Nº125
ENGLISH EDITION

OLIVAE

OFFICIAL JOURNAL OF THE INTERNATIONAL OLIVE COUNCIL

THE OLIVE GROVE IN MOROCCO

Morocco is a key player in the global olive sector. It will play an increasingly important role in the coming years

OLIVAE
OFFICIAL JOURNAL OF THE INTERNATIONAL OLIVE COUNCIL

Published in Arabic, English, French, Italian and Spanish.
Peer reviewed journal.

Príncipe de Vergara, 154
28002 Madrid, Spain
Tel.: 34-915 903 638
Fax: 34-915 631 263
E-mail: iooc@internationaloliveoil.org
Web: www.internationaloliveoil.org
ISSN: 0255-996X
Registration: M-37830-1983

Abdellatif Ghedira
Executive Director
of the International Olive Council
Madrid

EDITORIAL

The marvels of Morocco

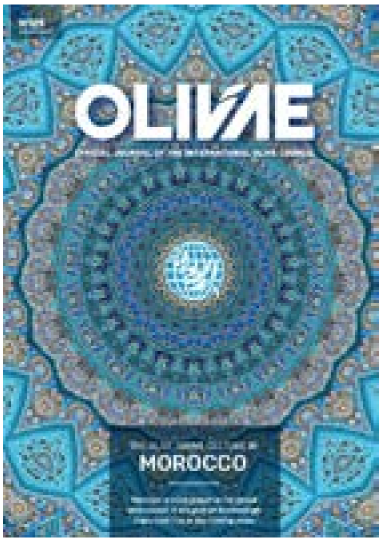
It is with great pleasure that I bring to you the new graphic layout for the OLIVAE magazine. We promised this to our readers, and in particular the members of the International Olive Council, who are the real editors of this prestigious magazine. After 35 years, OLIVAE has a new look, a new colour scheme and a new dynamic layout.

In this 125th edition, which launches the new editorial concept, we have put the spotlight on olive growing in Morocco. As a founding member, Morocco has been generous to the IOC. The Moroccan delegation, whom we thank wholeheartedly for their cooperation, sent us plenty of information as we wrote this magazine, which is also available online. In the digital edition, you will find links to other, more detailed articles on topics that may be of interest to you. We have compiled all the information given to us by the Moroccan authorities and experts so that you can enrich your knowledge using our easy consultation tool.

Morocco is a major player in the world olive sector, and will play an increasingly important role in the coming years for a number of reasons. The Moroccan authorities plan to increase the total area of cultivation from 773,000 hectares in 2009 to 1,220,000 hectares by 2020. This will create many permanent jobs that will boost the economy no end; the number of employees in the sector could rise from 100,000 today, to 300,000 once the expansion is complete.

We can therefore only welcome Morocco's initiative and its ability to play its far-reaching role. The cultivation of olives is synonymous with the richness of the territory and permanent employment. We look forward to sharing this enthusiasm with you, dear reader, and how fortunate we are to be able to do so in this new edition of the official IOC magazine.

Enjoy!



OLIVAE

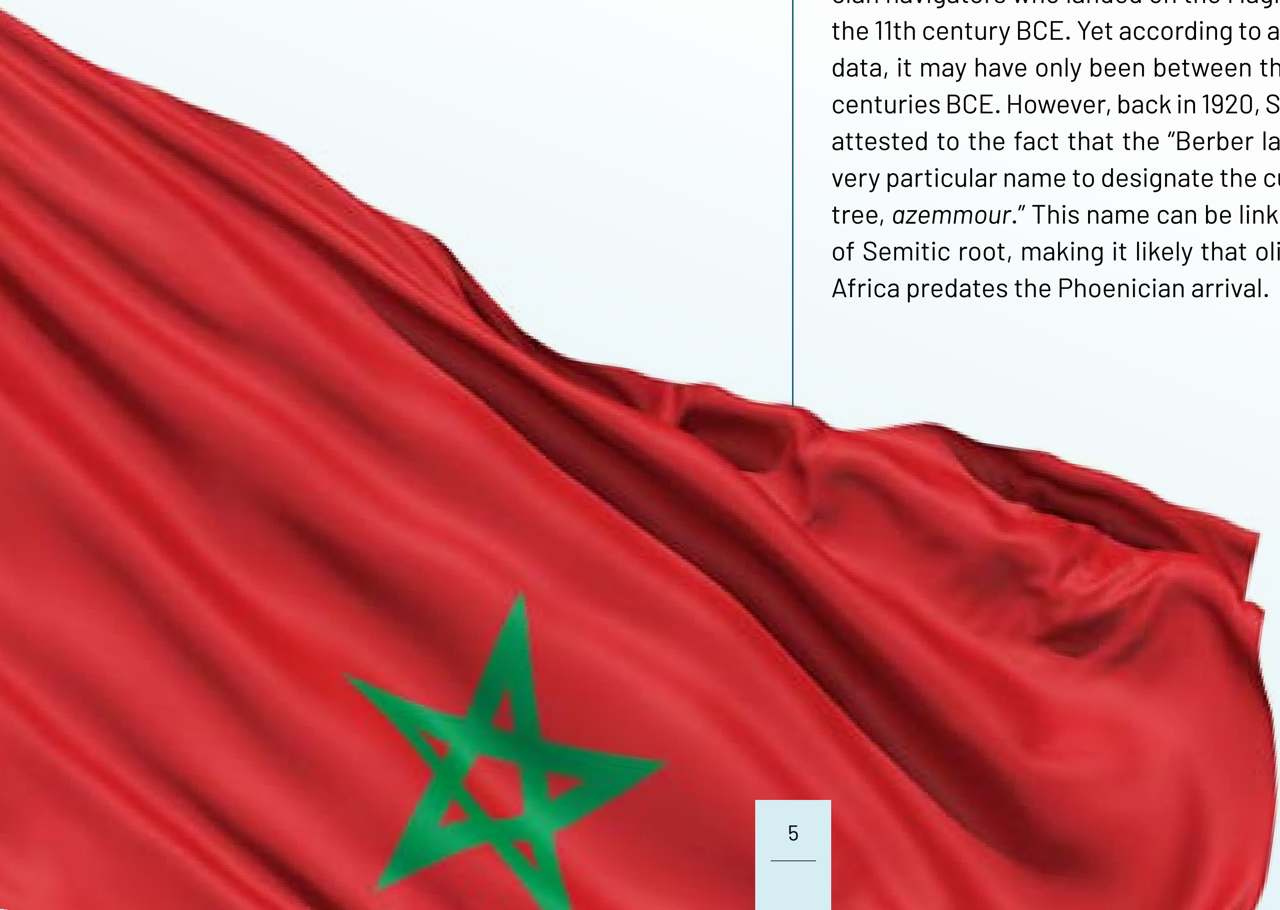
CONTENTS

OLIVE GROWING IN ANCIENT MOROCCO

Ministry of Culture and Communication

In the 9th millennium BCE, the Iberomaurusians of the pigeon cave in Taforalt (Western Morocco) were familiar with the wild olive tree. Based on the analysis of charcoal found at level II – the most recent – of the cave has revealed a sample of *Olea europaea*, although indeed it was found among 13 samples of Aleppo pine. This prehistoric people were hunter-gatherers and olive growing was clearly not a priority at that time. For them, the tree was nothing more than a secondary element in their landscape.

So when did the inhabitants of northern Morocco begin cultivating olive trees? According to the literary tradition, this technique was brought over by Phoenician navigators who landed on the Maghreb coasts in the 11th century BCE. Yet according to archaeological data, it may have only been between the 9th and 8th centuries BCE. However, back in 1920, Stéphane Gsell attested to the fact that the "Berber language has a very particular name to designate the cultivated olive tree, *azemmour*." This name can be linked to any sort of Semitic root, making it likely that olive growing in Africa predates the Phoenician arrival.



The spread of the olive tree throughout the Mediterranean.
Photo: IPEPO

Nevertheless, if we exclude the lands under the direct domination of Carthage which were to see large extensions of olive groves relatively early on, the olive growing period coincides with that of Roman domination. From Tunis to Rabat, reaching the current confines of the desert in southern Algeria, the ruins of oil mills and traces of irrigation works are a testament to the overlap. Did the Roman powers deliberately encourage olive growing to ensure the supply for Rome and above all to settle the population, thus making them easier to control? Or was this a mere consequence of the *pax romana* ensuring peasants the benefits of their efforts? Both hypotheses are certainly right, and at the same time both are incomplete.

In a certain sense, olive oil is tied to Romanisation and its corollary, urbanisation. As in the modern period, the crop serves as food and the by-products of its processing (pomace and by-product oils) can be put to several different uses including fertilizers and insulation. Yet the applications of olive oil itself are far more numerous and varied. Olive oils entered pharmacies with the production of ointments and other remedies. They were used for lighting in homes. Consumption is hard to calculate, but was certainly substantial. Roman bathers used olive oil in their thermal baths to coat their bodies before physical exercises that normally preceded the bathing ritual. A map denoting the location of Roman baths could no doubt be superimposed over a map of oil mills! Just as it is political and economic, the spread of olive growing and oil mills during the Roman period is also a cultural fact.

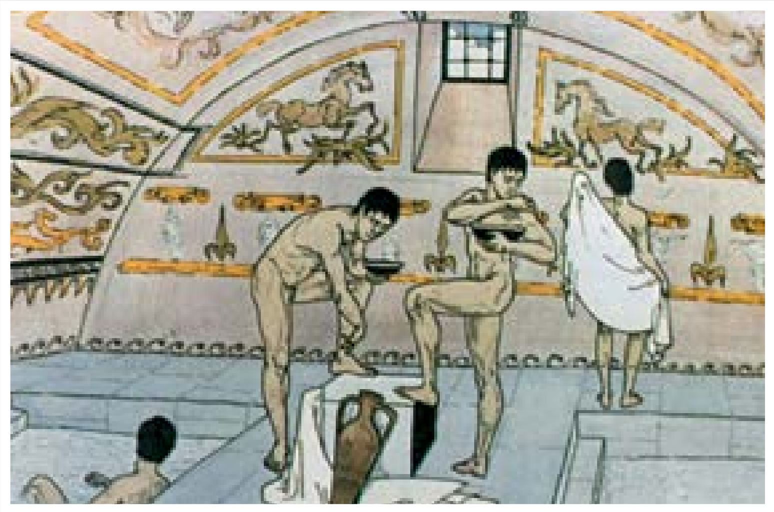
Here we can limit ourselves to a proven fact. We definitely do not know of any oil mills in Morocco before the reign of Juba II (25 BCE - 23 CE), and most of the facilities we know of date from the 2nd and 3rd centuries CE, the height of Roman civilisation in Mauritania Tingitana.

Production areas

Given the lack of palynological studies region by region, the results of which would merely be partial in any event, it is impossible to accurately determine the areas of intensive olive growing. We can only rely on archaeological data that must be taken with precaution.

We know virtually nothing of the ancient city of Tingi, or Tanger today. In Lixus (near Larache), only the sites of public baths have been excavated. Conversely, Volubilis has been widely excavated and several oil mills were found. However, this may distort our overall picture. Progress

Roman bathers rubbing their bodies with olive oil in the thermal baths
Photo : IPEPO - SNO



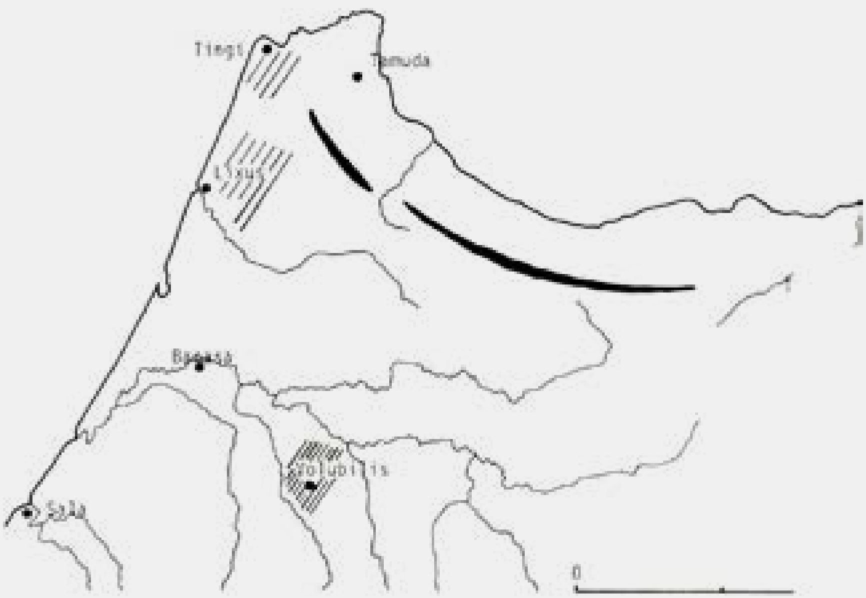


Figure 1: Olive growing regions in ancient Morocco.

made in prospecting is highly uneven from one region to another, and interpreting the findings is always delicate. At times, evidence of an oil mill is based on no more than a basin made of tile mortar (a mix of chalk, sand and an aggregate of bricks, tiles and crushed ceramic used to weatherproof walls and floors). Yet, such vestiges could correspond to other types of facilities in an ancient home.

