte leakage (%) and relative water content (%) of hydroponically grown purple basil (*Ocimum basilicum* var. purpurascens Benth.)
*Means followed by the same letter (a-b) in each column are not significantly different at $p \leq 0.05$ based on Duncan's multiple range test.

4. Conclusion

Overall results showed that the photosynthetic pigments and the water status of hydroponically grown purple basil plants were negatively affected by the seaweed liquid extract when it was injected into the nutrient solution in comparison to the control.

Consequently and in case of purple basil, it is not recommended to add the seaweed liquid extract of *Ulva intestinalis* in the hydroponic culture of this medicinal and aromatic plant.

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Technological aspects of lactic acid bacteria isolated from Tunisian camel and goat kefir

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1. Introduction

Kefir is a fermented drink, originated in the Caucasus Mountains (Fausta Serafini, 2014). Currently, an increase in kefir consumption in many countries has been reported, due to its unique sensory properties associated with beneficial effects on human health (Farnworth, 2005).

In Tunisia, the knowledge of this beverage, their benefits, as well as kefir manufacturing are not very widespread. This drink differs from other fermented dairy products because it is not the result of the metabolic activity of a single or a few microbial species (Farnworth and Mainville, 2008).

It is made by adding kefir grains to milk that resemble a cauliflower in appearance. The use of camel milk is limited; due it is less suitable for processing despite its nutritional properties. This study aimed to popularize Kefir in Tunisian society, valorize camel and goat milk by its transformation into Kefir manufactured and isolation their lactic acid bacteria. Also it aimed to know their technological aspect in comparison to kefir from cow milk.

2. Materials and Methods

a. Origin of the Milk samples:

Camel milk: Fresh camel milk was collected from female camels (Camelus dromedarius) belonging to the Arid Land Institute (Medenine, Tunisia), n = 30,

Cow milk from dairy cow farm, n = 20 and goat milk from a herd belonging to the Arid Land Institute (Medenine, Tunisia) (IRA, Tunisia), n = 15.

b. Kefir Manufacture: All milk samples were pasteurized at 72°C for 20 sec, inoculated with 2% (wt/vol) grains and incubated at 25°C during: 18 h for goat and cow milk: and 24 h for camel milk.

c. Physicochemical and microbiological characteristics analysis: pH, acidity, Total solid MS, ash (MM), Fat and the number of lactic acid bacteria LB and Yeast and mold LM ufc/ml were determined for all samples.

d. Isolation and technology aspect of lactic acid bacteria of Kefir: The technological aspects of the isolated strains from Kefir (camel, goat and cow) and from the Kefir grains are studied

3. Results and Discussion

1. Physico-chemical and microbiological characteristics of kefir

Camel kefir reached acidic pH (4.75 ± 0.31) after 24 hours of incubation, while goat kefir milk and cow's kefir milk reached this pH value after 18 hours (4.72 ± 0.71 and 4.14 ±0, 39 repectively). The viscosity, dry matter and fat rate of goat kefir were the highest. The bacterial load of LAB from camel kefir is around 40.10^3UFC / ml which is the uppermost compared to other Kefirs. These values are very low compared to those found by Garrote et al, (2010); 10^8CFU/g and from 10^6- to 10^7 CFU/g respectively for BL and yeasts.

Parameters	Camel Kefir (24h)	Goat Kefir (18h)	Cow Kefir (18h)
pH	4,75±0,31	4,72±0,71	4,14±0,39
Acidity (°D)	74,7±17,38	72,72±11,30	57,6±9
Viscosity (cP)	6,64±0,39	7,18±0,72	6,48±0,64
Fat MG (g/l)	20,4±6,48	44,2±14,64	33,25±9,25
Total solid MS (g/l)	109,18±16,98	125,68±27,58	105,125±8,67
Ash MM (g/l)	10,22±2,18	8,7±0,44	8,49±0,73
LAB ufc/ml	40.103	38 103	35 103
Yeast and mold LM ufc/ml	5104	9 104	7 104

Table 1: Physico-chemical parameters of milk kefir

2. Technological activities of lactic strains isolated from Kefirs

- **Acidifying power**

All isolated bacteria showed an acidic profile. The Strain 5 and the Strain 6 from Camel Kefir(CaK 5) (CaK 6) showed good acidifying power. A difference in the reduction of pH between strains of the same species has been raised by authors (Luquet and Corrieu, 2005).

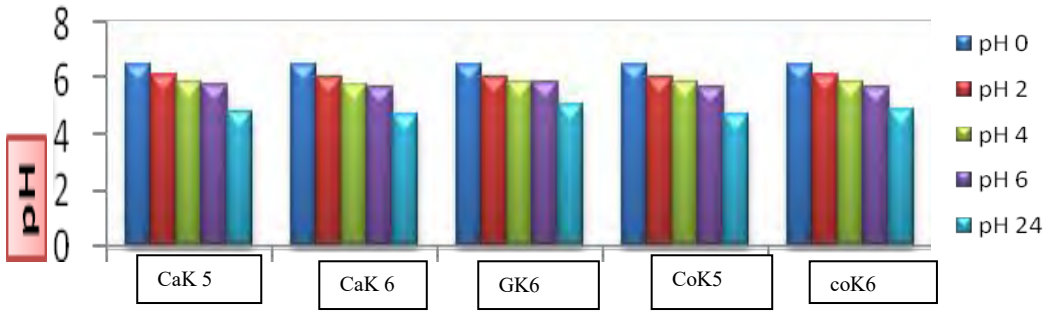
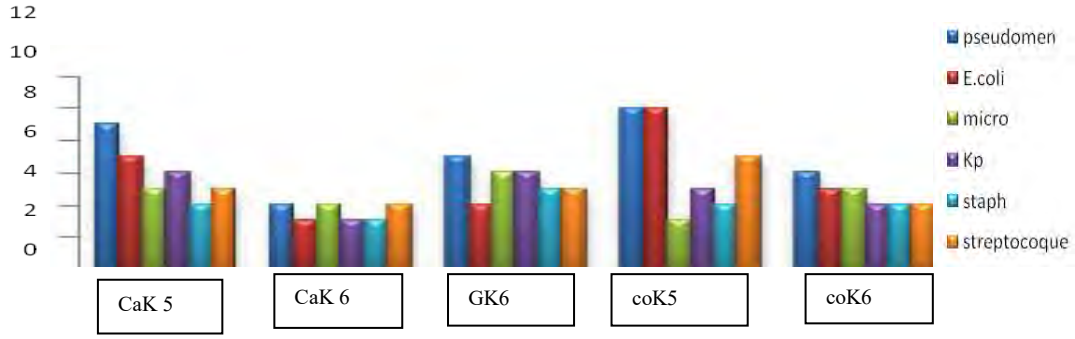


Figure 1: Evaluation of the pH of isolated bacteria

CaK 5:Strain 5 from Camel Kefir; CaK 6;Strain 6 from Camel kefir; GK6: Strain 6 from Goat kefir.;CoK: Strain 5 from Cow kefir; coK6: Strain 6 from Cow kefir

- **Antibacterial activity**



CaK 5:Strain 5 from Camel Kefir; CaK 6;Strain 6 from Camel kefir; GK6: Strain 6 from Goat kefir.;CoK: Strain 5 from Cow kefir; coK6: Strain 6 from Cow kefir

Figure 2: Antibacterial activity of the 7 strains of lactic bacteria against 6 pathogenic strains

All the LAB strains showed strong antibacterial activity against 6 pathogenic strains. The Strain 5 from Camel Kefir (CaK 5) revealed a stronger antibacterial activity. According to Aslam and Qazi (2010) the antibacterial properties of LB are derived from antibacterial metabolites.

4. Conclusion

Camel and goat Kefir prepared in this trial are safe to eat according to legislative standards. In fact the technological aspects of seven strains of lactic acid bacteria isolated from camel and goat Kefir have a good technological potential: acidifying and antibacterial activity.

The Strain 5 and the Strain 6 from Camel Kefir(CaK 5) (CaK 6) showed good acidifying power. In addition The Strain 5 from Camel Kefir (CaK 5) revealed a stronger antibacterial activity.

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Place de l'activité de maquignonnage dans les élevages ovins de la région agropastorale de Tiaret en Algérie

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1. Introduction

En Algérie, l'élevage ovin constitue une véritable richesse nationale pouvant être appréciée à travers son effectif élevé par rapport aux autres spéculations animales et particulièrement par la multitude de races présentes, ce qui constitue un avantage et une garantie sûre pour le pays (Dekhili, 2010). .D'après les statistiques officielles, l'Algérie compte 26 millions de têtes d'ovins et produit 325 000 tonnes de viande ovine (ONS, 2017). La population ovine de la région de Tiaret est composée de la race locale « Rumbi » (DSA 2019), considérée comme la plus lourde race ovine algérienne, avec des poids avoisinant les 90 kg pour le bélier. Les maquignons sont considérés comme étant les principaux acteurs dans les circuits de commercialisation de la viande ovine. Ils exercent la fonction de médiateur entre les éleveurs et les consommateurs. Ils sont au nombre de plusieurs dizaines exerçant l'activité dans la région de Tiaret. Ils achètent les animaux sur pied (en gros) et les vendent également sur pied (au détail).

2. Materials and Methods

La méthodologie mise en œuvre est basée sur une enquête auprès de 22 intermédiaires choisis difficilement répartis dans la région de Tiaret et exerce l'activité au niveau de deux principaux marchés les plus importants de la région et qui sont celui de Sougueur et Hamadia. Le choix du marché à bestiaux de Sougueur se justifie par le fait qu'il est d'envergure national en matière de transit et de commercialisation des ovins, au même titre que les marchés de Djelfa, d'El-harrach et de Sid Bel Abbes, considérés comme des régions expéditrices des ovins vers d'autres régions du pays (Zoubeidi et Chehat, 2011).

3. Results

La majorité des enquêtés, soit 72,70%, ont déclarés que l'estimation des prix se fait par la prospection en faisant un tour dans tout le marché. Par contre 27,30% d'entre eux déclarent que la connaissance du prix se fait selon l'expérience dans le métier, car c'est l'ancienneté dans le métier l'exercice de l'activité qui rend facile la connaissance du prix. Ainsi, 68,20% négocient avec l'éleveur surtout le prix, selon ses capacités financière. Alors que le reste, soit 31,80% négocient surtout le poids de l'animal pour la maitrise du prix du vif et celui de la carcasse dans le but de la maximisation de la marge. Nous avons constaté que 63,60% de notre échantillon font les achats et les ventes le même jour, alors que 36,40% ne vendent pas le même jour les animaux achetés et préfèrent les transporter vers le lieu de résidence et qui sont généralement destinés à des bouchers. En effet, 54,5% des maquignons estiment que la période de vente ou le prix demeure plus élevée est celle de l'Aid El-adha et le mois de Ramadhan, ou on assiste à des fortes demandes durant ces périodes religieuses. Alors que 45,5% d'entre eux estiment que le prix augmente durant le pèlerinage et 13,60% pendant les périodes de mariage.
Durant l'achat et la vente des animaux, 63,60% estiment que les problèmes qu'ils rencontrent est dû aux fluctuations des prix, qui sont considérés comme un obstacle, alors que pour 31,40% c'est dû aux risques de maladies et ce qui ne maitrise pas l'achat peut entrainer la mévente de l'animal malade. Par contre 4,5% des maquignons ont un risque de mort de l'animal lors de l'achat, ce qui entraine une perte d'argent (figure 1).