Having said this, olive growing does seem to have been concentrated in the region of Volubilis (Figure 1), still a significant oil producing area today. No fewer than 55 oil mills can be counted inside the city, and some ten were found in the surrounding countryside. Medium areas of production can be found in the region of Tanger (15 oil mills pinpointed) and Lixus (16). The Gharb plain, where its rivers, the Sebou, Beth and Rdom had not yet developed stable beds, were certainly marshy and hardly apt for olive growing. No more than six presses were found in Banasa (near Souq L'arbaa al Gharb). And no more than two are known of in the city of *Sala* (Rabat) and four in that region, while none are known of in Tamuda near Tetouan.

It can therefore be accepted that, within Roman Morocco, the areas of production during the 1st and 2nd centuries CE coincide with the current producing areas.

Figure 2: Olive millstone

Figure 3: Olive millstone

Oil manufacturing techniques

Therefore, it is in Volubilis where we can become the most familiar with the procedures of manufacturing Tingetana olive oil.

In these ancient facilities, we find the essential elements present in any oil mill: one or two crushing tools, a press, and decanting basins.

The most widespread crushing instrument comprised two stones, one set over the other. One was fixed and cone shaped, crowned by a vertical wooden axle. The other was in a ring shape under a wooden support (two vertical pieces joined by a horizontal piece through which the axle of the fixed portion passed), enabling it to turn. The mobile piece was slightly convex in order to adapt to the horizontal grindstone and allow the olives to be poured in for grinding. The grindstone rested on a base and the ensemble was surrounded by a round parapet made of stonework or erected stones (Figure 2). The olive paste fell within the circle and was then shovelled out. This tool looks more like ancient grindstones for cereals than the olive grindstones described by ancient authors. Its use in oil mills seems to have been characteristic of Mauritania Tingatana.

We sometimes find, either by itself or associated with the grindstone, a mill made up of a monolithic basin where a cylindrical drum made of hard stone turned around a vertical axle. (Figure 3).

For pressing, the ancients knew of screw presses. By about 50 CE, Pliny the Elder (Naturalis Historia 9, 3, 171) considered them to be the standard of technological development in oil manufacturing. No press of this type has been discovered in Africa. The presses that we have been able to study are horizontal lever presses (*prelum*) that worked with a hoist.

The wooden machinery has been lost and must be rebuilt based on the indications of ancient authors, principally Cato and Pliny the Elder, and with the vestiges on the ground. All of the Volubilis oil mills, without exception, involve two levels, at times connected by a small ladder (Figure 4). The system to secure the prelum can be found together with the press table and a secondary area for the various manipulations on the top level (Figures 5 and 6). On the bottom level, the oil mill's general level, the counterweight can be found. This is a large stone serving to maintain the hoist which, with a system of cords and pullies, served to lower the prelum's free end.

The system for securing the head of the prelum is one of the original features of the Volubilis press. The horizontal beam is engaged between two pairs of wooden bearing posts, props, fastened to the ground in a four-unit stone and held up by a framework beam resting on a pile of small planks slid between the two front and back posts of each pair. On top, another pile of planks stack up to the framework. Enough space is left for the beam to be moved slightly on the vertical plane (Figure 7). This relatively "rustic" system must have been convenient for handling. By simply transferring one or more planks from the lower pile to the higher pile or vice versa, the prelum could be raised or lowered. Yet the system's solidity was not flawless. Nearly a third of the facilities show traces of repairs on the wooden bearing posts.

Figure 4: Floor plan of the "Two press house" oil mil in Volubilis.

Drawing: G. Monthel. This oil mil, one of the best preserved in Volubilis, has a press for initial work without any counterweight. It stands adjacent to a shop that opens up directly onto the city's main avenue.

1. **OIL MILL**
2. **SHOP**

A: Press table

A': Press table in the first press

B: Maintenance area

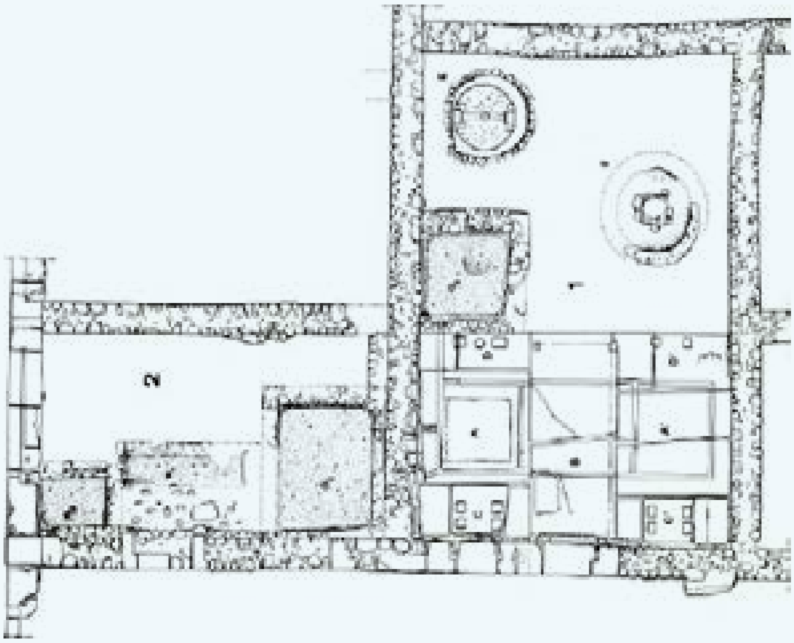
C-C': Four-unit stones (system for fastening the head of the prelum)

D-D': Two-unit stones (system for steering the prelum)

E: Counterweight

F: Mill base and parapet. GrG2: Oil mil basins

FrF2: Shop basins (?)



The press tables, made of stone or tile mortar, are either square or circular. They generally have spillway incisions to channel the liquid into the decanting basins (Figure 8). Their size seems large: 2,20 m^2 on average, that is, a 1,50 m square. Large diameter mats were certainly used on low piles. No trace of any system to keep the pile of mats balanced has been discovered in or on these press tables. The pressure exerted by the beam was conveyed to the pile of mats by an intermediary vertical wooden piece supported on a wooden disc to distribute the pressure.

The free end of the prelum was tied with cords to a hoist, which was solidly fastened to a heavy stone deeply buried in the ground. This cylindrical stone, known by archaeologists as a "counterweight", although the term does not seem entirely accurate, weighs an average of 1,800 kg in Volubilis. The counterweight is not mobile. Its sole function is to prevent the hoist from being pulled out.

This device ensemble is often completed by a system to steer the prelum: two pillars, either wooden or stone, frame the heavy beam to prevent buckling. This wooden framework is always placed between the press table and the counterweight on either the top or bottom level.

The dimensions of the oil mills allow us to evaluate the size of the lever, either a single piece of wood or several juxtaposed pieces. Although they were up to nine and a half metres long, they averaged 7.5 m and 0.5 m in diameter and weighed approximately 1,300 kg.

As the counterweight stone was secured, the force exerted on the mats depended on the weight of the prelum, but also on the radius of the hoist that lowers the beam, on the length of the lever that moves the hoist, and the force exerted by the labourers. The shorter the diameter of the hoist and the longer the arm of the lever, the greater the force, yet also the greater the fragility of the hoist. Although we have no figures available, we can assert with a great deal of plausibility that the Volubilis press, moved by two men, in relatively good conditions of solidity, could exert forces of

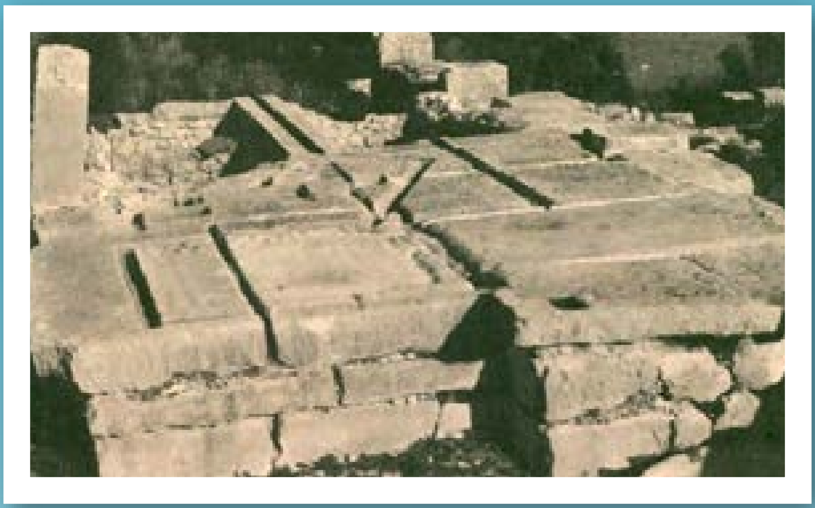


Figure 5: An oil mil in Volubilis. In the foreground to the left, press table and four-unit stone (bearing traces of repair). To the right, maintenance area. In the background: decanting basins. The complex circuit of spillway incisions is noticeable.

Figure 6: An oil mil in Volubilis. In the foreground, the decanting basin. In the background, to the left, press table and four-unit stone. To the right, the maintenance area. The stone standing in the centre of the photograph served to secure a wooden balustrade surrounding the maintenance area. The cup-like shape carved out of the top held a lamp for night work. The maintenance area directly overlooks the street. The threshold is equipped with a spillway.

between 10,000 and 13,000 kg. Therefore, with 70 cm diameter mats, pressure was exerted between 2.6 kg/cm^2 and 3.4 kg/cm^2 and could be between 4 and 4.2 kg/cm^2. The pressure falls to between 1.3 and 1.7 kg/cm^2 with mats of 1 m in diameter (7).

This performance seems to be absolutely comparable and perhaps slightly superior to traditional Moroccan presses known as *maâsras*, whose yield must have been similar, on the order of 16 litres of oil per 100 kg of olives.

Careful examination of the oil mills, and particularly the decanting facilities, allow us to assert that certain Volubilis farmers did pressing in stages, using intermediary crushing between the two pressings.

The oil was decanted into stonework basins covered with tile mortar. These basins were deep (between 1 and 1.20 m). Some have holes at the bottom of one of the walls to divert the vegetable water. This is yet another original feature of the Volubilis mills. The oil was collected to then be decanted using cups or dippers.

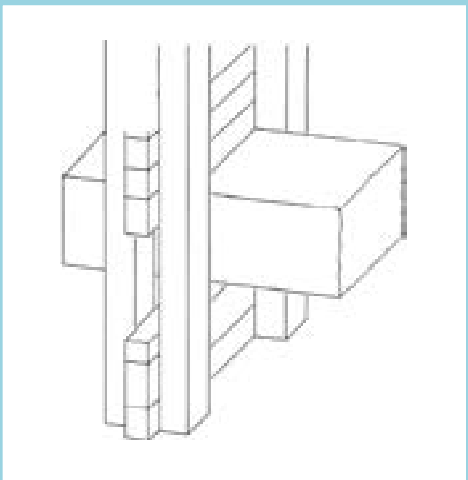


Figure 7: Prelum fastening system

Most of the oil mills have no more than one basin containing an average of 2,450 litres. About a third are equipped with two decanting basins that are not connected to each other and therefore cannot serve for cascade decanting. The sizes of these two basins differ, the smaller one being where the oily liquid from the press table goes and the larger one, generally fed by two grooves, one from the press table and the other in a secondary area adjoining the press table. This area cannot solely serve, as it has at times been thought, as a storage bin for harvested olives. Otherwise, the purpose of spillway could not be understood. But two-phase pressing requires a series of manoeuvres to handle the olive paste, place and remove mats, and so forth. At this stage, the olive paste exudes a liquid containing a certain proportion of oil. This liquid was collected and the oil contained in this liquid was collected in the maintenance area. As it was considered to be of inferior quality, it was blended with oils from the second or third pressing obtained directly from the press table while the finer and purer first-pressed oil was decanted separately into a smaller basin (8).

The practice of crushing in different steps, tied generally to the various stages of pressing, is also proven by the simultaneous presence, in various oil mills, of the two crushing instruments that we have briefly described above and which cannot have the same function when found together. One of them, perhaps a millstone, must serve for the first crushing while the second served for subsequent crushing.

Production and commercialisation

We should nevertheless underscore that the facilities using multiple crushing and phased pressing are not the majority of those in Volubilis. It seems that only a minority of manufacturers sought to produce quality oil by distinguishing the production phases. Most seem to have been content with medium quality oil.

It thus could be inferred that this oil could not be exported. Based on a frequently cited text by poet Juvenal (Satires V, 86-91) we know that African olive oil had a poor reputation in Rome, merely good enough to fill lamps and season poor men's cabbage... This proves that it did at least come on the market for domestic use, even if it was not appreciated by gourmets. But it is equally true that Juvenal seems rather to have been describing the oil of Numidie (east Algeria and south-west Tunisia).

The amounts of oil produced are impossible to estimate. The size of the basins is of no use since they could have been emptied several times a day. And we have no knowledge of how many pressings took place in a day, or how many olives were pressed, etc.

There is indeed no proof of Mauritania Tingitana oil exports in Roman times. Indeed, the facts seem to be on the contrary.

An assessment of the population of Volubilis has allowed us to estimate the density of presses in the city. There was nearly one press per 60 inhabitants. In 1981, a purely farming village in Zerhoun had one press per 130 inhabitants. The difference is not as significant as it seems. One needs to factor in not only "overconsumption" in ancient times given that oil had multiple uses, but also "underconsumption" in modern times. Currently, consumption of local olive oil is curbed by imports and consumption of seed oils (9).

Yet above all, the Volubilis facilities do

Figure 8: A (displaced) press table in Volubilis. At left, the blocked cavity proves that the stone was used in two different positions. The stone has worn down and the spillways deepened due to the acidity of the oil.

not have any industrial characteristics. Elsewhere in Africa, in Tunisia, east Algeria and the Cherchell region, oil producing factories could be found with ten or even 20 presses in a single facility (10). Nothing of the sort could be found in Volubilis, where houses were equipped with one press if at all, and only three out of 55 facilities (5.5 %) had two presses.

Production was thus artisanal, primarily for family consumption. Any surplus was sold in the village or province as a whole. Demographic growth in the 2nd and 3rd centuries and the spread of Roman customs, or as we would say today, the improvement of the quality of life, broadly explain the increase in the number of presses and the quest for better productivity that we imagine unfolded between the years 160 and 180 CE. Domestic trade was far greater than the foreign trade of oil, which was somewhat negligible.

The discovery in Mauritania Tingitana of globular, stubby Dressel 20 type amphorae for trading oil, will come as no surprise. These amphorae were used to trade oil from the province of Baetica and spread throughout the Roman empire. They can be found in Moroccan archaeological digs, though in smaller proportions compared to the rest of the Empire. We believe they bear witness to sumptuary imports by well-to-do clientele seeking out-of-the-ordinary products with a reputation. Conversely, their relative scarcity bears witness to the fact that the province was able to provide enough oil for its own consumption.

A self-sufficient province using widespread techniques adapted to local traditions throughout the Roman world is the image we would like to leave with our readers at the end of this brief description of Roman Morocco.

THE OLIVE SECTOR

THE NATIONAL STRATEGY TO DEVELOP THE MOROCCAN OLIVE SECTOR

The Ministry of Agriculture, Fisheries, Rural Development, Water and Forests

In 2008, the Department of Agriculture launched a new agricultural development strategy called the Green Morocco Plan, which is based on a global and contractual approach that includes all stakeholders. This project aims to build the agricultural sector as a lever for socio-economic development in Morocco, and is a means to tackle the country's major projects, which include creating jobs, tackling poverty and protecting the environment and natural resources.

The Green Morocco Plan has taken a sector-based approach to developing agriculture in Morocco, with better integration both up- and downstream the agricultural value chain as well as increased investment. This has taken the form of establishing a contractual and partnership framework with professional organisations, aimed at modernising and developing the various production chains by integrating the various links in the value chain. The goal is to improve productivity and quality and thereby increasing farmers' added value and income.

As part of this partnership, in April 2009, the Moroccan state and Interprolive, a Moroccan interprofessional organisation, signed a contract programme aimed at developing and upgrading the olive sector over the 2009-2020 period. The main objectives of this project are:

- To encourage private investment in the various branches of the sector;
- To improve production conditions;
- To boost competitiveness by improving productivity and quality;
- To improve trade conditions and developing exports;
- To improve the framework conditions of the sector, through providing support to upgrade interprofessional organisations and strengthen research and development.

Main objectives of the contract programme

The fundamental quantified objectives of the contract programme by 2020 are summarised below:

	Situation 2009	Objectives 2020
Surface (ha)	773,000	1,220,000
Total production (t)	863,000	2,500,000
Olive oil	80,000	330,000
Table olives	92,000	320,000
Exports (t)		
Olive Oil	16,000	120,000
Table olives	60,000	150,000
Contribution in foreign currency (Billion MAD/year)	1,5	6
Job creation (Permanent jobs)	100,000	300,000
Domestic consumption (kg/hab/year)		
Olive Oil	2	4
Table olives	3	5

Focuses of the Contract Programme

In order to meet these objectives, the following lines of action will be taken:

Axe 1

Develop production through expanding areas, rehabilitating existing plantations and providing drip irrigation equipment.

Axe 2

Enhance production by increasing pressing and canning capacity through creating new units, upgrading existing units and promoting the various uses of olive pomace.

Axe 3

Developing opportunities in the foreign and domestic market, in particular through:

Reinforcing and diversifying exports of olive oil and table olives and developing packaged exports to the EU and new markets;

Conducting promotion campaigns in foreign and domestic markets by targeting quality and respect for standards and the environment.

Axe 4

Improving the framework conditions of the sector through strengthening associations, research, training and supervision.

Investment

The overall investment for implementing the contract programme is MAD 29.5 billion, of which MAD 8.4 billion is covered by the State (28.5%) and MAD 21.1 billion representing the contribution of the profession (71.5%).

Main achievements

In 10 years, the following progress has been made:

- The expansion of olive tree plantations by 272,408 ha, reaching 1,045,000 ha in 2017/18
- Equipping 111,200 ha with a localized irrigation system, representing 82% of the target set for 2020 (136,000 ha)
- Significant improvements to production, from 549,000 t between 2003-2007 to 414,000 t between 2015-2018, a 158% increase, with production in the 2018/2019 crop year expected to reach 2 million tonnes
- Increase in olive oil production, which went from 66,000 t between 2003-2007 to 125,600 t between 2015-2018, a 98% increase. Table olive production went from 88,000 t to 113,000 t in the same period, a 28% increase
- Improvement in the consumption of olive oil and table olives, going from 2 kg per person per year to 3 kg per person per year respectively in 2009 to 3.6 kg per person per year and 6.1 kg per person per year today (including table olives from the informal sector)
- The creation of 211 new pressing units
- The publication of Decree No. 2-14-268 of 29 January 2015 on the quality and health safety of olive oils and olive-pomace oils
- The organisation of two promotion campaigns in 2016 and 2017 for quality olive products on the domestic market
- Creation of the national olive growing register (the study is in its third year)
- Establishment of five tasting panels that have been recognised by the International Olive Council
- Organisation of 10 editions of the national competition for the best extra virgin olive oil producers in the margins of the International Agricultural Show, Morocco
- Recognition of the ten distinctive signs of origin and quality for olive oil and an agricultural label for table olives
- Recognition of Interprolive on 14 March 2018 and establishment of regional representations of the interprofessional associations
- Signing of the agreement to provide support to upgrade the olive oil industry

Development prospects

The main prospects for developing the olive sector are summarised as follows:

- Upward revision of the objectives of the contract programme, in particular as regards the extension of the area, given the socio-economic importance of the sector and the existing opportunities for its development.
- Capacity building for olive conservation
- Intensifying campaigns to promote the consumption of good quality olive products on the national market to combat bulk sales, using innovative communication tools and targeting both consumers and producers
- Strengthening programmes to promote exports of olive oils and table olives and market diversification
- Collaboration with other ministerial departments for the implementation of existing texts that regulate the marketing of olive products on the domestic market in order to improve quality and organise marketing channels
- Establishment of an operator information system to serve as a database for the industry

THE MCA PROGRAMME: FRUIT TREE PRODUCTIVITY

The Ministry of Agriculture, Fisheries, Rural Development, Water and Forests

The Fruit Tree Productivity Project of the MCA programme (PAF/MCA), which is the anticipated embodiment of one of the major foundations of the Green Morocco Plan, namely Pillar II regarding solidarity in agriculture, is an innovative project with a unique conceptual identity. The main elements that have prevailed throughout all stages of its implementation are summarised as follows:

- The application of the participatory approach with the direct involvement of beneficiary farmers in all stages of the project, from feasibility studies to its implementation on the ground, which gives greater transparency and equity to the activities scheduled as part of the project
- **The adoption of a global approach to specific development** centred around promising sectors related to arboriculture in mountain regions, with a view to demonstrating their strong agricultural potential. This consists in particular in implementing a territory-based intervention system that integrates the development efforts of the various partners, including new plantations, hydro-agricultural developments, production enhancement, supervision, professional organisation of farmers, etc.
- **The systematic treatment of value chains** according to an integrated vision of the links in the targeted sectors, from the planting of seedlings and production to valuation, market access and consumer satisfaction
- The implementation of a financial support system to operate the recovery units of the Economic Interest Groups (EIGs), enabling them to get supplies from their members under optimal conditions, at competitive prices, and to perform well technically
- Taking into account the environmental dimensions by optimising opportunities and important natural resources, in particular sustainably managing water and soil and controlling factors that affect the surrounding environment
- Implementing a streamlined system for managing and administering the PAF/MCA with dedicated structures (APP, PMU) and substantial material resources that ensure autonomy in management, freedom of action, a judicious and reasonable motivation of the human resources mobilised, pre-

cursors of the success of a meticulous and close monitoring of the activities undertaken within the framework of the project

- In addition to planting **80,000 ha** of olive trees and hydro-agricultural developments in the PMH, the project has enabled the construction of **20 olive pressing units**, each with a capacity to press 60 to 80 t per day, and to store 600 t of oil per day, which helps **over 6,800 farmers** and **150 cooperatives** organised into EIGs.

This major project is of particular interest to rural populations in mountainous regions because of the scale of its achievements and its positive socio-economic and environmental impacts, helping reduce poverty and the precarious nature of these areas.

According to the results obtained so far by the EIG organisational model, production is close to 20,000 t per year, an encouraging performance.

- Improvements in performance since the pressing units were set up is corroborated by the progress recorded by several qualitative indicators, such as the fact that **78%** of EIG oil is of **extra virgin quality**, compared to a national average of **10**%. Progress rewarded by multiple prizes and trophies at national and international events awarded to the many EIGs, the last of which was awarded to Chiadma Mogador at the Mario Solinas Quality Award 2018, an International Olive Council competition held every year.

This is the result of an innovative system to provide financial support for small producers, which allows EIGs to get advances on goods to fund the crop year with up to MAD 5 million per EIG. This system, which was set up by the CAM in accordance with the project financing agreement, is undergoing significant changes both in terms of the number of participating EIGs and the amounts used by the EIGs, which reached 16 out of 20, for an approximate total of MAD 30 million in the last crop year. This method, which is highly sought after by many EIGs as a prerequisite for running their units and producing high quality olive oil, has been gradually adopted by building relationships of mutual trust between the EIGs and the financing body.

We would like to highlight an important element that characterises the pressing units used by the EIGs. They are made with the preservation of the environment in mind, as well as getting the most out of the by-products of the pressing process, in particular pomace and olive pits. With basins to gather the pulp and pomace, pit separators and drying platforms, many olive oil EIGs have already started developing by-products and diversifying their sources of income by installing ancillary units for manufacturing logs made of pomace and pits. Examples include the EIGs Ziz Guir, Al Alfia, and Bni Mellal, among others.

In addition to producing olive oil, some EIGs have taken advantage of their membership base and their anchorage in production basins by diversifying their production and sources of income, opening up to other agricultural activities such as table olive production. One such example can be found in the AHLAF Taourit case.

The testimonies of many olive oil EIGs have confirmed the strong ownership members feel over their projects and the farmers in the production basins they cover and whose direct positive effects are beginning to be felt, such as:

- Capital gains resulting from the upward revision of olive and olive oil prices over the last three crop years.
- The in-situ valuation of production and falling transport costs.