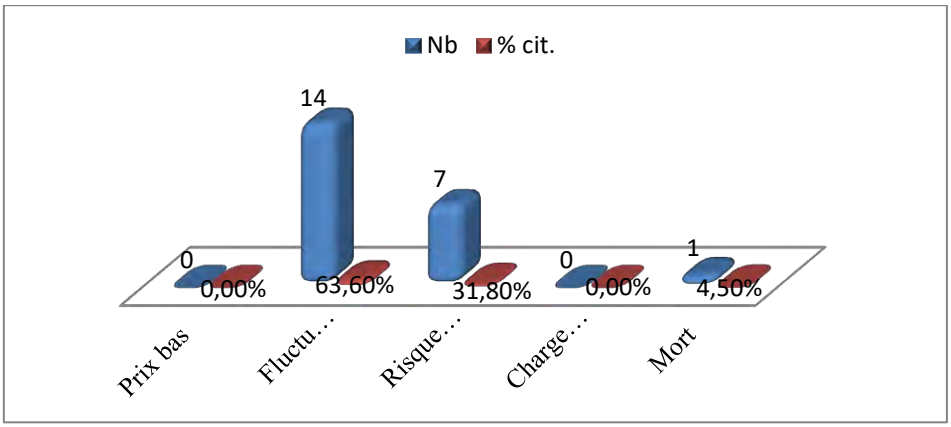

Figure 1 : les problèmes rencontrés par les maquignons lors de l'achat et la ventes animaux

La moitié de notre échantillons, soit 50% déclarent que le problème rencontré au niveau du marché se situe dans la difficulté d'évaluer la qualité des ovins, dû au manque d'expérience de certains d'entre eux et il sollicite un vétérinaire pour ne pas être tromper par le vendeur et ce pour décider sur l'achat ou non de l'animal. Ainsi, la difficulté d'estimation du poids vif de l'animal quand il s'agit de la vente au boucher. Par contre, 4,5% des enquêtés rencontrent des problèmes respectivement de manque de savoir-faire, dû au manque d'expérience et le coût de transport qui revient au maquignon élevé (figure 2).

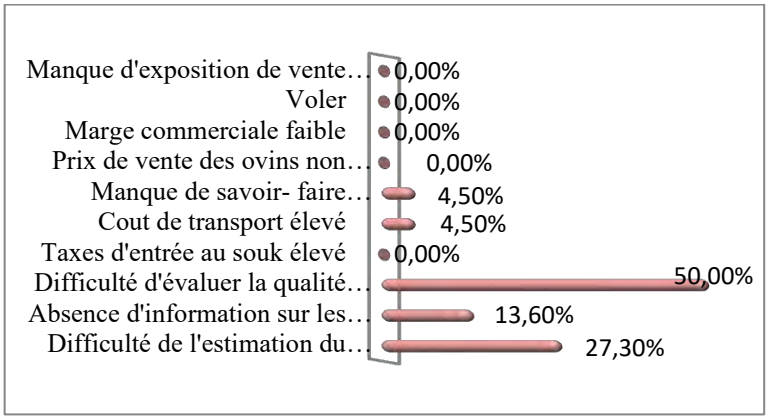

Figure 2: problèmes rencontrés par les maquignons dans les marchés de la région de Tiaret

4. Discussion and Conclusion

Dans la région de Tiaret comme dans le reste d'Algérie, la dynamique des flux d'animaux a été observée à partir de l'effectif des maquignons intervenant dans la commercialisation des ovins, qui témoigne de la part importante du marché détenu par ces acteurs. Ils sont caractérisés par leurs pratiques qui sont particulières qui visent la maximisation de la marge, suite à leurs stratégies qui consistent en la pratiques des transactions qui consistent à acheter au moment où les prix sont bas et vendre dans des conditions avantageuses. Il induisait des comportements commerciaux fortement déterminés par les seuls signaux du marché. Cela témoigne de la part importante du marché détenu par ces acteurs. Dans ce système, le maquignon limite considérablement le contact entre l'éleveur et le boucher et interrompt par conséquent le flux d'informations sur l'origine de l'animal et le système de production.

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Innovation in the agriculture and food industry as a way to strengthen the resistance of olive growing in the Mediterranean climate-era in Turkey

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Abstract

The agriculture and food industry, which is essential for the countries' economies, has become important and turned into a strategic industry with globalization, especially in developing countries, with its contribution to poverty reduction, food security, production frequency in industry, currency exchange earnings and economic growth.Quality control and food safety are also very critical in the olive farming innovation process to improve the competitiveness of the products and increase the level of approval by consumers. "Traceability" is the keyword in the today's food industry presented as a way of increasing the competitiveness and rationalization of production systems and improving the quality of productions. Therefore, this study aims to investigate both the olive cultivation innovation process, olive quality as well as quality control systems in Turkey.

Key words: Olive,*Oleaeuropaea sativa*, irrigation, variety selection.

1. Introduction

The olive (*Oleaeuropaeasativa*) tree is a plant that can grow in diverse climatic and soil conditions, has a high adaptability, and can be greatly benefited from its fruit to its leaf. Olive is an economically crucial product since it yields for many years (Pres at al., 2020). Most of the olive productions in Turkey has been carried out in the form of small-scale family businesses and in small parcels (Özkaya et al., 2010). The reason why olive yield is not at the desired level is that the developments in agricultural methods and technology cannot be reflected in olive industry despite the presence of trees and suitable climatical conditions (Rallo at al.,1999).

Turkey is ranked 4thin terms of number of olive trees and 6thin terms of olive planted area with 7% among olive producing countries in the world. Turkey is ranked as the 1st country in terms of black olive producing and as the 4th country in the production of table olives with a share of 9% as well asit is ranked as the 5th country in olive oil production with a share of 8% (TUIK, FAO, 2020).

Turkey's olive trees have been long adapting to environmental impacts and conditions through natural selection for several years. However, variations, types and weeds should be protected as gene sources and considered in breeding studies for both yield efficiency and high quality in olive and olive oil production. Although there is an increase in the number of trees and the amount of olives produced, there will be no significant change in the cost of production per unit if the land size of the agricultural firms remains the same. It is necessary to avoid the possible damages of the bottom land by rearranging the olive farming organizations with policies such as cooperatives/corporation and land consolidation. Supports for sapling certifications and facilities of garden plants should be provided to the reproduction process (high support to high cost). The production of variations which can adapt to different regions and are commercially important should also be supported(Kumral et al., 2010).

2. Materials and Methods

The methodology of this study consist the literature review.

3.Conclusion

The identified variations and types should be recorded, and registered, and base material production of high-qualityvariations and clones should be done as soon as possible, and rootstock and scion breeders with adequate production capacity should be established in the facilities owned by both public and private sapling producers. There is a need of a facility such as a "Center for Tissue Culture" for the rapid production of disease-resistant varieties obtained as a result of breeding effort. By having this center,

the farmers' rootstock, cuttings and engraftmentdemands will be met. Attention should be paid to technical issues (irrigation, variety selection, drainage, and pollinator ratio) in the garden facilities(Tunalıoğlu, 2009).

Olive fruit flyis a harmful concern that harms olives, reduces olive yield and olive oil quality, and requires collective effort. The necessary tools, equipment, workers and financial resources should be provided with the state support to the organizations that fight against "Olive Diseases and Pests"(Yıldız, 2008).

Preventing deep tillage, encouraging and promoting the no-tillage system due to erosion is required in terms of tree health and production efficiency. In addition, the producers should be informed about rejuvenation pruning of old trees and not harming young trees.The association between precipitation and olive yield is vital. Problems arising from lack of information and coordination are observed in the assessment of irrigation projects(Novara et al., 2020)

It is critical that olive tree products are produced with different processing methods in accordance withtechnique. Quality and productivity are limited due to inadequate infrastructure. In order to deal with this, research should be done to provide trainings to the workers in compliance with the technical and hygienic regulations of the small business facilities. Overall, it is essential to take adequate inventory on the structure, number, capacity, and so on of these firms(Alvarado et al., 1997; Rallo et al., 1999).

The most important factors in olive oil quality are the timely harvest of the olives, the timely delivery of the olives to the facilities, the transportation of the olives to the facilities in suitable containers and vehicles, keeping them in the facilities for a reasonable short time and under appropriate conditions as well as the use of technology during processing and the storage of the olive oil which is obtained under propersettings. Other than the integrated facilities, only olive squeezing facilities, refined oil production facilities, oil filling facilities and suppliers that trade oil are also included in this industry.Olive oil is generally stored in unsuitable conditions in producers and oil brokers and sent to the industry after the occurrence of convenient factors (e.g., price, supply, and demand, etc.) and this causes significant quality losses. Increasing the production of extra virgin olive oil should be the main production goal of Turkey. For this aim, attention should be paid to all factors affecting quality and yield at every phase of production from tree to bottle. Although olive farming always finds a vital place for itself in Turkey's agricultural policies, the existing supports should be increased(Cirio 1997).

Therefore, this study aims to investigate both the olive cultivation innovation process, olive quality as well as quality control systems in Turkey.

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Use of a bioaccumulative plant for the evaluation of heavy metal concentrations in western Algeria

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1. Introduction

Several researchers have shown that sensitive plants react as true bio-indicators of pollution. This "bio-monitoring" technique uses plant organisms that can store pollutants in their tissues or on their surfaces through fixation and transfer mechanisms. The measurement of pollutant levels in these sensitive plants makes it possible to detect the degradation of air quality before it severely affects the biotope or man. Plants considered sensitive are used as bio-indicators to monitor the stress generated by air pollution (Rupa and Venkatachalam 2018).The evaluation of heavy metal emissions from motor vehicle traffic is the objective of this work. It provides a better understanding of these emissions, whose deposition is harmful to the environment and humans through a plant species used as a bio-accumulator of airborne heavy metal contamination from road traffic. Heavy metal emissions from road traffic are mainly in the form of fine particles that are then collected by leaf surfaces (Sulaiman and Hamzah 2018).

2. Materials and Methods

The study area includes the town of Sidi –Bel- Abbes and a service station on the national road linking Sidi-Bel-Abbes to Telagh. It is located in Western Algeria characterized by a Mediterranean climate of the semi-arid type with an average annual rainfall of 350 mm with a rainfall regime of the HPAE type. The study area is characterized by very dense and elevated road traffic all year round, inducing particles, dust and organic complexes from vehicles.
Plant sampling: Needle samples were collected from Aleppo pine trees and samples of litter under the trees at both sites. Each site has been divided into 3 different zones to assess the degree of heavy metal contamination from road traffic. For the chemical analysis, 200 grams of needles and 200 grams of litter were collected for each zone. The 12 samples collected were kept in airtight bags and labeled for analysis.
Extraction method: All media and equipment used for the analyses were washed with distilled water, then soaked in HNO3, rinsed with distilled water and dried in an oven. The needles were separated from their supports and dried in a filtered air oven for 4 days at a temperature of 40°C without any treatment and then ground to a powder with an agate mortar. The analytical protocols used are based on ICI (Inter-Institute of Analytical Techniques) methods and dry mineralization was used for Cd, Cu, Fe, Ni, Pb, Cr and Zn. The solution of the metallic elements is carried out on a 1 g ground sample, then the procedure applied: calcination at 420°C for 4 hours in an oven, then recovery of the ashes with 5 ml of HNO3 65%, let evaporate for 3 minutes, then add 10 ml of HNO3 50%. Filtration is then carried out for 24 hours on filter paper (10µm). Six solutions are prepared for each site (3 solutions for the Pine needles “Zone1, 2, 3”and 3 solutions for the litter needles “Zone1, 2, 3”in total 12 solutions are prepared. A blank control solution of 65% HNO3 and distilled water was prepared in the same way as the 12 solutions mentioned above.

Elements analyzed: The metals sought in the samples "Cd, Cr, Cu, Fe, Ni, Pb and Zn" are subjected to analysis by "flame atomic absorption spectroscopy": FAAS (Rayleigh WFX-130BAAS). An air/acetylene flame was used for the excitation of the metal atoms and specific lamps for each metal were used for the detection of each element. The limit of quantification of pollutants in plants is, according to themethodused: 0.01, 0.05, 0.13, 0.045, 0.03, 0.1 and 0.007 mg/kg for Cd,Cr,Cu,Fe, Ni, Pb and Zn.

3. Results and discussion

The classification of heavy metals according to their concentrations in descending order at the two study sites: for the Urban site Pb> Fe> Zn> Cr> Cu> Ni> Cd, and for the Rural site Pb> Fe> Zn> Cu> Cr> Ni> Cd. Cr enriched road dust from our urban site has higher total concentrations than our rural site. Apeagyei et al (2011) observed that urban road dust was significantly enriched in Cr compared to rural road dust. Athanasopoulou and Kollaros (2016) observed that total heavy metal concentrations in road dust came mainly from highways. With vehicles traveling at 80 km/h, heavy metal levels in road dust were much higher than those emitted by vehicles traveling at 50 km/h (Duong and Lee 2011). The major sources of Ni were determined to be diesel emissions, brake abrasion and vehicle corrosion. Cu was mainly derived from brake abrasion and combustion exhaust. Zinc concentration was influenced by vehicle emissions and tire wear (Duong and Lee 2011).Copper in street dust may be a result of wear and tear on automobile engines, while tire wear and lubricating oils are possible sources of zinc and cadmium. Exposure to halogen and pollutant emissions from motor vehicle traffic is detrimental to human health and associated with an increased risk of respiratory disease (Hirshon et al 2008);

Table 1. Summary of heavy metal concentration results "mg/kg" at the two study sites.

Metals	Sidi Bel Abbes Bosquet		Telagh gas station		Deviations	
	"Urban site		" Rural site "			
	Needle	Litter	Needle	Litter	Needle	Litter
Fe	293,77	343,10	312,60	393,17	+ 18.83	+ 50.07
Cu	104,60	213,60	193,27	307,30	+ 88.67	+ 93.70
Ni	44,70	162,27	52,13	177,63	+ 7.43	+ 15.36
Pb	325,27	378,67	391,70	486,00	+ 66.43	+ 107.33
Zn	202,50	312,07	233,87	356,73	+ 31.37	+ 44.66
Cd	22,90	127,47	37,67	105,57	+ 14.77	- 21.90
Cr	161,87	233,67	165,77	284,00	+ 3.90	+ 50.33
Total	**1 155,60**	**1 770,83**	**1 387,01**	**2 110,40**	**+ 231.40**	**+ 339.57**

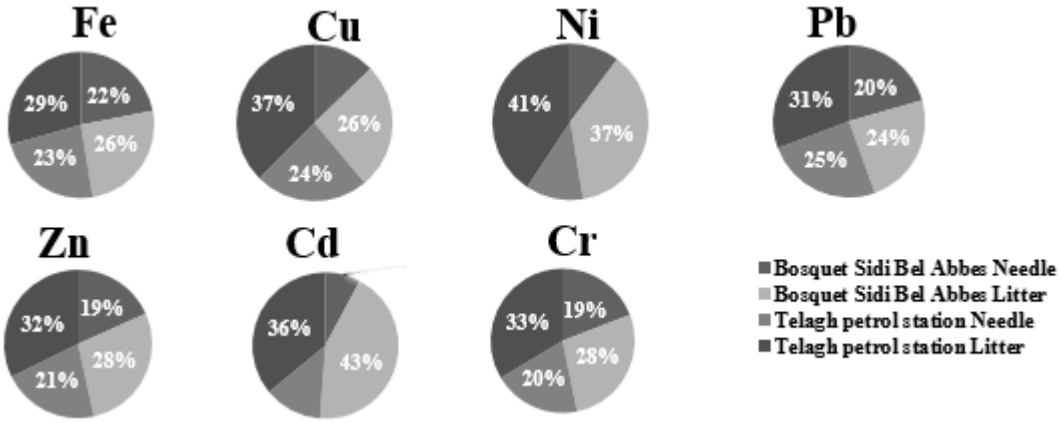

Figure 1: Percentage representation of each metal in Aleppo pine needles and its litter at the two study sites.

4. Conclusion

A total of 1155.60 mg/kg and 1387.01 mg/kg are recorded for needles for the urban and rural sites respectively. Concentrations in litter are 1770.83 mg/kg and 2110.40 mg/kg for the urban and rural sites respectively. Road traffic is an important source of heavy metals for the environment. And Aleppo pine is a very good accumulator of heavy metals. The litter accumulates more heavy metals compared to pine needles. The results also show that the areas exposed to road traffic (Zone 1) were found to be more polluted than the other sampling areas (Zones 2 and 3) for both study sites. The rural site is more polluted than the urban site due to the presence of a service station containing the lubricants and has very frequent heavy truck traffic throughout the year.

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Valorisation des extraits aqueux de deux plantes acclimatées en Tunisie

PRIX MEDFORUM 2021

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1. Introduction

Le stress oxydatif, les additifs alimentaires synthétiques, et bien d'autres facteurs ont poussé le consommateur à changer ses habitudes alimentaires pour lutter contre ces problèmes. Les acteurs du secteur agricole et agroalimentaire, que ce soit de la méditerranée et à l'échelle mondiale, se sont mobilisés à la recherche de nouvelle ressources alimentaires naturelles ayant le profil préventif du stress oxydatif et ses conséquences. Parmi ces ressources, on cite les plantes aromatiques et médicinales. Ce sont la source de la majorité des substances bioactives. Cependant, elles restent encore sous exploitées dans l'industrie pharmaceutique, l'agriculture et l'agroalimentaire. Ainsi, la valorisation de ces ressources naturelles peut avoir des retombées économiques considérables. C'est dans le cadre de la valorisation des ressources naturelles que notre intérêt s'est porté sur deux plantes de la flore tunisienne, peu étudiées, à savoir *Eucalyptus stricklandii* et *Pistacia lentiscus* . Cette brève investigation s'inscrit dans le cadre de la réponse à la demande accrue d'industriel de lutter contre les problèmes d'altération de matière première céréalière, et laitière lors de son stockage. L'objectif est donc de fournir au consommateur un aliment sain , sans additif ni conservateurs synthétiques, et de répondre à la demande de l'industriel pour lui fournir une solution biologique de conservation de sa matière première avant sa transformation. Ceci argumente le choix des méthodes expérimentales évoquées dans ce manuscrit à savoir l'extraction et l'évaluation chimique globale des composés phénoliques, l'étude de leur pouvoir antioxydant, antimicrobien et antigerminatif.

2. Matériels et Méthodes

Les feuilles de *Pistacia lentiscus L.* (cueillies de la région de Ain Drahem, Nord de la Tunisie) et *Eucalyptus stricklandii*(cueillies de l'arboretum Hajeb Layoun, Kairouan, centre de la Tunisie) ont servi pour cette étude. Après séchage à l'ombre et broyage,
Nous avons procédé à la préparation des extraits aqueux par différentes méthodes : macération à froid , infusion et décoction en utilisant l'eau distillée comme solvant.
Le dosage des polyphénols totaux (suivant la méthode utilisant le réactif de Folin-Ciocalteu) et flavonoides (selon la méthode adaptée par (Arvouet-Grand et al., 1994) est déterminé par le biais de méthodes spectrophotométriques, en se référant aux travaux de Ben Hassine et al. (2012). L'activité anti-radicalaire est déterminée à l'aide du radical DPPH suivant la méthode appliquée par Ben Hassine et al. (2012). La concentration Inhibitrice 50 a été calculée permettant de déterminer la concentration minimale des extraits aqueux capable de piéger 50% des radicaux libres. Concernant l'activité antimicrobienne, elle est réalisé à l'aide de la technique de diffusion sur milieu solide connu sous le terme d'antibiogramme. Le pouvoir antimicrobien des extraits aqueux a été évalué contre deux bactéries Gram positives *Staphylococcus aureus* ATCC 6538 et *Listeria monocytogenes* ATCC 19117, ainsi que deux bactéries Gram négatives *Escherichia coli* et *Pseudomonas aerogenosa.* Le diamètre de la zone d'inhibition est calculé en mm, et comparé aux antibiotiques standards. Par rapport au test antigermination, des graines de blé dur (*Triticum durum*) ont servi pour réaliser ce test. Cette activité est faite à la demandé d'un industriel confronté à la germination des grains de blé lors du stockage. Ces graines ont été triées, homogénéisées puis mises dans des boites de Pétri contenant de l'eau distillée supplémentée des différentes doses utilisées des extraits aqueux des Feuilles d'*Eucalyptus stricklandii* et de *Pistacia lentiscus* en se basant sur les travaux de Amri et al., 2012.

3. Résultats et discussion

Le rendement d'extraction est variable selon les feuilles des différentes plantes de notre étude, ainsi que de la méthode d'extraction employée. Pour les deux plantes étudiées, les extraits obtenus par décoction gagnaient les premiers classements en termes de rendement alors que ceux obtenus par la macération à froid (MF) possèdent les rendements les plus faibles. L'extrait aqueux des feuilles de *Pistacia lentiscus* possède le rendement le plus important quelque soit la méthode d'extraction utilisée (Tableau 1). La composition chimique globale a montré que les extraits aqueux obtenus suite à la décoction des feuilles d'*E. stricklandii* sont un vrai réservoir de polyphénols totaux et flavonoïdes avec des teneurs respectives de 628,12 ± 0,77 mg AG eq/ g

MS et 372,72 ± 0,43 mg Q eq/ g MS (Figures 1A, 1B). Par rapport au pouvoir antioxydant, l'extrait décoction d'*E. stricklandii* possède la meilleure CI_{50} de l'ordre de 0,17± 0,0 µg/mL. Un pouvoir piégeur des radicaux libres DPPH presque vingt six fois plus important que la référence Vitamine C dont la CI_{50} est équivalente à 4,4±0,24µg/mL.
Par rapport à l'évaluation de l'activité antimicrobienne, tous les extraits aqueux des deux plantes sont actifs contre les souches testées donnant des diamètres de zone d'inhibition de 15 jusqu'à 30 mm. Seule *L. monocytogenes* est résistante à tous les extraits (Figure 2). Les résultats de l'évaluation du pouvoir antigerminatif montrent que les extraits décotion d'*E. stricklandii* et Macération à froid de *P. lentiscus* ont un effet inhibiteur sur la germination des graines de blé dur et que le pourcentage de germination diminue en augmentant la concentration des extraits.

Tableau 1. Rendement d'extraction en %

	M F	Décoction	Infusion
Pistacia lentiscus	28,10±0,14	33,60±0,14	30,90±0,21
Eucalyptus stricklandii	16,60±0,23	20,30±0,13	16,90±0,34

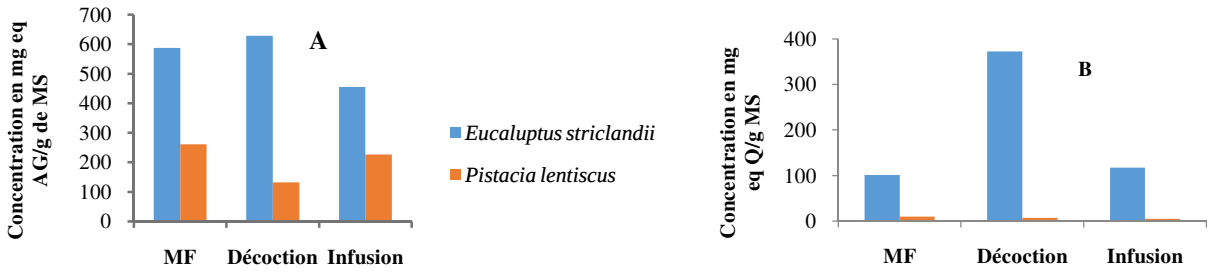

Figure 1: Composition chimique globale des extraits aqueux des feuilles d'*E. stricklandii* et *Pistacia lentiscus*

A : Teneur en polyphénols totaux (mg AG eq/gMS) ; B : Teneur en flavonoïdes (mg Qeq /gMS)

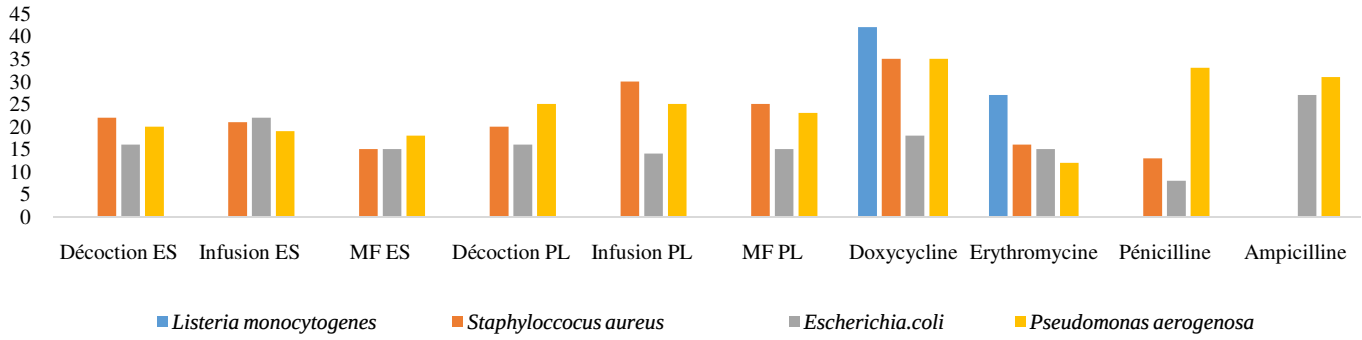

Figure 2 : Activité antimicrobienne des extraits aqueux exprimée en diamètre de zone d'inhibition (mm)

4. Conclusion

En guise de conclusion, les extraits aqueux des deux plantes sont riches en composés phénoliques et sont dotés d'activités antioxydante et antimicrobienne importantes. Concernant l'évaluation générale des plantes étudiées, l'*Eucalyptus stricklandii* parait plus efficace que le *Pisatacia lentiscus* en terme d'activités biologiques.
La valorisation de ces extraits a été réalisée par des applications dans le domaine agronomique (test antigermination) et agroalimentaire (pouvoir antimicrobien contre des souches responsables d'altération des denrées alimentaires). Il serait judicieux de piocher en profondeur dans le mode d'action de ces molécules phénoliques, de les caractériser avec CLHP-SM, d'étudier l'impact économique de ces supplémentations biologiques que ce soit par rapport à l'industriel ou par rapport au consommateur.