This progress has been made without losing sight of the importance of the volumes of production expected for future crop years, with new plantations entering into full production from the perimeters installed as part of the IIP projects (MCA and others).

In addition, the adoption of a new organisational model, which is based on second-rate professional agricultural organisations as an axial development actor in mountain areas, has resulted in a **generally positive outcome**. This comes with the premises of a new reconfiguration of the balance of power governing the operation of the olive oil sector in favour of small farmers, through the strengthening of their negotiating power and successfully establishment their links with public authorities in the new governance bodies of the sector.

Thus, we consider that the action undertaken, in particular concerning expanding and maintaining young plantations; strengthening the infrastructure of pressing units; efforts to provide technical assistance to enhance the professional and managerial capacities of farmers, with the support and assistance of Ministry of Agriculture, Fisheries, Rural Development, Water and Forests, have been key in the development process and in securing the considerable investments made.

Implementing this innovative model requires a sustained effort of persuasion and technical and financial support so that it can be operationalised and fully adopted by farmers.

THE MOROCCAN OLIVE SECTOR TODAY

The Ministry of Agriculture, Fisheries, Rural Development, Water and Forests

The socio-economic importance of the olive tree

The olive tree is the main fruit grown in Morocco and represents 65% of the tree-growing area of the country. Through its products and their age-old uses, this fruit has helped fight erosion, boosted the value of agricultural land and settled populations in mountainous regions for centuries. Olive growing actively contributes to settling populations in rural areas, providing more than 51 million working days per year, or 380,000 permanent jobs, 20% of which are held by women.

The olive sector provides a source of income for poor farmers and plays a decisive role in feeding rural populations thanks to its highly calorific and nutritional value.

The olive sector also helps meet the country's need for edible oils by covering almost 19% of consumption and balancing trade by ensuring foreign inflow equivalent to 1.8 billion DH/year, or 156 million €/year (average for the 2013-2017 period). This represents 7% of all agricultural exports.

The olive orchard and its location

Evolution

The national olive-growing area has increased by 63% since the early 00s, rising from 641,000 ha in 2002/2003 to 1,045,000 ha in 2017/2018, meeting 86% of the 2020 target. The rate of expansion has accelerated from 13,000 ha/year in the 2003-2007 period (before the launch of the Green Morocco Plan), to nearly 27,000 ha/year in the 2008-2018 period.

Regional distribution

Olive plantations are of interest to the entire country. Distributing this heritage among agricultural regions shows that, with the exception of the Atlantic coastal strip, where olive growing is not as widespread, this species has adaptive capabilities at all bioclimatic levels, from mountain ranges at 1,200 mm, to arid and Saharan areas at less than 200 mm.

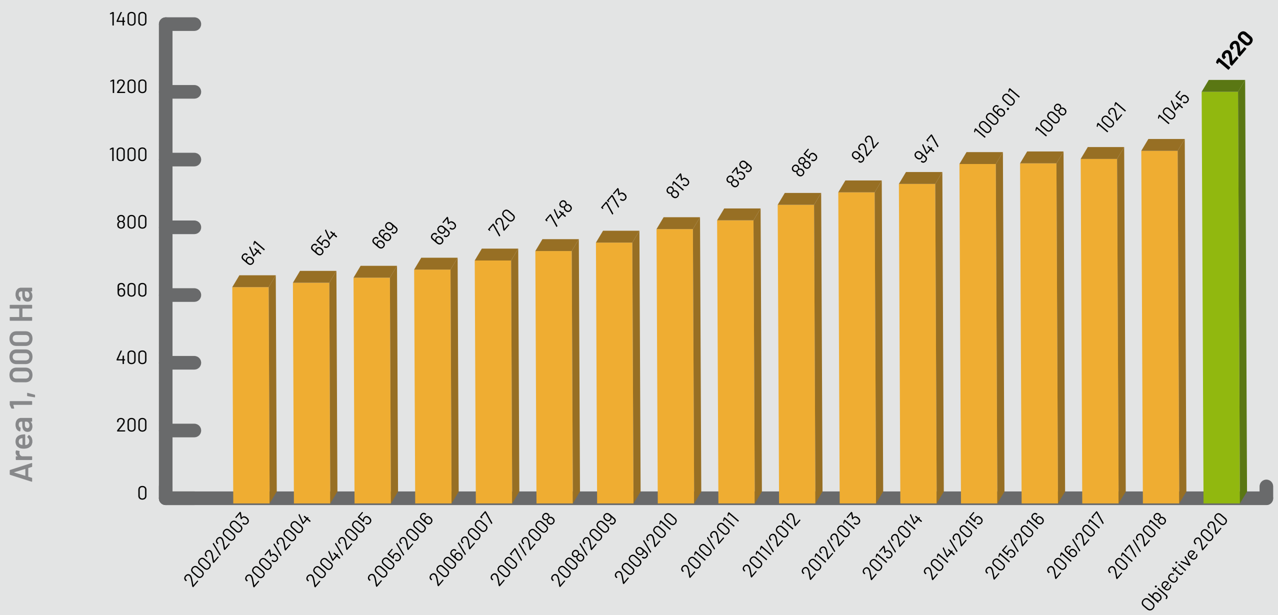


Figure 1: Changes in olive growing area 2002-2017

Click here to read
'From gravity to deficit irrigation: a promising strategy to save water, increase production and improve the quality of olives and olive oil in arid and semi-arid areas.'

FRENCH

REGIONAL DISTRIBUTION OF THE OLIVE GROWING AREA (2017/2018 CROP YEAR)

Regiones	Bour area (*) (ha)	Superficie de regadío (ha)	Total (ha)
Fez-Mequínez	299.911	46.375	346.286
Marrakesh-Safi	47.151	167.950	215.102
Tánger-Tetuán-Alhucemas	160.432	2.306	162.737
Oriental	55.598	67.005	122.603
Beni Melal-Jenifra	33.281	46.796	80.077
Rabat-Salé-Kenitra	56.727	9.408	66.135
Sus-Mas	2.506	16.950	19.455
Draa-Tafilalet	1.546	14.262	15.808
Casablanca-Settat	3.506	11.319	14.826
Guelmim-Río Noun	-	2.157	2.157
TOTAL	660.658	384.528	1.045.186

(*): Oleicultura de secano
Fuente: MAPMDREF

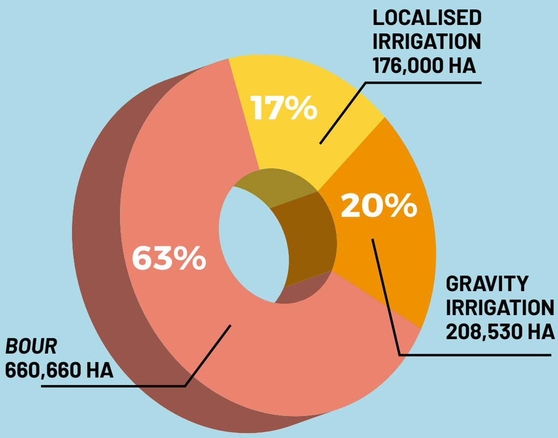


Figure 2: Managing the olive grove

Managing the olive grove

The area under irrigation covers 384,500 ha, or 37% of the total area, compared to 660,700 in non-irrigated hectares, or 63% of the total. Some 176,000 ha are under localised irrigation.

The area under localised irrigation has increased significantly, from 39,000 ha in 2009, the year the contract programme for the development of the olive sector ended, to 176,000 ha today. This is thanks to state aid which varies from 100% of the investment cost for projects carried out collectively or by small farmers, to 80% of the investment cost for projects carried out individually.

Age pyramid

Some 125 million olive trees grow in plantations across the country. There are three age categories for olive trees:

- Young plantations from 0 to 7 years old (26 million olive trees, or 21% of the country total)
- Plantations in full production from 8 to 50 years old (72 million, or 57%)
- Old plantations over 50 years (27 million, or 22%).

The Moroccan olive grove has a balanced overall age pyramid, with a productive potential consisting of 26% young plants and 72% fully productive plants. Old plantations represent about 22% of the total.

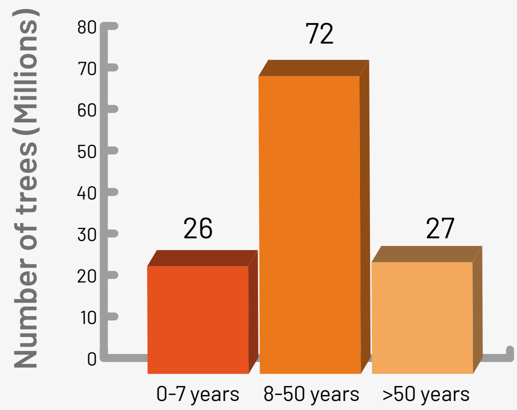


Figure 3: Age Pyramid

Production and yield

National olive production fluctuates every year thanks to the combined effort of three essential factors:

- Sometimes inadequate maintenance techniques
- Climatic conditions, in particular rainfall
- Iternative bearing, a physiological phenomenon found in olive trees.

Olive production has improved significantly since cultivation areas were expanded, rising from 549,000 t in 2003-2007 to 1,414,000 t in 2015-2018, an increase of 158%. Yields have not changed much since; olive production for the 2018/2019 crop year is estimated at nearly 2 million tonnes, an increase of 28% over the previous crop year.

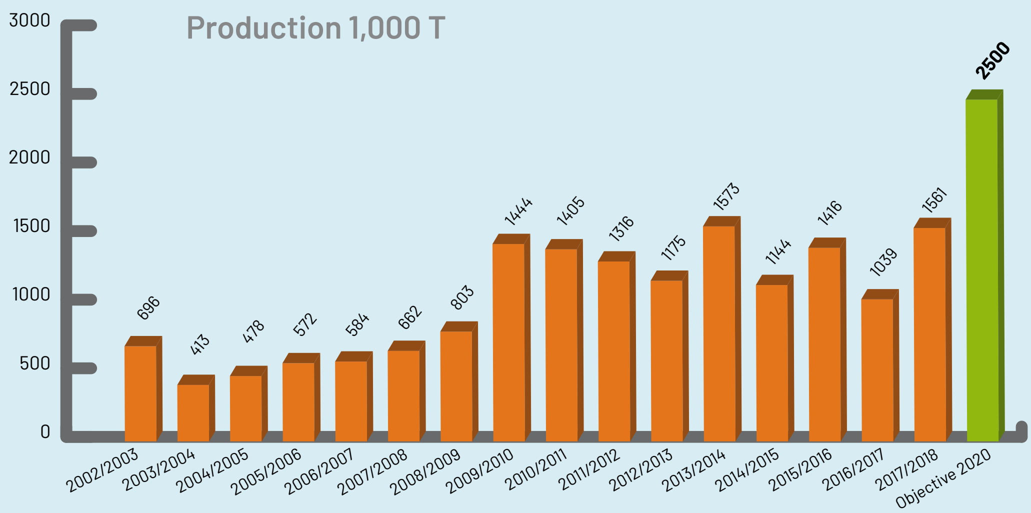


Figure 4: Changes in total olive production 2002-2017

This increase in production is due to the favourable climate conditions at critical phases of olive tree development during the 2017/2018 crop year, in particular as regards average temperatures and rainfall and their distribution, as well as young plantations entering production.

Olive oil production has followed the same trend, rising from 66,000 t in the 2003-2007 period to 127,500 t in the 2015-2018 period, a 93% increase.

In terms of yield, a distinction should be made between two schemes:

- The dry crop, which is characterised by low yields of between 1.2 and 2.0 t/ha of production in the last ten crop years.
- The irrigation regime, which provides for perennial or emergency irrigation of trees. The average yields range from 1.4 to 2.7t/ha of production in the last ten crop years.