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Study of the sensitivity of *Myrtus Communis L.* in condition of saline stress

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1. Introduction

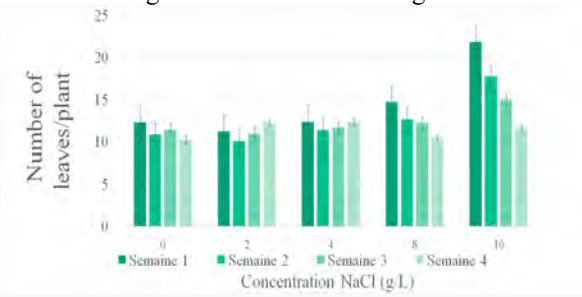
Salinity is a global issue threatening land productivity and food production in many parts of the world in general and of Tunisia in particular, which negatively affects plant production. Myrtle (*Myrtus communis* L.) is a bushy evergreen sclerophyllous plant with significant ornamental interest used in re-vegetation projects in arid and degraded land and landscaping projects. It is a Mediterranean specie that is well adapted to abiotic stresses, although it may be affected by salinity. The objective of this study was to follow the tolerance to salt stress of *Myrtus communis* L. under different cultivation modes (hydroponic and under greenhouse).

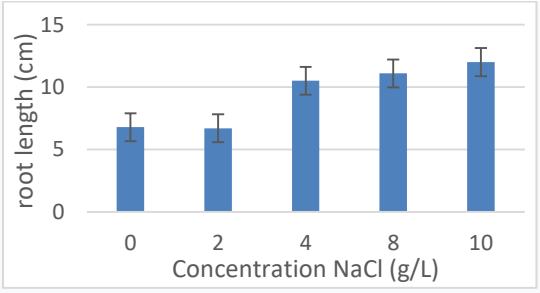
2. Materials and Methods

The experiment was carried out in hydroponic mode of cultivation at the Institute INRGREF with five salt concentration levels: 0g/L, 2 g / L, 4 g / L, 8 g / L, 10 g / L of Nacl. The data collected (7 days after application of stress) related to the biochemical parameters (chlorophylle, proline, and soluble sugars) of Myrtle (*Myrtus communis* L.). The experiment under greenhouse was carried out with the same concentration levels of Nacl. All measurements were performed on plantlets cultivated in pots filled with substrate "Perlite". The experiment is a completely randomized with three blocks. The data collected (28 days after the application of stress) focused on physiological parameters (chlorophyll content, number of leaves per plant and root length), biochemical (soluble sugar content, proline content) of the plantlets of Myrtle and mineral content (K+, Na +).

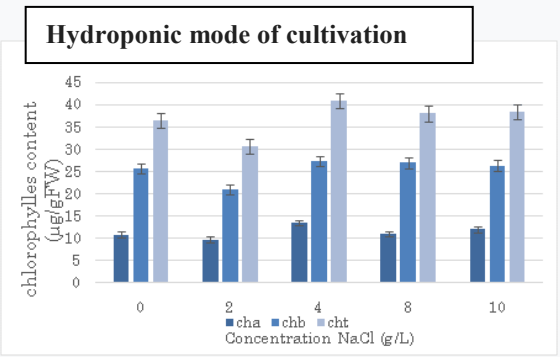
3. Results and discussion

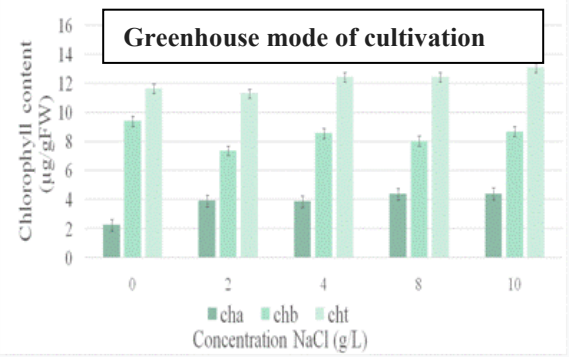
The results obtained showed that the effect of the concentration of 8 and 10 g / L of NaCl had influenced on the morphological and physiological parameters under the greenhouse: reduction in the number of leaves . The ANOVA results showed **high effect** of NaCl in plant growth, especially the **number of leaves which are sensitivity at the dose of 8 g / L**. The results show that the salt stress induces a non-significant decrease in the growth of the roots.



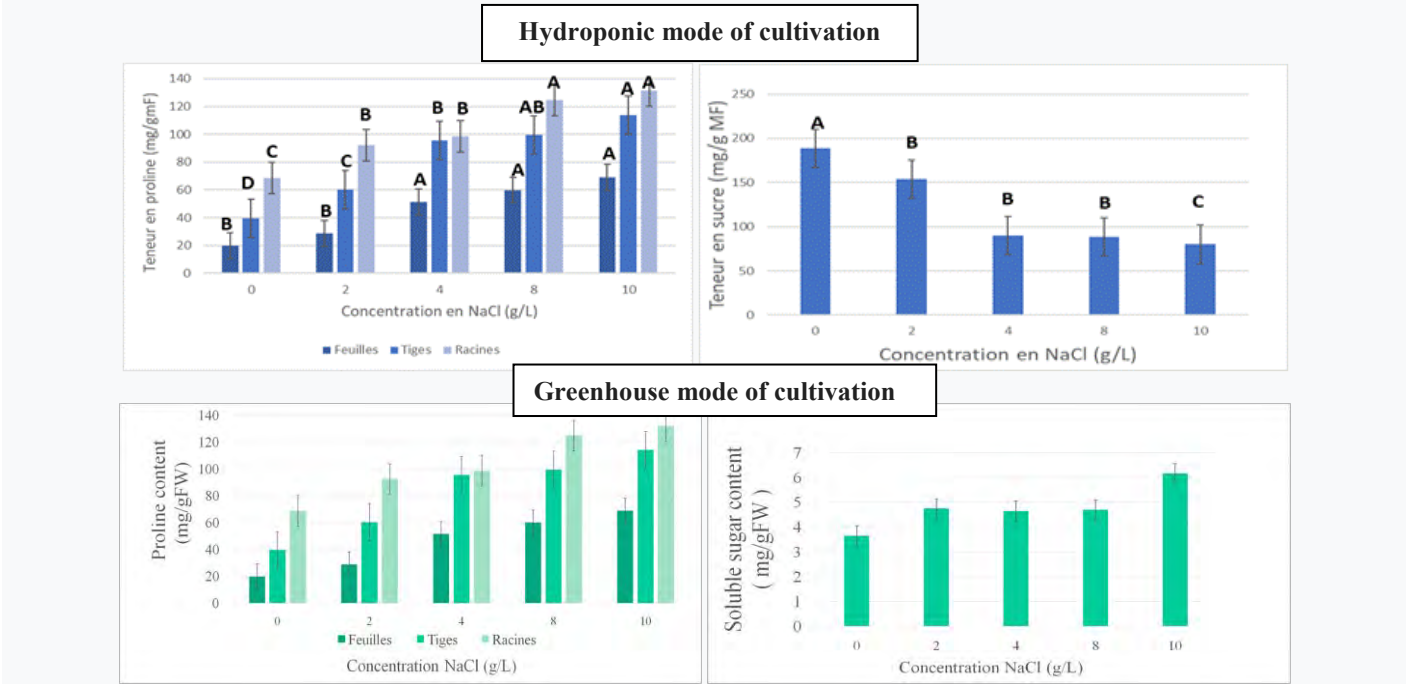


While for the **Physiological parameter**, stress did not generate a significant effect only for high concentrations which are of the order of 10g / L. The results for chlorophyll content show that all accessions studied (chlorophylls a, b and total) respond negatively to salt stress in the two mode of cultivation . We can deduce from our results that despite the NaCl concentrations to which our seedlings were subjected, they were able to protect their photosynthetic apparatus while ensuring growth and development of the aerial part, this is the case in Atriplex halimus (Benrebiha et al., 2012).These results agree with those of Sharaf et al. (1990) on tomato, Dali et al. (1997) on chilli and Rhim et al. (2013) on chilli pepper (*Capsicum annuum* L.) which indicated that moderate salinity increases the amount of chlorophyll a and total chlorophyll.

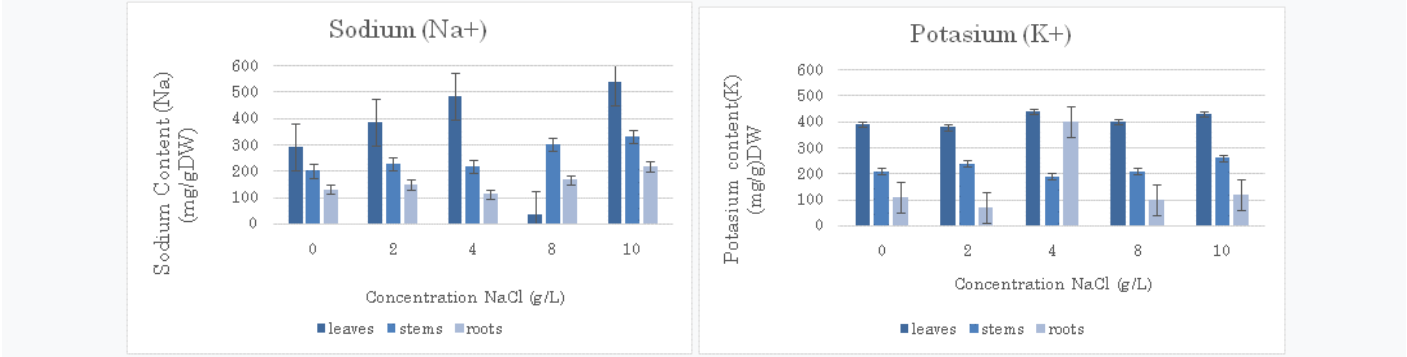




Salinity also caused a highly significant increase in proline content and soluble sugar content in the *Myrtus communis* treated especially at the level of 10 g / L in greenhouse .However, hydroponic mode showed the inverse. There is a decrease in sugar content by increasing the dose of NaCl. A highly significant effect in stressed plants and the highest for the 10g / L concentration. The results show that proline content is more important at the root level followed by stems and leaves. *Myrtus communis* is relatively tolerant at concentrations below 10g / l of NaCl in hydroponic mode of cultivation for sugar content. A highly significant increase in proline content and soluble sugar content in the *Myrtus communis* treated especially at the level of 10 g / L under greenhouse mode. Proline content is more important at the root level followed by stems and leaves. The accumulation of proline is a form of osmotic adjustment and constitutes a means of tolerance to salinity.



The analysis of the mineral nutrition of myrtle under salt stress allowed us to conclude that the levels of sodium Na + increase with the concentrations of NaCl therefore the myrtle plant accumulates the mineral elements in the event of salt stress. This allows us to suggest that this plant is of the "includer" type because the part which accumulates more sodium is the most sensitive to stress, this is the case of the leaves which have the highest sodium content Na + and increases with increasing stress. the concentration of salt (NaCl).



Thus several studies have shown that salt tolerance in higher plants depends on how plants control salt transport through the organs (Niu et al, 2010). Our results have shown that the potassium content is lower at the level of the roots compared to the aerial part. This is because salinity can affect K + uptake, depending on species and salt level (Grattan and Grieve, 1999). The efficiency of absorption and use of K +, which acts as an osmoticum, is therefore crucial in adapting to salt stress (Hamrouni et al, 2011)

4. Conclusion

This work has improved knowledge of the behavior and adaptation strategies of Myrtus communis under saline stress conditions in different cultivations modes (hydroponic and under greenhouse).

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Prévalence de la nosémose dans les colonies d'abeilles mellifères dans quelques régions du centre d'Algérie

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1. Introduction

L'abeille constitue un élément indispensable de l'équilibre environnemental dans le monde en tant que pollinisateur de très nombreuses espèces. Elle présente aussi d'autres intérêts dont la production de miel, de propolis, de gelée royale et de cire. Malheureusement, cette espèce est menacée par plusieurs facteurs, le plus important est la présence des agents pathogènes qui provoquent des pathologies dans les colonies. L'une des pathologies les plus dangereuses est la nosémose. L'intérêt de ce présent travail est d'évaluer la situation sanitaire des colonies d'abeilles dans quelques régions du centre d'Algérie (Boumerdès, Bouira et Blida).

2. Matériels et Méthodes

Lieu et période de travail :
Le travail a été réalisé sur 21 ruchers. Au niveau de chaque rucher, l'échantillonnage est effectué sur 5% des ruches. Les prélèvements sont effectué en 2019 à la fin de l'hiver et au début du printemps dans 3 zones agricoles : Boumerdès, de Bouira et Tizi ouzou avec 7 ruchers dans chaque région.
Méthode de prélèvement des abeilles
Des abeilles ouvrières d'âge indéterminé sont prélevées au niveau du 4ème ou du 6ème cadre du couvain des colonies de la race *Apis mellifera intermissa.* Après le prélèvement, les abeilles sont conservés dans des boîtes contenant de l'éthanol à 95° et à une température de – 20°C jusqu'au jour des analyses.

Figure 1: Localisation de la zone d'étude.

3. Résultats et discussion

Après observation avec le microscope photonique, les spores de *Nosema* semblent transparentes avec un contour foncé très distinct, mesurant entre 5 et 7 µm de long et 3 à 4 µm de large . La comparaison de pourcentage de contamination entre les trois zones étudiées montre que les ruchers situés dans la zone de Boumerdès enregistrent le taux de contamination le plus élevé (21%) (Figure 3). Ce taux plus élevé que ceux notés dans les deux autres zones, celles de Bouira (08 %) et de Tizi ouzou (10 %).

L'analyse de la variance montre une différence hautement significative dans les résultats de la prévalence entre les zones étudiées. L'analyse des données climatiques mentionnées pour la région étudiée montre que la zone de Boumerdès correspond à un hiver prolongé et une humidité élevée. Il semble qu'il existe une relation entre l'augmentation de la prévalence et les conditions climatiques particulières tels que le niveau élevé de l'humidité et de la grande durée de la période froide. En effet, il est généralement admis que *Nosema* sp. est répandue dans les zones froides et que la gravité de l'infection se limite aux régions à hiver long (Moeller, 1978). Bailey (1981) indique que les causes qui favorisent le développement de cette pathologie sont liées essentiellement durant les hivers longs au confinement prolongé de l'abeille à l'intérieur de la ruche, ce qui favorise une dissémination active de *Nosema.* Selon Barbançon et L'Hostis (2007). Les recherches menées sur *Nosema* aussi indiquent que l'infestation atteint son taux le plus élevé pendant les saisons humides de l'année (Fries, 1988; Huang *et al.* 2007). Dans les régions méditerranéennes où l'humidité est élevée en été, l'infection est également forte au cours de cette même période (Martin-Hernandez *et al*. 2007). Le maximum de l'infestation est enregistré au printemps et le taux le plus faible en été (Higes *et al*. 2006).

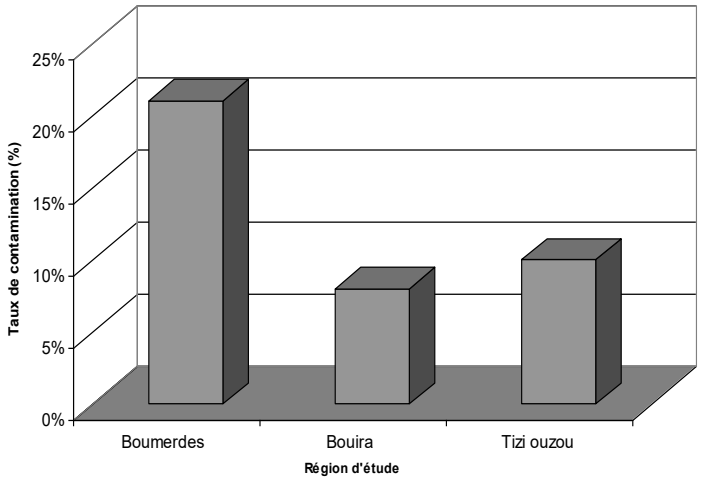

Figure 2 : histogramme de pourcentage de contamination par la nosémose dans les zones étudiées

4. Conclusion

Les résultats de notre étude montrent que cette pathologie est présente dans toutes les zones étudiées, avec une différence dans le taux d'infestation. Le fait que la zone de Boumerdès soit caractérisée par des infestations par *Nosema sp.* Significativement plus élevées que dans autres régions montre l'importante influence des facteurs du climat en particulier de l'humidité élevée suite aux abondantes chutes de pluies et de l'allongement de la durée de l'hiver. Ainsi, l'humidité et les basses températures favorisent le développement de la nosémose. L'observation des symptômes de la pathologie au niveau du rucher ne constitue à aucun cas une preuve de la présence ou l'absence de Noséma. En effet, les résultats obtenus montrent la présence des spores de Noséma sans aucunes présences des symptômes typiques. Probablement, ces signes de la maladie apparaissent lorsque le taux de présence des spores au niveau des abeilles est très élevé. D'où la nécessité de prévoir à l'avenir des travaux pour l'étude d'une éventuelle corrélation entre le taux de la présence des spores et l'apparition des symptômes. Le dépistage précoce de la maladie est un élément essentiel pour éviter les pertes de colonies. Il peut aider à empêcher la propagation de l'infection vers des colonies d'abeilles encore saines. Lorsque les colonies sont atteintes par cette maladie, la production devient un problème secondaire devant la nécessité de traiter en urgence la colonie infectée pour la sauver. Il serait utile de procéder à 4 prélèvements par an, soit 1 par saison.

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Diversité floristique d'adventices des agrumeraies du secteur phytogéographique Oranais (Ouest d'Algérie)

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1. Introduction

Les adventices dans l'agro-écosystème sont connues comme un problème critique qui est associé à de graves pertes économiques. Il y a un manque des informations sur la biologie et l'écologie des communautés adventices dans les agro-écosystèmes du tell nord-ouest d'Oranie (ouest algérien),en particulier les vergers d'agrumes

2. Matériels and Méthodes

Pour l'inventaire de la flore adventice, nous avons réalisé200 relevés phytoécologiques sur l'ensemble de l'aire étudiée (Oran, Mascara, Mohammedia, Sig et Tlemcen) (Fig. 1), dans les vergers agrumicoles, durant la période printanière de l'année 2015-2016. Ils ont été répartis sur l'ensemble de la zone d'étude de façon à prendre en compte la variabilité des facteurs écologiques et agronomiques. La technique de relevé floristique utilisée est celle du tour de champs, qui permet de connaître les différentes espèces de la parcelle (Lebreton *et al.,* 2005).Les relevés sont réalisés sur des surfaces représentatives d'environ 100 m2 (aire minimale) homogènes du point de vue floristique. Chaque espèce inventoriée est affectée d'un coefficient d'abondance– dominance (de + à 5). Les espèces inventoriées ont été réparties selon la famille botanique, le type biologique de Raunkiær et le statut biogéographique.

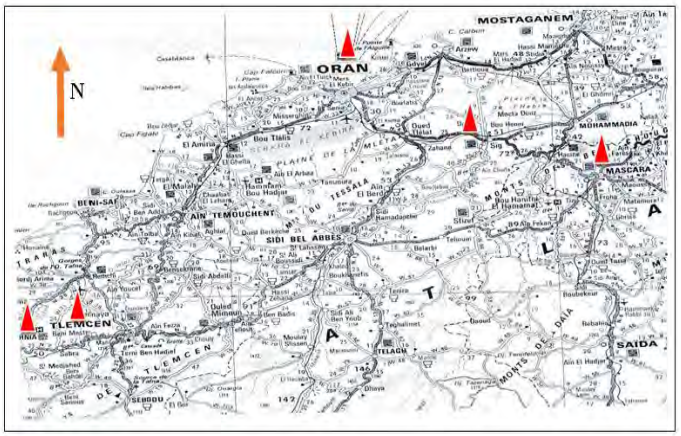

Figure 1 : Localisation des sites d'échantillonnage (triangles rouges). Carte géographique de l'Oranie de l'Institut national de cartographie d'Oran (carte au 1/500).

3. Résultats et discussion

Sur toute la zone d'étude, nous avons recensé 101 espèces adventices appartenant à 87 genres et 31 familles. Nous avons remarqué que la famille des *Poaceae* est la plus riche en espèces avec 17 soit 16.83 % de l'effectif total, suivie par la famille des *Asteraceae* avec 13 espèces soit 12.87% et les familles *des Brassicaceae* et *Fabaceae* avec 9 espèces soit 8.91 % et la famille des *Apiaceae* avec 6 espèces soit 5.94 %. Les autres familles sont reparties entre 1 et 4 espèces avec une contribution de 0.99% à 3.96%. Les espèces recensées appartenant notamment à l'élément méditerranéen présentent un taux de présence de 43%. La dominance des thérophytes dans tous les sites visités est d'environ72, 27% de l'effectif total.. Les géophytes sont représentés par 15 espèces soit 14,85% de l'effectif total. Les hémicryptophytes et les chaméphytes constituent respectivement 10,89% et 0,99%. Dans la plupart des cas des géophytes, la multiplication végétative devient leur seul mode de survie. Nous citons : *Cynodon dactylon* L est l'une des principales mauvaises herbes pérennes qui pose un problème pour l'arboriculture (**Fenni 2003**). Cela a été également confirmé par **Jauzein (2001)**, le fait que si le travail du sol détruit parfaitement les espèces ligneuses (phanérophytes et chaméphytes) ou les espèces herbacées à souche (hémicryptophytes), il a une action beaucoup plus nuancée sur les types biologiques adaptés aux perturbations comme les vivaces à fort pouvoir de multiplication végétative (géophytes) ou surtout les plantes annuelles (thérophytes). Pour ces dernières, l'action destructrice est largement compensée par l'incidence bénéfique de l'enfouissement des semences.