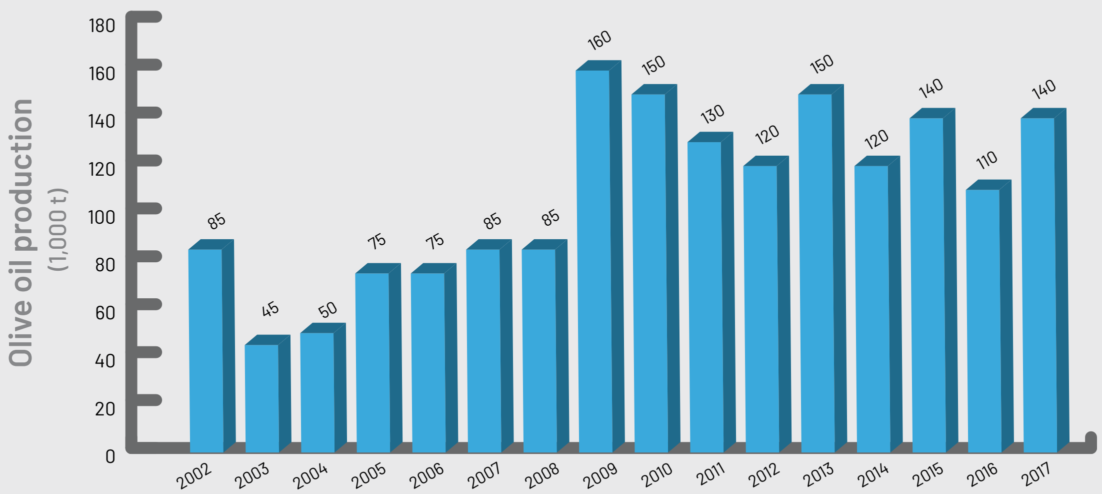


Figure 5: Changes in olive oil production 2002-2017

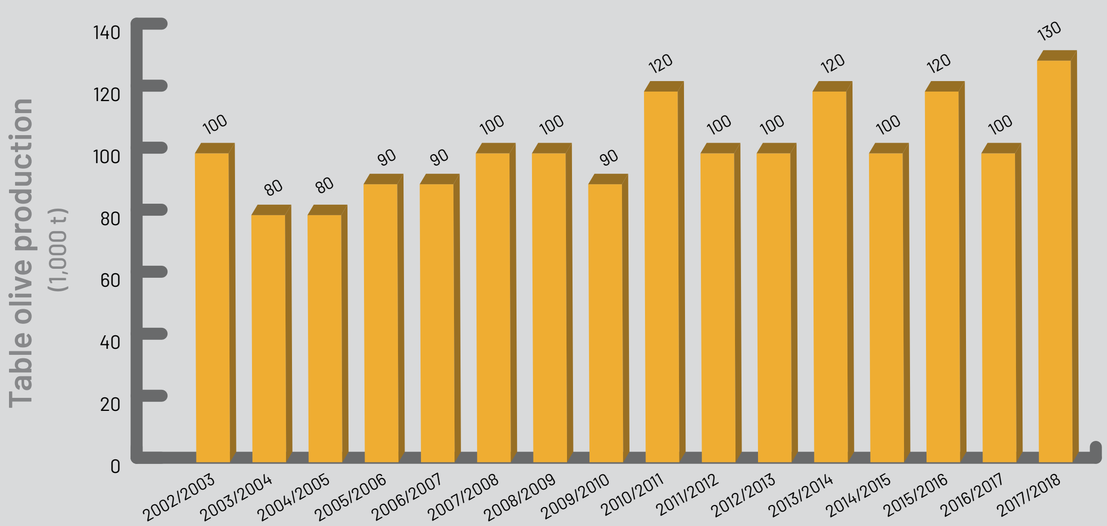


Figure 6: Changes in table olive production 2002-2017

Variety profiles

The olive grove is mostly made up of the Picholine marocaine variety, which is found in over 90% of plantations. Several varieties make up the remaining 10%, in particular Picholine Languedoc, Dahbia and Mesla-la, which are mainly concentrated in irrigated regions (Haouz, Tadla, El Kelaâ). There are also some Spanish and Italian varieties, such as Picual, Frantoio, Manzanilla, Gordal, Arbequina, etc.

The Picholine marocaine variety is a double-purpose variety: it is highly resistant and very adaptive – it is able to anchor strongly on sloping land and can withstand drought, among other qualities. Its oil yield is 18 to 22%, and this oil is good quality, with high polyphenol content, low acidity and stability as key characteristics.

As part of the Green Morocco Plan, the State encourages the diversification of the variety profile by using the Haouzia and Menara varieties, which stem from clonal selection from within the Picholine marocaine variety. These two clones have the same advantages as the Picholine marocaine variety, with better performance and homogeneity. Foreign varieties with low resistance are used in super-intensive orchards.

It should be noted that the five new varieties obtained by the National Institute for Agricultural Research (French acronym INRA) have been included in the official catalogue. These varieties are Baraka, Mechkate, Agdal, Tassaoute and Dalia, the latter two of which are currently being propagated in nurseries for distribution to farmers.

Click here to read

'The National Institute of Agricultural Research proposes five new olive varieties'

FRENCH

The value of production

Overall, 65% of national olive production is destined for pressing and 25% for canning, with the remaining 10% for losses and domestic consumption.

Olives are pressed in a modern and semi-modern sector with 948 units and a total capacity of 1,803,000 t/year, and a traditional sector of about 11,000 maâsras, the country's traditional olive press. These maâsras operate intermittently because they depend on the size of the harvest.

The dynamism of this sector is unevenly distributed between regions and depends heavily on the industrial infrastructure for processing olives, in particular olive mills. The activity of the maâsras is mainly oriented towards extracting oils for the specific needs of the olive grower, whether they are the owner, temporary tenant or consumer. Only a very limited number of maâsras purchase olives for pressing and for sale of oils produced on the retail market or for industrial pressing units.

Olives are preserved through 75 modern olive canning units with a total capacity of 203,000 t/year and by artisanal canning factories.

Commercialisation

OLIVE OIL

Most of the olive oil produced in Morocco is intended for the domestic market. When production is high, a significant proportion is exported.

Indeed, throughout our history, olive oil has been the main edible oil consumed in Morocco. It was only in the 1960s, with changes in Moroccan household habits, that Moroccans began to consumer less olive oil in favour of seed oils. The latter currently account for more than 80% of our consumption of edible oils, almost all of which is imported.

The seed oil market is fully regulated and prices are set by public authorities, while the olive oil market remains free and prices fluctuate from one year to the next depending on production rates (35 to 60 DH/litre over the last five crop years).

TABLE OLIVES

Around 30% of the table olives produced in industrial canneries is consumed locally; the rest is exported. Most table olives intended for the domestic market come from artisanal units.

There is a wide range of table olives sold on the local market: green olives, black olives, mixed olives, pitted, candied, stuffed, etc.

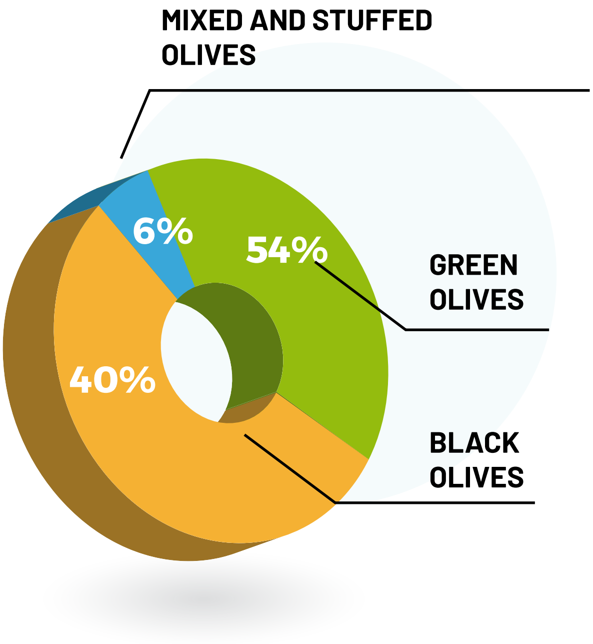
Exports

Average annual exports are around 82,290 t of canned olives and 13,320 t of olive oil. It should be noted that the main importers of Moroccan table olives are France, the USA, Italy and Germany, while Moroccan olive oil exports are mainly intended for the USA, Spain and Italy.

The table below summarises the evolution of exports of table olives and olive oil between 2009 and 2017.

Year	Table olives (T)	Olive oil (T)
2009	64.720	3.080
2010	76.270	20.882
2011	75.570	32.552
2012	73.480	11.640
2013	72.140	6.230
2014	88.780	12.490
2015	74.316	23.670
2016	90.550	15.530
2017	85.670	8.700
Average 2013-2017	82.290	13.320

Source: Exchange office

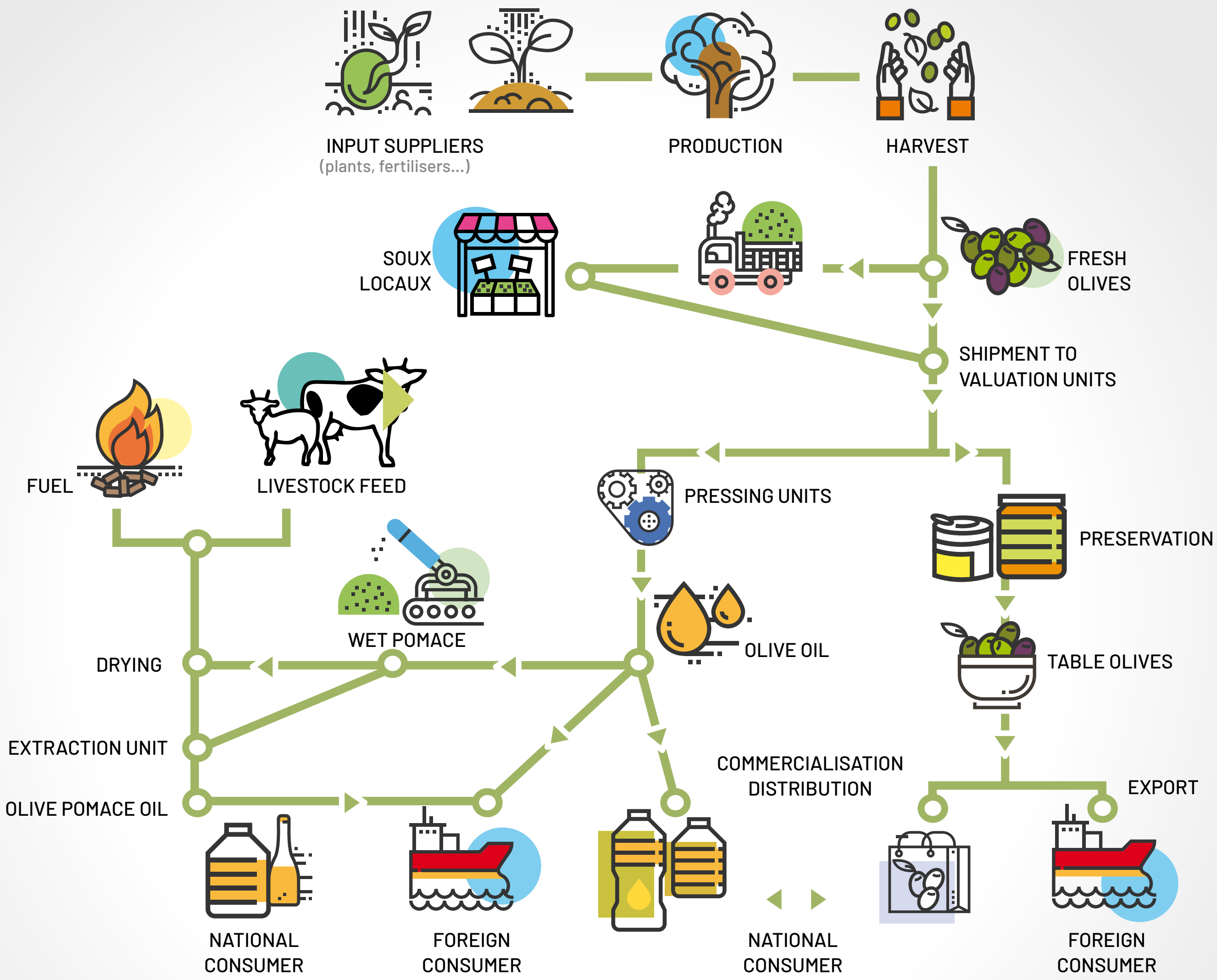


Exports of packaged olive oil remain low and do not exceed 10% of the total tonnage exported, the rest being sold in bulk.

For table olives, exports in hermetically sealed containers account for 50% of the exported tonnage, compared to 50% in drums (bulk).

Several types of table olives are exported. An average of 54% of the exported tonnage are green olives, followed by black olives with 40%. Mixed and stuffed olives account for the remaining 6% of exports (see image below).