L'importance agronomique

L'analyse de nos adventices a permis de distinguer 6 groupes d'espèces reflétant leur potentiel de nuisibilité, donc leur importance agronomique (fig.2). L'analyse de l'importance agronomique des espèces adventices est étudiée à partir de la relation entre la fréquence relative et l'abondance moyenne des espèces (**Le Bourgeois et Guillerm, 1995** ; **Stevoux *et al*., 2000).** Les espèces agronomique les plus nuisibles se sont révélées être : *Avena sterilis* L., *Oxalis cernua* et *Cynodon dactylon*. Cynodon dactylon est une espèce thermophile affectionnant les sols limoneux à limono sableux, secs, éclairés et très chauds des vergers et vignobles. **Thomas (1969)** a montré que cette dernière espèce est très résistante à la sécheresse et que ses rhizomes difficiles à extirper, peuvent survivre jusqu'à un taux d'humidité d'environ 10 % de leur poids total ce qui l'a rendue dans les régions subtropicales (Afrique du Sud notamment) une des adventices exotiques (introduite initialement en tant que plante fourragère) les plus menaçantes pour l'agriculture **(Holm et *al.*, 1977).** *Convolvulus arvensis*, est classée parmi les quinze premières "mauvaises herbes" des cultures printanières et estivales (**Maillet, 1988).**

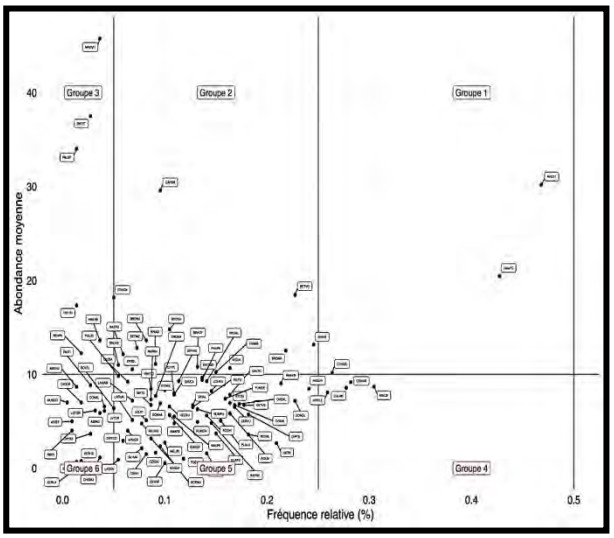

Figure 2: Diagramme d'infestation des espèces (les espèces sont représentées par leur code OEPP).

4. Conclusion

L'étude de l'importance agronomique d'adventice a permis de distinguer 6 groupes d'espèces reflétant leur potentiel de nuisibilité, elle a mis en évidence les espèces les plus préoccupantes dans les verger d'agrumes. Il s'agit particulièrement d'*Avena sterilis*, *Oxalis cernua* et *Cynodon dactylon* (L). La connaissance de la composition de la flore adventice des agrumerais et de son évolution avec les pratiques culturales du secteur phytogéographique oranais (ouest d'Algérie) est un préalable indispensable à toute mise au point de stratégies de lutte intégrée. L'intensification de l'agriculture a créé des conditions nouvelles pour lesquelles peu d'espèces adventices sont équipées. Cependant, le processus d'ajustement à ces nouvelles conditions de milieu a récemment commencé **(Edwards *et al.*, 2006).**

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In silico assessment of insecticidal activity of *Thymus algeriensis* and *T. numidicus*

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1. Introduction

Crop losses due to harmful organisms (pests) can be substantial and may be prevented, or reduced, by crop protection measures (Oerke, 2006). The use of chemical pesticides has numerous advantages. However, in addition to their direct costs, they have numerous indirect or external costs, which they include monitoring and sanitation for contamination of soils, drinking water, or food, poisoning of pesticide users and farm workers, and the deleterious effects on non-target organisms such as bees and other beneficial insects, fish and birds (Lamichhane *et al.*, 2016)

There is a growing interest given these last years to biopesticides, for a sustainable development. Biopesticides are a group of naturally occurring, often slow-acting protecting agents that are usually safer to humans with minimal residual effects to the environment than conventional pesticides (Hassan Adeyemi, 2010).

In nature, plant essential oils play an important role in the protection of the plants as antibacterials, antivirals, antifungals, insecticides and also against herbivores by reducing their appetite for such plants (Bakkali *et al.*, 2008).

Thymus algeriensis is the most widespread North African species, endemic to Algeria, Libya, Tunisia and Marocco (Nikolić *et al.*, 2014). Whereas, *T. numidicus* is an endemic species to northern Algeria and Tunisia (Kabouche *et al.*, 2005).

One application of molecular docking is to design pharmaceuticals *in silico* by optimizing lead candidates targeted against proteins (Thomsen & Christensen, 2006). It has the benefits to reduce costs and time necessary to test biological activities of compounds.Thus, this work aims to assess the virtual effectiveness of the *Thymus algeriensis* and *T. numidicus*'s chemical composition against insects.

2. Materials and Methods

The main objective of this paper is to study the interactions between two molecules: a receptor and a ligand by molecular docking, in order to elucidate the potential insecticidal activity of some compounds of *T. algeriensis* and *T. numidicus* essential oils (EO). To do this, we used the following material: microcomputer (with 2 GB of RAM, Intel(R) Core I3 CPU M370 @ 2.40 GHz), MOE (Molecular Operating Environment) package version 2014.0901, PDB (Protein Data Bank) and Pubchem databases.

The protein *Drosophila melanogaster* Acetylcholinesterase receptor have been chosen as target and then downloaded from the PDB database (Table 1).

Code PDB	Classification	Resolution	Ligand
1QON	HYDROLASE	2.72 Å	I40

Table 1. Data about the target protein

Chemical composition of EO is obtained from several articles, after that we chose seven among their major compounds, and we downloaded them from the PubChem website (Table 2).

Code PubChem	Compound name
CID 17868	α-Thujene
CID 6654	α-Pinene
CID 6616	Camphene
CID 79035	Tricyclene
CID 6427476	Verbenene
CID 18818	Sabinene
CID 14896	β-Pinene

Table 2. Compound codes downloaded from PubChem

Finally, the study of the interaction between the active site of the protein and the EO compounds to form a stable complex is carried out using MOE software.

3. Results and discussion

The docking procedure allows the generation of a list of complexes representing the favorable association modes between the ligand and the macromolecular receptor. In general, α –Thujene gave the best affinity result with 1QON (Table 3).

	CID	S score
α -Thujene	17868	-4.7791
α -Pinene	6654	-4.4318
Camphene	6616	-4.5979
Tricyclene	79035	-4.1508
Verbenene	6427476	-4.2834
Sabinene	18818	-4.7391
β -Pinene	14896	-4.3973

Table 3. The results of the different compounds with the studied target protein 1QON

The association between proteins and ligands is governed by several thermodynamic parameters: hydrophobic interactions, electrostatic interactions …. (Figures 1 & 2).

For instance, Figure 1 showed electrostatic field of the *D. melanogaster* acetylcholinesterase receptor and the ligand α - Thujene. The region in blue represents positively charged atoms, while regions in red are negatively charged atoms.

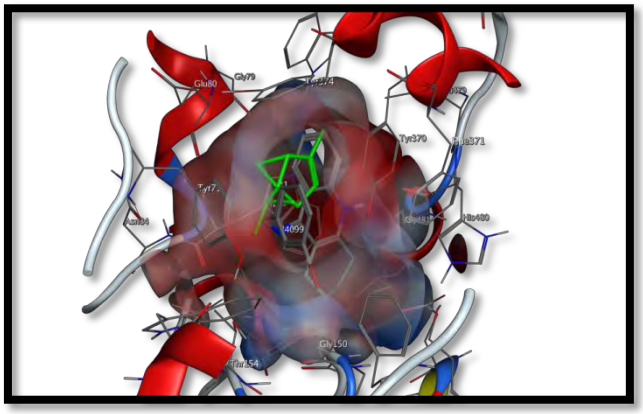

Figure 1. Graphical representation in surface mode of the electrostatic interactions of the active site with α -Thujene

On the other hand, Figure 2 showed the hydrophobic patch of *D. melanogaster* acetylcholinesterase receptor and the ligand α - Thujene, which indicates lipophilic atoms (most of the receptor regions are green in color).

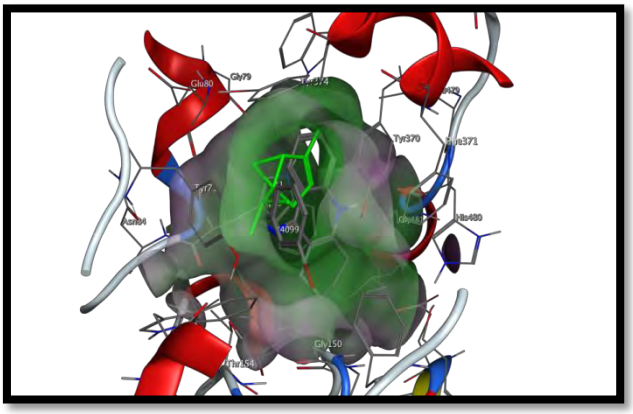

Figure 2. Surface mode graphical representation of the hydrophobic interactions of the active site with α -Thujene

4. Conclusion

According to the results obtained, we noticed that 1QON has the lowest energy with α -Thujene ligand (- 4.7791), which mean that this compound is the best among the seven tested, so it has some insecticidal activity.

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Characterization of mechanically extracted almond oil and its residue for specific cosmetic and food applications

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1. Introduction

The almond tree (*Prunus amygdalus* Dulcis) is generally recognized as drought tolerant. Recently eastern Morocco, an ancestral area for almond cultivation, was supported by Belgian development agency "Enabel" through the "PROFAO*" project for the planting of 6000 ha of two late-flowering cultivars *ferragnes (Fg) and feraduel (Fd)*. This study concerns the improvement of the value chain of almond products; it concerns the valorization of broken and defective kernels of low market value, resulting from almonds sorting, as raw material for the mechanical oil extraction. Almond oil and de-oiled almond flour from almond oil residues could be recovered for specific cosmetic and food uses, respectively.

*Projet de développement de la filière des amandes dans la Région de l'Oriental

2. Materials and Methods

Cold-pressed almond oil and oil's residues (almond cake) were obtained from the cooperative "Sidi Bouhria" in eastern Morocco. Almond oil and almond cake, which had been ground to obtain flour, which were stored in the dark until used for analysis

Almond Oil analysis:

- Fatty acid (FA) analysis was performed by GC-FID (HP 6890) series gas chromatography system equipped with FID detector. FA were identified by standard according to the method developed in the lab and as described by Mansouri et al., (2016).
- Almond oil (AO) oxidative stability index (OSI) was determined according to the Rancimat Test (Metrohm apparatus model 743). OSI of AO is expressed as the induction time in hours.
- Tocopherols (α, β, γ isomers) analysis was performed according to the AOCS method Ce 8-89 AOCS, (AOCS, 1989) by HPLC-FLD. The tocopherols were identified and quantified by external standardization.

Almond cake analysis:

Total of sugars, ash and proteins were analyzed in almond cake respectively according to Bertand method, AOAC (1990) standards and Kjeldahl method by AFNOR: NF V04-407. Gluten was measured by AACC 38-10 Gluten-Hand Washing method

3. Results and discussion

The results show that the main fatty acids of analysed almond oils are in descending order, oleic (62.68%), linoleic (25,62 - 26,10 %) and palmitic acids (7,32 %–7;71 %). This dominance leads to classify these oils in the oleic oil class. Our results are consistent with those reported by (Gouta et al., 2020) for almond oil from *Ferragnes* and *Ferraduel* varieties cultivated in other geographical area. The test *t* does not show significant difference between the studied varieties. The monounsaturated fatty acids (MUFA) represent more than 63% of total FA, whereas, the saturated fatty acids (SFA) represent the minor fraction in analysed oils (10%). SFAs are often considered undesirable for human health. However, several studies have demonstrated the positive effect

of the stearic acid which represents 28% of SFA proportion in the tested oils. Regarding the MUFAs, the results show the prevailing individual MUFA is oleic acid (more 62%). This latter is considered to be beneficial FA to our health in particular its effects on plasma cholesterol and low-density lipoprotein (Emken, 2013). In the present study, the predominant PUFAs is linoleic acid with a percentage of 26%.

The tocopherol analyses allows to identify three tocopherols homologs (α-, β and, γ-tocopherol) with a dominance of α-tocopherol. The results show a significant difference between the analyzed almond oils (p<0.05). The total tocopherols average ranged from 408.99 to 457.21 mg/Kg. The content of the predominant tocopherol (α homologue) varies from 401.23 to 448.81 mg/kg respectively for Fg and Fd. Concerning the γ-tocopherol, the recorded values range between 5.32 and 6.26 mg/kg for Fg and Fd, respectively. This result is comparable to values found for other introduced varieties cultivated in the same area, while, is lower than that recorded in our study for Beldi ecotype (Melhaoui et al., 2018). This difference could be explained certainly by genetic factors (Melhaoui et al., 2018).

Almond cake is a co-product of the physical extraction of almond oil. The registered results show that almond cake contains 92.92% of dry matter, including 33.02% protein (gluten free), 13.07% total sugar, and 4.85% ash. This powder is a flour rich in fibber, which can be used as an ingredient in the formulation of dietary foods for special dietary needs.