VALUE CHAIN
OF THE OLIVE SECTOR



RESEARCH BACKGROUND

GENETIC RESOURCES: AN ASSET FOR GENETIC IMPROVEMENT AND VARIETAL SELECTION PROGRAMMES OF THE MOROCCAN OLIVE TREE

El Bakkali Ahmed, Moukhli Abdelmajid, Zaher Hayat, Hadidou Amal, Sikaoui Lhassane

National Institute for Agricultural Research (INRA), Morocco

Since it was founded in 1946, the National Institute for Agricultural Research (French acronym INRA), has been collecting, preserving, managing and enhancing the local and foreign genetic resources of a variety of plants. Today, roughly twenty fruit species are preserved in ex-situ collections across various INRA experimental facilities.

The olive tree is one of several fruit species that have been studied at INRA since the 1920s. Given the national socio-economic importance of the sector, and in order to meet the sector's expectations, various programmes have been carried out, including the collection and preservation of local material, the introduction and study of the behaviour of foreign varieties, and crossbreeding to broaden the range of varieties.

Collection of genetic resources of the olive grove at INRA

Genetic resources provide material and characteristics for breeding and selection. Selection programmes make use of the variability of the species, which is why INRA has been working on setting up platforms to provide genetic resources of the olive grove since its creation. The institution currently has three categories of collections in experimental farms, especially in Tassaoute and Menara- Saâda (Marrakech) and Ain Taoujdate, namely:

I) Collections of introduced varieties;

II) Resource collections.

III) Collections of hybrid populations from cross-breeding.

INRA has several foreign olive variety collections. The first, installed in Menara in 1927 with 40 varieties, was successfully transplanted to the Saâda experimental facility in 2007. In 1954, a second collection was installed at the experimental facility in Ain Taoujdate, with 78 varieties from 9 countries. A third collection of 27 varieties was installed at the experimental facility of Tassaout in 1974. In addition, 10 Mediterranean varieties were installed in 1987, as part of the FAO ESCORENA programme at the experimental facility of Menara, to study the behaviour of the main Mediterranean cultivars known to perform well. Finally, as part of the ResGen-T96/97 project, under the aegis of the International Olive Council, a global collection of 591 accessions from 14 Mediterranean countries was installed at the Tassaout experimental facility in 2003 (Haouane et al., 2001; El Bakkali et al., 2013). All of these collections have been characterised using agro-morphological characters and molecular markers. The task is twofold: first, to correct the denominations and reveal synonymy and somaclonal variants; and second, to help establish a database on Mediterranean olive resources. Characterisation has given interesting results on the importance of genetic diversity in the global collection in Marrakech for the Mediterranean, compared with the collection that was established in the 1970s in Cordoba, Spain. Indeed, the comparison between the two collections, using the characterisation data published by Trujillo et al. (2014) revealed only 130 genotypes in common between the two collections, among a total of 672 genotypes identified using 20 microsatellite markers (Table 1; El Bakkali et al., 2018). The 130 genotypes correspond to 126 varieties, more than 60% of which are from Spain. This comparative study presents a strong point for the third global collection currently being installed in Izmir, Turkey (Malek, 2016).

The second type of collection includes local olive genetic resources. Several researchers have conducted surveys using the local knowledge of farmers in order to collect and preserve material with high adaptive potential. Their efforts have made it possible to locate genotypes in situ and set up national reference collections that represent local diversity, including both olive trees different from Picholine marocaine, at the morphological and molecular level, and traditional varieties, namely: Bouchouk, Bouchouika, Fakhfoukha, Dahbia, Meslala, Hamrani, etc. The local collection in Ain Taoujdate contains more than 60 accessions collected in different areas of northern Morocco, whose agronomic evaluation is in process for the selection of high-performance varieties adapted to rain-fed cultivation conditions. In addition, the local Tassaout collection holds 11 clones of Picholine marocaine selected from the regions of Tadla and Marrakesh, as well as 8 traditional varieties, in addition to Haouzia and Ménara.

The third type of collection concerns hybrid populations. This collection holds more than 1,600 trees from 12 different cross-bred plants, including Picholine marocaine, installed at the experimental facility of Tassaout. The clones of this variety (Menara and Haouzia) are crossed with four foreign varieties that local olive growers value highly: Arbequina, Leccino, Picholine Languedoc and Manzanilla de Sevilla. The first selections meant that 5 new varieties could be proposed for the official catalogue, which have certain agronomic characteristics that are more efficient than those of the parent plants.

Genetic resources in breeding and breeding programmes

The importance of genetic resources is undeniable for genetic improvement programmes. Variability within collections, both in terms of genes and traits, is a major asset that researchers should exploit in order to enhance genetic diversity while at the same time facing the sector's various challenges, in particular diversifying the existing range of varieties and developing new varieties that are better adapted to conditions in the country. Two key aspects must be considered when using and enhancing genetic diversity in the INRA collections.

Behavioural study and selection of new varieties

INRA has always worked towards selecting new varieties adapted to local conditions. This remains a priority for the genetic improvement programme conducted by its research teams. The study of the behaviour of foreign varieties under local conditions has made it possible to select two varieties for table olive production (Gordal and Ascolana Dura), two double-purpose varieties (Manzanilla de Sevilla and Picholine Languedoc) and a single oil variety (Frantoio) from the former Menara collection. In addition, three varieties – Arbequine, Leccino and Picholine Languedoc – were selected from the 10 varieties in the Menara collection installed in 1987. These three varieties were selected on the basis of their yield, oil content and tolerance to peacock eye.

As for newer varieties, INRA have selected two clones of Picholine marocaine (Menara and Haouzia) from the local material, and five new varieties have been obtained through crossbreeding: Agdal, Baraka, Dalia, Mechkat and Tassaout. These selection programmes take different criteria into account, namely yield and regularity of production, oil content and quality, resistance to peacock eye and adaptation to climate change. Indeed, the programme in Meknes, whose main objective is selecting new genotypes from surveys carried out in northern Morocco, has revealed promising results by pre-selecting two genotypes that perform better than the Picholine marocaine variety in different ways: early entry into production (from the third year), stable yields, oil content and many other criteria.

In Marrakech, about 100 crossbred varieties are being evaluated to select new genotypes with regular production, good oil content and/or fruit size, a high unsaturated fatty acid content, low to medium vigour, resistance to peacock eye and early flowering and ripening.

Study on the genetic determinism of characteristics of agronomic interest

Despite how important they are, studies into the genetic determinism of the characteristics of agronomic interest in olive trees are still at the preliminary stage. Thanks to recently published technological advances in high-volume sequencing and olive tree genomes (Cruz et al., 2016), research into the genetic mechanism of traits will soon make it possible to address genomic selection by allowing the selection of high-performance genotypes at early stages, while limiting evaluation to the field. As a result, the molecular characterisation of olive tree collections has made it possible to set up genetic devices to conduct long-term research into association mapping in olive trees in order to better exploit existing diversity. A "core collection" has been established as part of previous work, encapsulating the diversity contained in the collections with the fewest possible varieties (El Bakkali et al., 2013). This "core collection" is being installed in two contrasting sites, Meknes and Marrakech, as part of the Méga-projet olivier 2017-2020 for agronomic evaluation that will allow us to: i) determine the heritability and therefore the effect of the environment on the expression of characteristics of agricultural interest and ii) locate the genes involved or related to the expression of characteristics. In this sense, the hybrid collection will be used to develop a dense and consensual genetic map of the olive tree through genotype sequencing. This will take place within the framework of a European project (Bioresources for Oliviculture - Before, No.645595), of which INRA is a partner. This will provide a valuable, decisive and essential tool to aid research related to the genetic determinism of traits of agronomic and adaptive interest.

Conclusion

The narrow genetic basis of varieties grown under intensive conditions is a major obstacle to maintaining productivity because of the vulnerability of genetically uniform varieties to new biotic and abiotic stresses. Olive tree characterisation in these collections shows the importance of the platforms available for research conducted nationally but also in collaboration with international partners. However, there are several other important points to consider:

filling the Marrakech world collection with the missing genetic resources, from countries such as France, Iran, Jordan and Turkey; establishing a single national reference collection based on the different ex situ collections and genotypes identified in situ; and using the genetic diversity of wild olives (olive trees or Berri) through their collection and valuation, taking into account the diversity of this gene pool and the potential to adapt to local conditions to face climate change.

Click here
for bibliography'
FRENCH

THE INTERNATIONAL COLLECTION IN MARRAKECH: A PLATFORM FOR PRESERVING AND USING THE GENETIC RESOURCES OF THE OLIVE TREE

INRA, Regional Centre of Marrakech

Figure 1: The international collection in Marrakech (INRA)

Biodiversity is one of the world's most precious natural heritages. It represents a colossal genetic accumulation spanning millennia that man can never reproduce. Biodiversity has played and continues to play a major role in maintaining the balance of the Earth's ecological systems. By occupying the great Mediterranean region for thousands of years, the olive tree is part of that same biodiversity. It plays a key socio-economic and ecological role in the region.

However, this material is subject to genetic erosion as a limited number of varieties are selected and adopted. Older varieties tend to get left behind, and we may lose valuable genes through this process. Given the interest of these resources, olive-growing countries have identified and characterised their respective materials with the help of the International Olive Council. These accessions are currently being collected and preserved in three international collections, in Cordoba, Spain; Izmir, Turkey; and Marrakech, Morocco.

The Marrakech collection, the southernmost of the three, is of crucial importance to enriching the country with potentially high-performance varieties that are adapted to the local ecological conditions. This collection can also be used as a reserve for future generations for responding to biotic or abiotic constraints and adversities, through identifying and selecting genotypes that are resistant to possible scourges. This heritage is available to the scientific community so that they can study the many different aspects of olive tree genetics.

The Marrakech collection was founded in 2002, and is located at the INRA Tassaoute Experimental Field in the El Kelaa des Sraghna province, 70 km east of Marrakech. The first plantations date back to 2003; there are currently 9 ha of trees planted. Trees are planted as and when the plants are received from the different countries. Plantations between 2003 and 2005 were laid out in quartets (plot I), while in plot II, where planting began in 2008, the trees are planted in block plantations (four blocks and one plant per accession per block). Table 1 plots the plantations by country of origin and by year since the installation of the collection.

A total of 591 varieties have been planted out of the 661 received. The overall mortality rate is 10.5%. This mortality is recorded before and during plant breeding. The rate is related to transport conditions and the conditions of the plants when they arrive. Of the 591 varieties, 413 are represented by four trees at the time of planting.

TABLE 1: COMPARISON BETWEEN THE MARRAKECH INTERNATIONAL COLLECTION AND THE CORDOBA INTERNATIONAL COLLECTION IN TERMS OF NUMBER OF ACCESSIONS, GENOTYPES AND VARIETIES ACCORDING TO THEIR GEOGRAPHIC ORIGIN

ORIGIN	Nº of trees			No. accessions				No. genotypes1				No. varieties identified2			
	M	C	Total	M	C	Total	M&C a()b	M	C	Total	M&C a()b	M	C	Total	M&C a()b
Albania		13	13		12	12		1	11	11	1		10	10	
Argentina		2	2		2	2			1	1			1	1	
Algeria	43	3	46	43	2	45	2(4)	27	1	27	1	26	1	26	1
Chile		1	1		1	1			1	1			1	1	
Cyprus	31	3	34	31	3	34	3(9)	4	2	6		1	1	1	1
Croatia	16	7	23	16	7	23	4(9)	10	7	14	4	9	7	13	3
Egypt	19	5	24	19	5	24	4(8)	17	3	20		17	3	20	
France	13	13	26	13	10	23	8(18)	9	10	13	6	8	8	11	5
Greece	17	20	37	17	18	35	7(15)	14	17	26	5	13	15	22	6
Iran		5	5		5	5			5	5			5	5	
Israel		9	9		9	9			3	3			3	3	
Italy	163	40	203	163	36	199	16(47)	128	30	146	12	92	20	100	12
Lebanon	16	2	18	16	2	18	2(13)	11	2	13	3	4	1	4	1
Mexico		7	7		7	7			2	2			2	2	
Morocco	27	4	31	27	4	31	3(8)	11	3	12	2	10	1	10	1
Portugal	15	11	26	15	10	25	7(14)	10	8	14	5	10	6	12	4
Slovenia	10		10	10		10	1(3)	3	1	3	1	3		3	
Spain	89	298	387	89	279	368	91(220)	100	232	247	85	86	186	191	81
Syria	70	61	131	70	56	126	24(67)	42	42	80	5	35	37	64	8
Tunisia	25	7	32	25	7	32	6(13)	16	6	19	3	14	6	18	2
Turkey		20	20		19	19		2	17	17	2	1	15	15	1
USA		4	4		4	4			2	2			2	2	
Unknown		2	2		1	1			1	1			1	1	
Total	554	537	1091	554	499	1053	178(448)	402	400	672	130	329	332	535	126

1 On the basis of 20 SSR / 2On the basis of 20 SSR and 11 endocarp characters

a No. of denominations in the two collections / b No. of accessions with similar denominations in the two collections

It should be noted that the rate of planting has decreased significantly in recent years due to a fall in the number of transfers made with collaborating countries. The three collections have been exchanging plant material since 2015.