4. Conclusion

These results show the quality of the tested almond oil, which is rich in tocopherols and favorable fatty acids. It is recommended as an edible oil but is especially suitable for more profitable cosmetic applications. Almond cake flour, prepared from almond oil by-product, is a gluten-free flour that is rich in fiber and has good nutritional value; this makes it an interesting ingredient to mix with other gluten-free flours to make gluten-free biscuits and biscuits. These products are designed for patients with celiac disease who cannot consume baked goods made from wheat flour and its derivatives.

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Lutte biologique, via l'application des filtrats fongiques des mycoendophytes, contre le puceron noir de la fève; *Aphis fabae* (Hemiptera, Aphididae).

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1. Introduction

L'utilisation intensive des pesticides chimiques en agriculture cause des dommages à l'environnement, à la santé humaine et entraîne une perte d'efficacité liées au développement de résistance des insectes et des pertes économiques. Il est aujourd'hui largement acquis que le développement de systèmes de production agricole plus durables dépend de la réduction de l'utilisation des pesticides et donc la mise en place des alternatives de lutte plus efficaces, rassurantes et durables est devenue actuellement plus qu'une necessité en vue de preserver une qaulité de vie (Etilé, 2012). L'application des biopesticides à base de mycoendophytes est considérée l'un des moyens de lutte biologique les plus prometteux en matière de lutte contre les insectes ravageurs. C'est dans ce contexte, se justifie ce travail qui vise à exploiter les potentialités aphicides de quelques mycotaxons endophytes isolés à partir du faux-poivrier (*Schinus molle* L., Anacardiaceae) et le Harmel (*Peganum harmala* L., Zygophyllaceae) envers le puceron noir de la fève, via l'application des filtrats fongiques.

2. Matériels et méthodes

Après la stérilisation superficielle, les fragments ont été ensemencés sur le milieu de culture PDA (Potato Dextrose Agar) et incubés à l'obscurité (25°C) (Tejesvi et al., 2006). Un milieu liquide spécifique de Wickerham a été opté pour la culture submergée des mycotaxons testés (Hassan, 2007). Quotidiennement, les cultures ont été soumises à une agitation afin d'homogénéiser le milieu et la biomasse fongique. Une fois atteignant une biomasse importante (après 7 à 15 jours), les cultures fongiques seront récupérées et filtrées en série. L'obtention des filtrats de cultures fongiques est donnée selon la méthode de Stekoll et West, (1978). Enfin, les filtrats fongiques sont conservés entre 0 et 4°C jusqu'à leurs utilisations. Le dispositif experimental est basé sur une technique dite VCE (Ventilated Chamber Bioassay). Les tests de traitement par pulvérisation directe ont été réalisés sur des fragments de plantes de fève mis dans des boites de pétri contenant du coton imbibé d'eau placé à l'extrémité de chaque fragment afin d'entraver une perte hydrique rapide et de préserver le statut osmotique lors des essais (Navon et Ascher, 2000). Chaque boite contient 10 individus de pucerons avec un nombre de répétition de 10 pour chaque filtrat (le témoin traité avec l'eau distillée). Le pourcentage de mortalité est déterminé après 24^{h} de la pulvérisation. Le calcul du taux de mortalité tient en compte la formule de la mortalité corrigée d'Abbott (1925). L'analyse de variance (ANOVA) est effectuée afin de révéler les différences et les liens au sein des filtrats fongiques. Toutes les analyses statistiques ont été réalisées moyennant le module XLSTAT 2009 de Microsoft Office ®.

3. Résultats et discussion

Les résultats concernant l'activité insecticide des filtrats fongiques appliqués, exprimé par le taux de mortalité de la cible, sont exposés dans le tableau et la figure.

Type du filtrat	Taux de mortalité (%) (mortalité ± erreur standard)
Alternaria sp.	28,73 ± 0,42
Fusarium oxysporum	35,63 ± 0,6
Chaetomium sp.	68,96 ± 0,56
Trichoderma sp.	51,72 ± 0,57
Témoin	13 ± 0,26

Tableau. Taux de mortalité enregistrés chez *A. fabae*, 24^{h} après pulvérisation des filtrats fongiques.

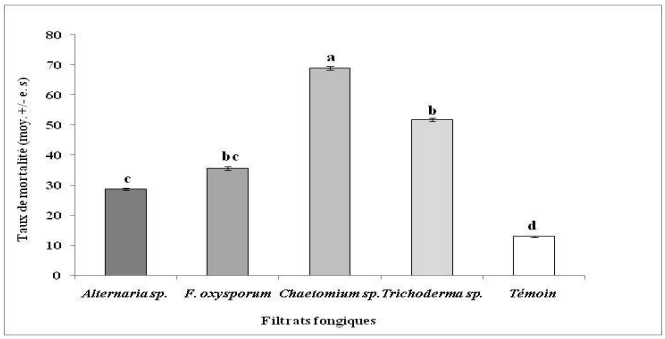

Figure: Effet des filtrats fongiques sur *A. fabae*, 24^{h} après pulvérisation.

L'analyse de la variance (ANOVA, P < 0,05, F = 0,64) indique que l'efficacité du filtrat fongique obtenu à partir de *Chaetomium sp.* vis-à-vis *A. fabae* est significative tandis que l'efficacité des trois groupes fongiques restants (*Alternaria sp.*, *F. oxysporum* et *Trichoderma sp.*) est non significative, avec un taux moyen de mortalité minimum enregistré pour *Alternaria sp.* et *F. oxysporum* (28,73% et 35,63% respectivement) comparativement avec celui de *Trichoderma sp.* et *Chaetomium sp.* (51,72% et 68,96% respectivement).

Comparativement à nos résultats, la toxicité des filtrats fongiques envers les bio-agresseurs a été démontrée (Bensaci *et al.,* 2012; Bensaci *et al.,* 2015; Rouabah *et al.,* 2018). Nous avons constaté que les filtrats fongiques ayant une activité aphicide très variable envers la cible. Cette différence de réponse de la part de l'espèce aphidienne peut être attribuée aux différences marquant la nature chimique des métabolites secondaires produits par les endophytes testés. Ainsi, suivant le biotype et la niche écologique, ces endophytes peuvent jouer un rôle très important en matière de protection de leurs plantes-hôtes en produisant des composés bioactifs appropriés (Bharathidasan & Panneerselvam, 2011).

De nombreux travaux ont été portés sur l'application des cultures des filtrats fongiques comme moyen de lutte contre les insectes (Anderson *et al.,* 2007; Bensaci *et al.,* 2015). *Coelomyces*, *Metarhizium* et *Lagenidium* ont été utilisés pour lutter contre les asticots de moustiques et se sont avérés intéressants dans un éventuel programme de lutte contre les Culicidés. *Alternaria sp.*, *F. oxysporum*, *Chaetomium sp.* et *Trichoderma sp.* sont appliqués comme filtrats fongiques envers le puceron vert du pommier; *Aphis pomi* (Hemiptera, Aphididae) (Rouabah et al., 2018).

Cependant, *Lecanicillium lecanii* et *Cladosporium oxysporum* sont utilisés dans un programme de lutte biologique contre les pucerons; *A. gossypii* et *A. fabae* respectivement (Bensaci *et al.,* 2015). L'endophyte *Chaetomium globosum* peut fournir une résistance contre *Myzus persicae* (Hemiptera, Aphididae) (Chougule et Bonning, 2012). Ainsi, l'application des différentes formulations des cultures fongiques du champignon endophyte *Metarhizium anisopliae* a causé la mortalité des adultes du charançon *Sitophilus oryzae* (Coleoptera, Curculionidae) dans les lieux de stockage (Batta, 2004).

4. Conclusion

Les filtrats issus des quatre mycoendophytes ont une activité aphicide variable à l'égard de l'espèce aphidienne ciblée; le puceron noir de la fève: *A. fabae.* L'endophyte *Chaetomium sp.* avait une meilleure activité insecticide avec un taux de mortalité de 68,96%. Cette variabilité est due principalement à la nature des composés bioactifs produits par les mycotaxons testés.

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Understanding Mediterranean Agriculture Food Systems and their Supply Chain Actors Under Local, Regional and Global Uncertainty
JULY 6-7 2021
CIHEAM MONTPELLIER

Influence of Geographic and Climatic factors on variation of the most significant Essential oil compounds of *Mentha pulegium* L. in Tunisia

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1. Introduction

Predicting how environmental factors affect species chemotypes can be a valuable tool to facilitate prospecting plants rich with researched compounds for nutrition, pharmaceutical or agricultural uses. *Mentha pulegium* L. (*Lamiaceae*) is one of the most common medicinal and aromatic plants in Tunisia. Although there are some studies on *M. pulegium* essential oil constituents, no information is currently available on the influence of environmental factors on its volatile compounds compositions. We proposed herein to investigate the relationship between geographic and climatic factors and the level of most significant essential oil compounds.

2. Materials and Methods

Nineteen *WorldClim* bioclimatic variables and three geographical variables were used to investigate chemotype diversity of 12 wild populations of *M. pulegium*, collected from various natural habitats in Tunisia. The Principal Components Analysis (PCA) was used to identify the most significant essential oil compounds. Pearson correlation-Mantel test analysis was used to explore potential correlations and relationships between chemotypes and environmental factors. All analyses and visualizations were performed using R-Studio version 4.0.3.

3. Results and discussion

PCA analysis allowed us to classify the volatile oils into three chemotypes according to their geographical origins (Figure 1). These chemotypes differed by mediated expression of pulegone (40-80%), isomenthone (25 -78%) and menthone (7- 28%).

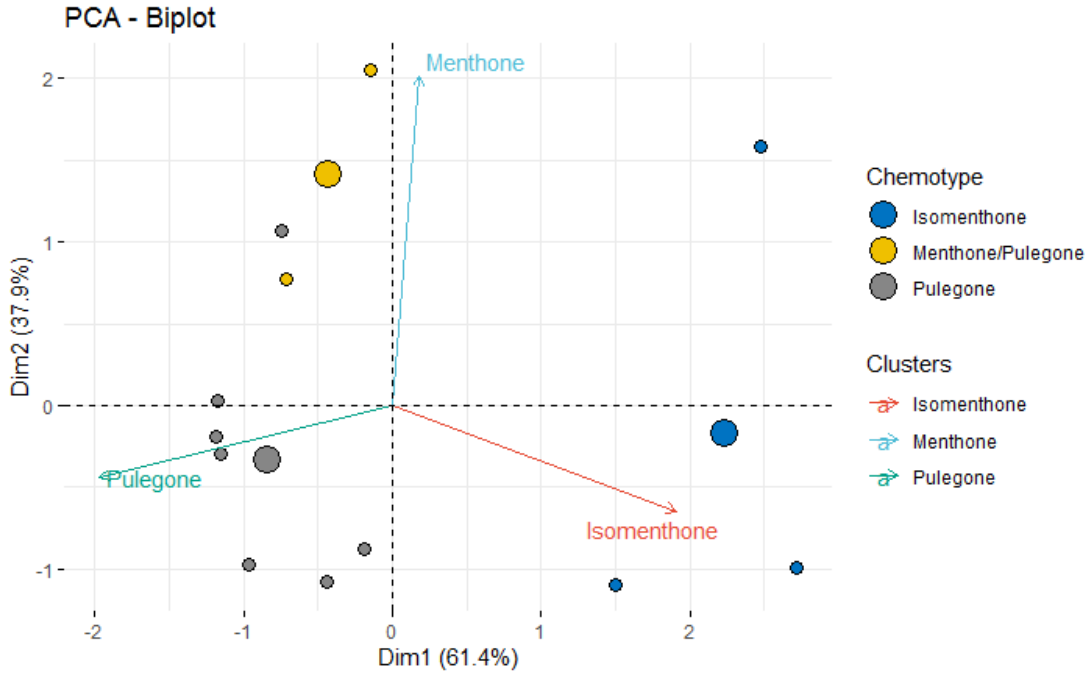

Figure 1: PCA-biplot representing chemical composition similarity relationships among twelve *Mentha pulegium* L. populations

Some environmental factors influenced most significantly *M. pulegium* essential oil constituents. Isomenthone content was the most affected by precipitation of the coldest quarter (Bio 19), precipitation of the wettest quarter (Bio 16), annual precipitation (Bio 12), and latitude (Mantel's $R > 0.5$, $P < 0.01$). Pulegone was most affected by Bio 12 (Mantel's $R > 0.5$; $0.01 < P < 0.05$). While menthone contents were affected by several environmental factors (Figure 2). Our results are consistent with previous studies in several Mediterranean regions pointing out that there is a relatively high correlation between environmental factors and chemotype structure in *M. pulegium* (Kokkini *et al*., 2004; Kanakis *et al*., 2011; Teixeira *et al*., 2012; Brahmi *et al*., 2020).