TABLE 1: THE TASSAOUTE INTERNATIONAL COLLECTION (2018)

ORIGIN	2003	2004	2005	2006	2007	2008	2009	2011	2012	Total
Italy	158	9								167
Spain	65	24								89
Cyprus		31								31
Greece	17									17
Portugal	15									15
France	13									13
Tunisia			15			12		4	13	44
Morocco					8	33				41
Algeria						44				44
Croatia						16				16
Egypt						19				19
Slovenia						10				10
Syria							70			70
Lebanon							15			15
Total	268	64	15	0	8	134	85	4	13	591

Several scientific studies are being conducted on varieties in the collection. They concern the different aspects found and are jointly led by the national and international institutions involved in bilateral cooperation or international research projects. The following are among the areas studied:

- Behaviour;
- The molecular characterisation and phenotype-genotype association;
- Resistance to diseases and pests;
- Compatibility;
- The phenological stages of climate change.

THE CHARACTERISTICS, PERFORMANCE AND RICHNESS OF THE CHEMICAL AND AROMATIC PROFILES OF MOROCCAN OLIVE VARIETIES

El Antari Abderraouf, El Moudni Abdelaziz and Sikaoui Lhassane

INRA

The olive tree is the main fruit-bearing tree grown in Morocco, accounting for more than half of all trees planted. In recent years, the pace of implementation has been significant, with a target of 1,220,000 ha by 2020. The olive-growing landscape of Morocco is dominated by a single population variety: Picholine marocaine. Due to their adaptability in almost all bioclimatic stages, olive trees can be found in plains, mountainous areas, and even in arid and Saharan areas.

To solve the problems caused by single variety cultivation and it weaknesses in terms of production and susceptibility to certain diseases, INRA was able to select several high-performance clones from this local variety. The Haouzia and Menara varieties are the two varieties in extension, resulting from massal selection. Likewise, there have been several waves of foreign varieties that have been successful in terms of production and inter-fertility. However, data and studies on their adaptation to local conditions to avoid problems that have already occurred in other countries are still inadequate.

In addition, INRA's experimental fields host a set of genotypes that come from massal selection or crosses between Picholine marocaine clones and several varieties from different Mediterranean countries. Researchers evaluate their quality and technical potential and test how they adapt to the local soil and climate conditions.

Figure 1: Impact of ripeness on the intensity of positive attributes

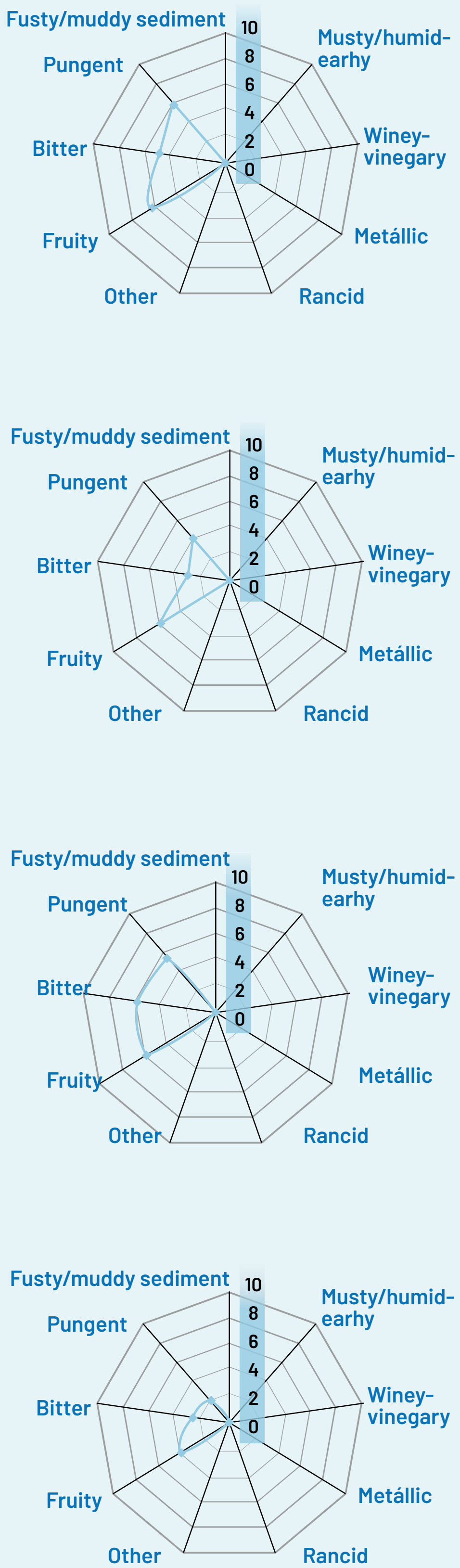
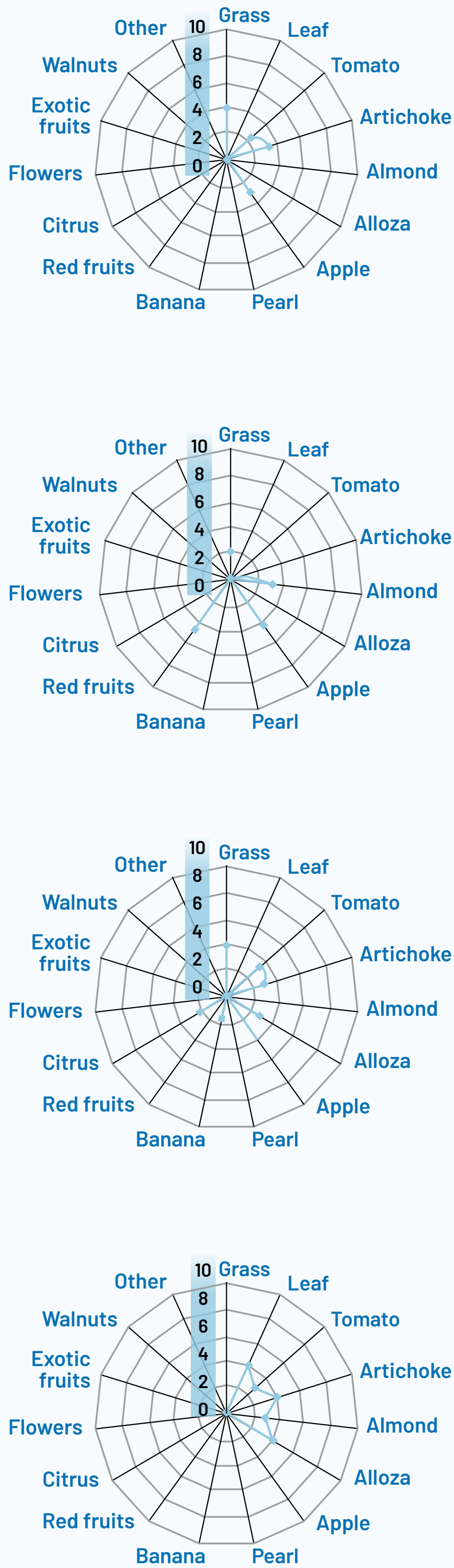


Figure 2: Impact of application and quality of irrigation on the aromatic profile: complexity and harmony



In order to fully evaluate the quality of the olive oils produced using the selected genotypes, they must be characterised by their chemical composition and organoleptic qualities and by gauging the consumer's opinion. This must be done in order to complement the agronomic and phytosanitary studies carried out on these varieties. The results will allows us to propose the best varieties in terms of technology, agronomy and plant health, which are necessary to ensure that Morocco's olive-growing heritage is diverse and robust. The plant material studied concerns mostly Picholine marocaine and varieties and clones that come from breeding at INRA. For characterisation by phenotype, all analyses on the quality and purity of olive oils were carried out according to International Olive Council methods. Evaluating sensory quality and determining the sensory profiles of Moroccan varieties are both carried out by the Marrakech-Safi regional tasting panel, according to the International Olive Council standard.

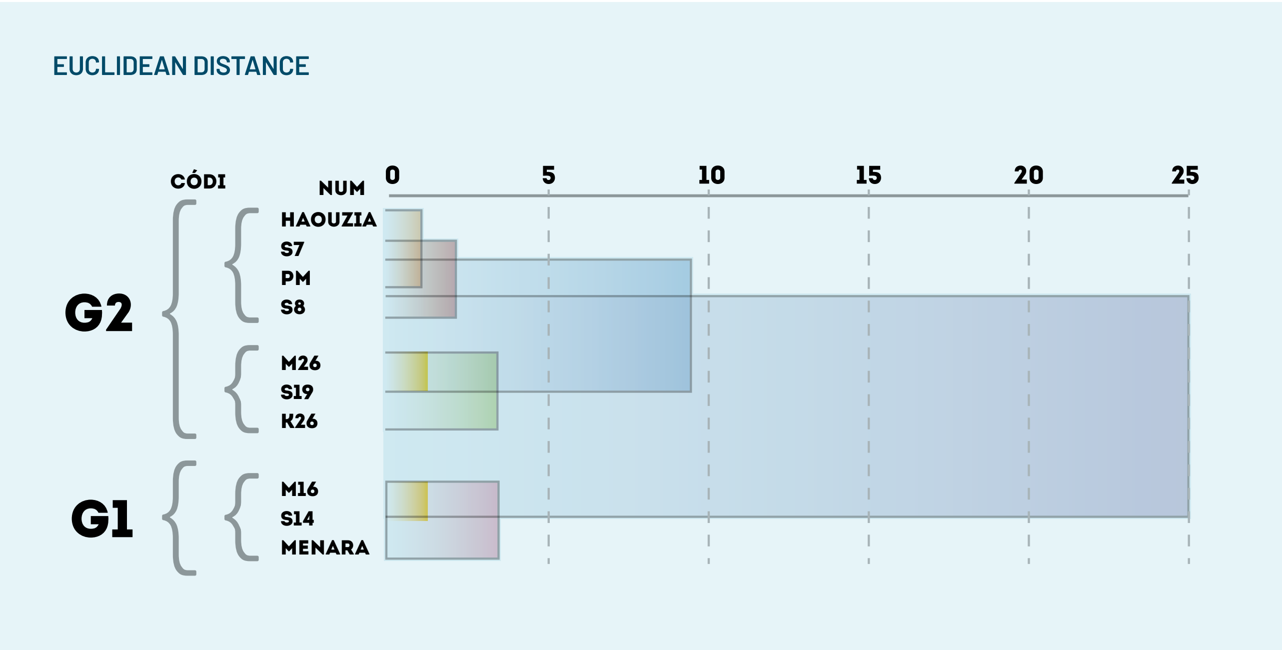
Stability parameters

The total phenol content and bitterness of the oil are very important parameters in determining its quality and stability. The values recorded for these two parameters showed an interesting phenolic content in oils produced from the main local variety, with a distinction found between certain areas where values exceeded 400 ppm and even 700 ppm, meaning high stability and variety among terroirs. This was the case for the Amizmiz terroir, where IG Amizmiz olive oil is produced.

Organoleptic characteristics

Picholine marocaine, the local variety, generally has basic organoleptic characteristics, such as medium green fruitiness, bitterness and balanced spiciness, as well as specific aromas of tomato, artichoke and green almond. However, we have noticed intense fruitiness and specific aromas of variable dominance in some potential sites, sometimes even other aromas with interesting intensity and harmony. We also noted that the ripeness stage has a direct impact on the intensity of the positive attributes that the oils present (Figure 1), while the mode and doses of irrigation and above all the quality of the water act on the specific aromas in terms of final overall quality and harmony (Figure 2).

Figure 3: Hierarchy of clone varieties on the basis of certain quality parameters



Fatty acid composition

The composition of total fatty acids is a quality and authenticity parameter in olive oils. In our study, we raised several interesting observations on the evolution of the proportions of fatty acids during ripening, and on the ability to distinguish between the varieties and clones studied through this composition.

Performance of the selected clones

Compiling the purity quality parameters allowed us to distinguish the performance of certain clones and varieties selected by INRA for their use and extension in the future (Figure 3).

Picholine marocaine is comparable in quality and fatty acid composition with other high-performance foreign varieties. Some clones, such as M14 and M16, stand out as they are the most stable, meaning they have interesting potential as varieties intended mainly for pressing, and are close to the Menara variety. Picholine marocaine remains a useful variety for selecting other high-performance varieties for the production of olives and premium quality olive oil.