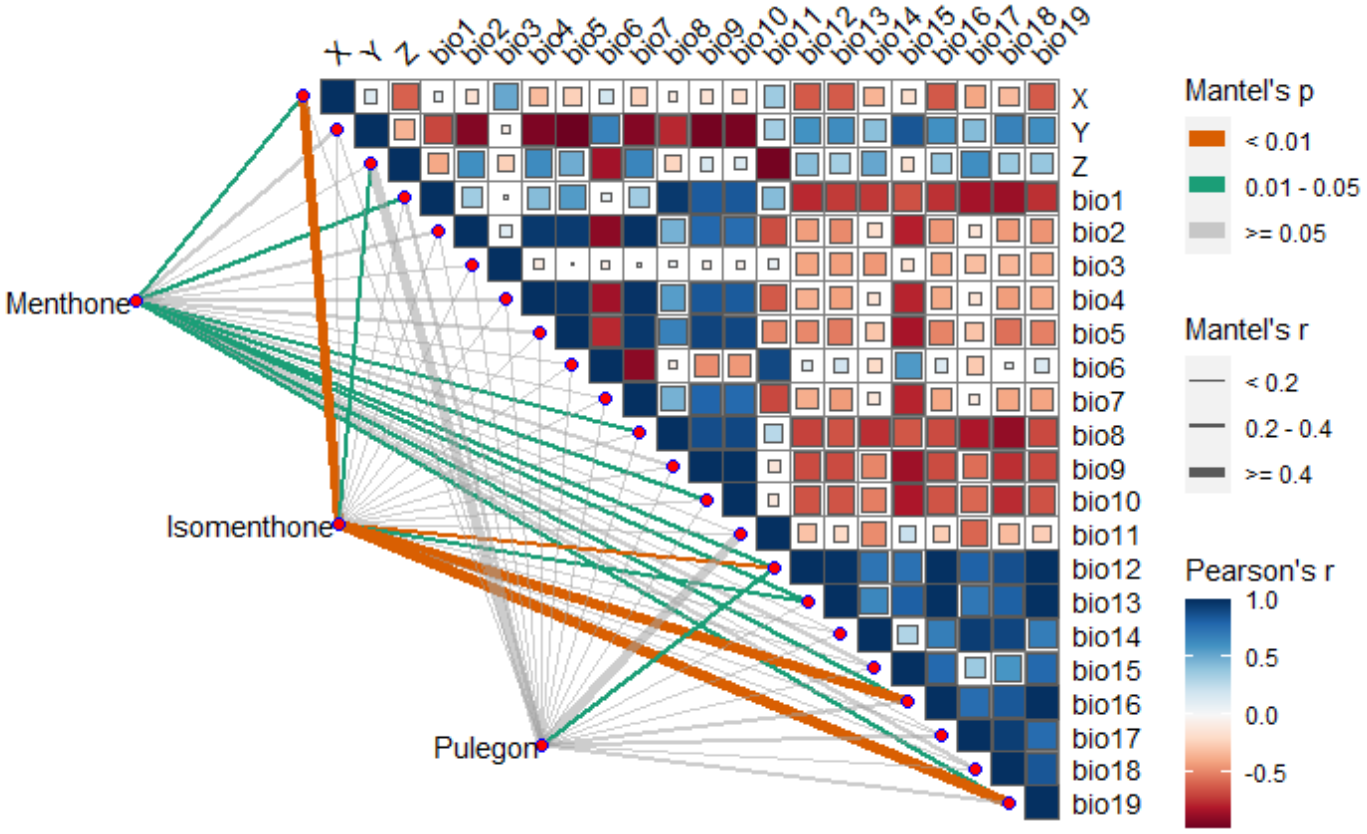

Figure 2: Relationships between environmental factors and chemotypes among twelve Tunisian *Mentha pulegium* L. populations

4. Conclusion

The present study underlined a significant interaction between chemotypes and environmental factors. Among the three identified chemotypes, two are novel and could be useful to produce commercial bioactive molecules. Furthermore, these results emphasize the importance of considering intraspecific diversity in future climate change scenarios.

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Evaluation du taux de colonisation mycorhizienne et du potentiel mycorhizogène du sol rhizosphérique d'une halophyte des dunes littorales d'Oran (Nord-Ouest de l'Algérie)

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1. Introduction

La restauration des dunes littorales nécessite d'adopter des stratégies plus durables telles que l'application d'inoculant mycorhizien, pour faire face aux conditions environnementales stressantes. Les mycorhizes sont des associations symbiotiques entre 80 % des plantes supérieures et des champignons (Smith et Read, 2008). Le taux de la colonisation mycorhizienne et le potentiel d'inoculum mycorhizien (PIM) sont des mesures importantes dans les études écologiques. Le PIM est un test reflète la capacité d'un sol à initier la formation d'associations mycorhiziennes à partir d'une quantité d'inoculum présent dans le sol sous forme de propagules. L'étude a porté sur l'évaluation du taux de colonisation mycorhizienne de l'halophyte (Plantain maritime) et du potentiel mycorhizogène des sols des dunes côtières d'Oran, dans la région nord-ouest de l'Algérie. Cette évaluation s'avère essentielle pour une nouvelle contribution à la recherche et l'ouverture d'une approche pour l'identification des champignons mycorhiziens, qui servent à la production d'inoculants autochtones dans les sols arides, afin de surmonter les problèmes de la salinité, la sécheresse édaphique et de l'instabilité des dunes côtières.

2. Matériels et Méthodes

2.1. Présentation de la zone d'échantillonnage

L'étude a été menée au niveau des trois sites (A, B, C) des dunes du littoral d'Oran (nord-ouest de l'Algérie). Les racines et les sols rhizosphériques des plantains maritimes ont été collectés.

2.2. Coloration des racines et évaluation de la mycorhization

- ✓ La méthode de Philips et Hayman. (1970) a été utilisée pour la coloration des racines.
- ✓ La méthode de Trouvelot et al. (1986) a été utilisée pour calculer la fréquence (F %) et l'intensité (M %) mycorhiziennes.

2.3. Estimation du Potentiel mycorhizogène du sol

La méthode du nombre le plus probable (Porter, 1979) a été utilisée pour l'estimation du potentiel infectieux mycorhizien (PIM) du sol. Les sols rhizosphériques ont été dilués dans le sable stérile et le sorgho a été cultivé comme une plante mycotrophe.

3. Résultats et discussion

3.1. Évaluation de la colonisation mycorhiztienne des racines

Le type endomycorhizien caractérise la plante halophile étudiée. Des vésicules, des spores et des hyphes ont été observées. Nos résultats rejoignent ceux de Hildebrandt et al. (2001) qui ont signalé un taux mycorhizien élevé chez les plantains maritimes des marais salants européens.

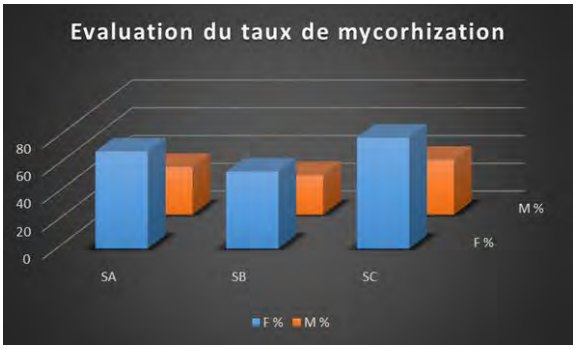

Figure. 1 Résultats du degré de la colonisation par les champignons mycorhiziens arbusculaires (CMA)

3.2. Estimation du Potentiel mycorhizogène du sol

Le nombre le plus probable de propagules calculé est de 370 / 100 g de sol rhizosphérique.

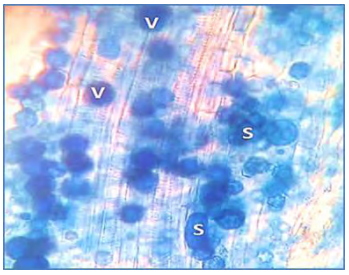

Figure. 1 Racines du sorgho infectées par les CMA du plantain maritime et colorées en bleu de trypan (× 400) .V: vésicule, S: spore

Le PIM élevé semble être le résultat de la viabilité des spores. De plus, les résultats obtenus montrent que l'infection est possible via des morceaux de mycélium extra-radical ou des fragments racinaires mycorhiziennes, ce qui offre la possibilité d'adopter plusieurs stratégies d'initier la colonisation mycorhizienne.

4. Conclusion

Les résultats ont montré que les plantains maritimes ont un degré de colonisation mycorhizienne et une potentialité mycorhizogène importants. Nous avons obtenu des résultats prometteurs pour les futurs programmes de la conservation et de la restauration des dunes littorales dans lesquelles le sol contient un nombre élevé de propagules infectieuses des CMA.

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Health lipid indices of autochthonous hemp seed oil from four regions in northern Morocco

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1. Introduction

Hemp (*Cannabis sativa* L.) seeds represent an important source of essential nutrients in particular the long-chain polyunsaturated fatty acids n-3. Recently, the United Nations Organization approved the reclassification of Cannabis Sativa in international conventions, effectively recognizing its therapeutic and nutritional benefits. This study aimed to assess the fatty acids profile and health lipid indices of hemp seed oil from "Beldia" variety as a native product of northern region of Morocco.

2. Materials and Methods [

The hemp seed were collected in 4 regions of Rif north of Morocco. The sampling is carried out in spring 2019. Further details about sampling are described by Taaifi et al. (2021). The oil was extracted according to the Bligh Dyer method (Bligh and Dyer, 1959).

The fatty acids were methylated and the samples were analysed by Gas Chromatography equipped with a flame-ionization detection and capillary column. A FAME standard, containing 37 components (Supelco, Bellefonte, PA, USA), was used to identify the individual peaks. The average amount of each fatty acid was used to calculate the sum, ratios, and health lipid indices of hempseed oil.

3. Results and discussion

The linoleic (49.5%), oleic (20.50 %), linolenic (15.14%), and palmitic (7.98%) acids are the dominants fatty acids of analyzed oils. The obtained fatty acids (FA) profiles allow to classify the analyzed hempseed oils among the linoleic oil class. Our results profiles are in line to those reported by Tringaniello et al. (2021) for Italian and extra-European hempseed oil. This polyunsaturated fatty acids (PUFA) richness is associated by a balanced ω 6/ω 3 ratios and a better hypo/hypercholesterolemic ratios respectively range from 3.14 to 3.37 and 10.67 to 11.41. Regarding the health lipid indices, the results show that the analyzed oils have a thrombogenic and atherogenic indexes of 87.82 and 8.03 respectively.

The "Beldia" variety showed the highest content in oleic acid compared to some European hemp varieties such as Dutch and Italian origin (Taaifi et al., 2021, Tringaniello et al., 2021). However, this local variety showed lower concentrations in linoleic (ω 6) and α-linolenic acid (ω 3) than those reported in the studies mentioned

above. This difference could be explained certainly by the genetic factors, but also by pedo-climatic ones in particular the temperature. Numerous searches report that the fatty acids composition is strongly affected by temperatures. As temperatures decrease, the PUFA content increases, as shown by Garcés et al. (1992) and by Mansouri et al. (2018) who assessed the effect of climatic factors on plant endogenous enzymes and effect of crop season respectively.

4. Conclusion

From a nutritional point of view, it can be deduced that this vegetable oil has an interesting fatty acids composition with a favourable lipid health indices due to its richness in desirable fatty acids (UFA + C18:0). This study provide more insights on the lipid quality of hemp seed oil from "Beldia" variety cultivated in Morocco in order to contribute to the characterization and promotion of this local product.

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