High variability in performance was recorded in the local variety, with the distinction of certain potential and specific terroirs. Some sites, where oils were produced from local varieties cultivated under local environmental conditions, presented genetically exceptional values. However, the final stages of this study will allow us to propose a database of the chemical and organoleptic composition of our olive oils, thus providing guidance for the development of certain potential olive-growing sites in our country and fuelling the debate on revising the standards in force.

THE NATIONAL OLIVE CULTIVATION REGISTER

The Ministry of Agriculture, Fisheries, Rural Development, Water and Forests

In recent years, the olive sector in Morocco has been the subject of unprecedented interest thanks to the adoption of important provisions aimed at intensifying and rehabilitating the national olive grove. New technical and technological practices have also been adopted for the production of olives and quality olive oil, resulting in a significant increase in the production and export of olive oil.

Today, one of the major challenges facing the Moroccan olive oil sector is compliance with the standards of quality, purity and composition established by the International Olive Council. These standards were developed based on the olive groves of its member countries. In the case of Morocco, the absence of an olive cultivation register reflecting the specific characteristics of Moroccan olive oil has had negative repercussions on the development of our olive sector.

Indeed, given the diversity of the climate and soil conditions found in olive-growing regions in Morocco, and the genetic diversity of the local varieties and genotypes grown in the country, as well as the olive cultivation practices that differentiate one region from another, Moroccan olive oils may show both qualitative and quantitative variations in their chemical and organoleptic composition.

In this context, the Ministry of Agriculture, Fisheries, Rural Development, Water and Forests began a study in 2014 to characterise Moroccan olive oil and establish a national olive cultivation register. The objective was to provide the country with a reliable database on the country's olive-growing heritage, and in particular on the chemical and organoleptic composition of oils stemming from the different varieties found in the country. The goal was to define homogenous olive-growing areas in order to identify national olive-growing localities with particular chemical compositions. The programme aims to identify the characteristics of olive oils specific to Moroccan terroirs for distinctive signs of origin and quality and will serve as a basis for drafting olive oil marketing contracts within Morocco and for export.

This ambitious programme has been carried out in partnership with:

- The National Institute for Agronomic Research (French acronym INRA): the international institution in charge of agronomic research, with experience and achievements related to olive oil typicity;
- The National School of Agriculture, Meknes (French acronym EnAM): the national teaching and agronomic research institution, with experience and achievements related to olive oil typicity;
- The Official Laboratory for Chemical Analysis and Research, Casablanca (French acronym LOARC): official national laboratory with IOC recognition for physico-chemical analysis of olive oil.

The research programme covers:

- Assessment of the Moroccan olive sector and international benchmark;
- Characterisation of the chemical composition of olive oils originating from the main olive-growing areas of Morocco;
- Evaluation of the physico-chemical quality of olive oils;
- Definition of organoleptic profiles of olive oils;
- Definition of the specifics of oils regarding their production site;
- Creation of a data base on typicity and olive oil quality;
- Identification of national olive-growing sites with anomalous chemical compositions;

- Proposal for decisions trees on the chemical composition of Moroccan olive oil;
- Identification of olive-growing sites with distinguished chemical and organoleptic potential favourable to implementing distinctive signs of origin and quality;
- Contribution to updating Moroccan standards on olive oil and making research available to stakeholders in the Moroccan olive oil sector, enabling them to incorporate the specific features of Moroccan olive oils in the forthcoming revisions of olive oil marketing standards.

The stages of the research programme are:

I: Development of methodological approach;

II: Assessment of the national olive sector and international benchmark;

III: Characterisation of olive oils from the 2015/2016 crop year;

IV: Characterisation of olive oils from the 2016/2017 crop year;

V: Characterisation of olive oils from the 2017/2018 crop year;

VI: Development of the national olive oil register and an "ATLAS" of the national olive oil heritage.

The research programme covers the main olive-growing regions: Tanger Tétouan Al-Hoceima, the East, Rabat Salé Kenitra, Fès Meknès, Marrakech-Safi, Beni Mellal-Khénifra, Drâa-Tafilalet and Souss-Massa. Researchers set up a model for sampling that represents all olives produced in these areas and spreads over more than 100 olive-growing regions. The model has been applied annually to nearly 600 samples at three stages: green, mixed and black olives. Attention was given to the choice of the areas of study and to the importance of the contribution of each to national olive and olive oil production.

The programme was conducted with the support of the regional services of the Ministry of Agriculture. It is currently in the final phase of implementation. The results obtained so far have fed into a very consistent database on the chemical and organoleptic characteristics of the olive oil produced in the sites studied. The final results will be available in 2019.

DEVELOPING PRODUCTION

OLIVE PRESSING AND OLIVE PRESERVATION IN MOROCCO

The Ministry of Agriculture, Fisheries, Rural Development, Water and Forests

The olive processing sector includes olives pressing units and table olive canneries. In Morocco, the pressing sector includes a modern sector composed of units operating with centrifugation (continuous two-phase and three-phase processing with a horizontal centrifugation settling tank) and semi-modern (discontinuous systems equipped with super-presses) and a traditional sector composed of traditional units known as maâsras. The olive canning sector is split into two, one traditional and one modern sector.

The olive pressing sector

The olive pressing sector occupies a key place in the Kingdom's agri-food industries. Indeed, it generates nearly 2% of the total turnover of the IAA (MAD 2.2 billion), about MAD 470 million in added value, nearly MAD 110 million in investments and about 1% of exports (MAD 300 million). The modern olive oil industry employs nearly 2,500 people, or 2% of the workforce employed by the agri-food industries.

Producing on average 140,000 t of olive oil per year, olive pressing, both modern and traditional, plays an important role in about 400,000 farms upstream of agriculture, since almost half of olive production (800,000 t) is intended for pressing.

The number of modern (using the two- and three-phase continuous system) and semi-modern (super press) units amount to nearly 1,020 units for a total capacity of 1,220,000 t per year. These units are located mainly in regions with high olive-growing potential, in particular Beni Mellal-Khénifra, Fez-Meknes, Marrakech-Safi and Tanger-Tétouan-Al Hoceima.

In the traditional sector, there are approximately 11,000 maâsras; their pressing capacity does not exceed 270,000 t per year. They tend to be of low capacity and the quality is generally poor, due to the olives being kept in storage for too long, resulting in significant deterioration in the quality of the olives even before they are pressed. These units are mainly located in mountainous or isolated regions.

Thus, and thanks to the efforts of the Green Morocco Plan to modernise the sector, traditional units are in clear decline and modern units are taking their place. This change is also based on the implementation of Law 28-07 on food safety, which requires modern practices to produce high quality olive oils.

Since the launch of the Green Morocco Plan, the government has paid close attention to modernising olive pressing. The Ministry of Agriculture, Fisheries, Rural Development, Water and Forests has introduced a grant as part of the Agricultural Development Fund to construct and equip olive pressing units and complexes that integrate olive pressing and olive oil bottling, limited to two-phase units.

In addition, and in order to boost the agri-food sector in Morocco, the Ministry of Agriculture, Fisheries, Rural Development, Water and Forests signed, alongside the Ministry of Industry, Investment, Trade and the Digital Economy as well as actors in the sector, a contract programme in April 2017 to develop agri-food industries. The aim is to develop private investment in promotion, processing, cold storage, support for export development and marketing prospecting, modernisation of marketing channels, as well as transversal measures (training, innovation, standardisation, etc.). It is intended for the main agri-food sectors, including the olive oil industry.

As such, and with regard to the olive pressing sector, this contract programme has provided for ambitious provisions for the olive pressing sector, in particular:

- Support for the creation, extension or upgrading of olive pressing units;
- Support for the creation of bottling units;
- Support for olive oil exports, with a view to reaching a target of 40,000 t per year;
- Sending Moroccan exporters of packaged olive oil abroad and inviting foreign delegations to Morocco, as well as promotion and communications campaigns on the Moroccan olive oil label at the international level.

As for the socio-economic impact of efforts to develop the olive pressing industry, by 2021 there will be:

- 2,600 more jobs;
- MAD 2.1 billion in additional annual revenue;
- MAD 880 million in additional annual export turnover;
- MAD 400 million in additional annual added value.

The olive preservation sector

The olive preservation sector has both modern and traditional elements to it.

The modern sector is made up of 68 units with a total capacity of 190,000 t per year. These units are located mainly in the regions of Marrakech-Safi (54% by number and 65% by capacity) and Fez-Meknes (12% by number and 13% by capacity).

The traditional task of preserving olives is essentially integrated into domestic trade and uses traditional craft techniques.

Most of the natural production of canned olives is oriented towards exports (70% of production), while the remainder is intended for the domestic market.

Some 88,000 t of table olives are exported nationally per year, or the equivalent of about MAD 1.3 billion. Given the importance of preserving olives, the contract programme provided for several actions, in particular:

- Support for the creation or upgrading of preservation units for agricultural products, including olives;
- Support for exports of canned olives with a view to export an additional 9,000 t per year by 2021.

HEALTH QUALITY AND SECURITY

BOLSTERING THE HEALTH QUALITY AND SAFETY OF OLIVE PRODUCTS

National Bureau of Food Health and Safety (ONSSA)

Since 2008 when the Green Morocco Plan was launched, several steps have been taken to boost development in high added value and highly productive agriculture. These steps were coupled with measures to support small holders with a view to raising income among the rural population.

Very significant support has also been devoted to backing the production chain, particularly by incentivising investment in production (i.e. upgrading, processing, storage, refrigeration, etc.), support to enhance exports, the modernisation of commercialisation circuits, prospection of new markets, and job creation.

In order to meet the established objectives, several types of action have contributed to enhancing production in both qualitative and quantitative terms.

Sector modernisation and regulation

The regulatory framework currently in force for olive oil was adapted to meet the International Olive Council's trade standard, which aims to:

- Harmonize the categories of olive oil with those provided for in the IOC standard with a view to meeting its obligation as a member country, as provided for in the International Agreement on Olive Oil and Table Olives, 2015.
- Introduce both organoleptic and physico-chemical characteristics as the quality criteria that must be considered when grading olive oil.
- Checks on organoleptic characteristics are performed by national tasting panels recognised by the International Olive Council and tied to the LOARC, EACCE, INRA and ENA-Meknes laboratories, designated by the minister in charge of agriculture.

Likewise, decree on the quality and health safety of tinned and jarred vegetables, which includes table olives, was drafted in alignment with international standards.

The regulations were applied in connection with Law 28-07 on the health safety of food products and Law 13-83 on inspection of merchandise to control fraud.

Improving the quality and safety of olive products

Health checks on olive products aim primarily to verify that production conditions meet hygiene regulations, to ensure that products pose no risk to consumers, and to monitor olive processing establishments. This responsibility lies in the first instance with producers. On this subject, Law 28-07 introduced requirements to be met in order to be placed on the market, primarily:

1/ The prohibition of placement on the market of products if they pose a danger to human health;

2/ The obligation to withdraw non-conforming products from the market;

3/ The obligation to establish best practice guides regarding health.

In addition, and in order to continue to operate legally, olive pressing units and olive conservation establishments that produce olives for commercial use must obtain approval or authorisation in accordance with the requirements of Law 28.07.

Granting health-related approvals and authorisations to olive processing establishments has enabled operators from the sector to integrate into a continuous quality approach through compliance with good practices in agriculture, hygiene and manufacturing.

The Guide to Good Health Practices in the Sector, which was drawn up by Interprolive for its members, testifies to the commitment and willingness of professionals, whether industrial, cooperative or economic interest groups, to ensure the loyalty, safety and traceability of the products they place on the market. On the basis of this standard, some 324 sanitary approvals and authorisations have been issued: 222 to the olive pressing sector; 43 to the canning sector; and 59 to the semi-preserved sector. This figure is still very low given the large number of units that have not yet applied for approval or authorisation. The general consensus of all agri-food units launched at the end of 2018 will make it possible to list all operators in the sector.

Monitoring quality and authenticity in olive products consists in combating fraudulent, misleading or adulteration practices and in verifying compliance with the specifications for labelled products, in accordance with the provisions of Law 13.83.

Boosting domestic consumption

In Morocco, there are several obstacles to the development of the olive sector. One of the main constraints is the supply of olive oil through informal channels and traditional maâsras, leading to the predominance of the bulk market. This hinders competitiveness, despite the efforts of institutional players.

Thus, and to promote the consumption of packaged and labelled olive oil and raise awareness of the risks and dangers of buying olive oil from bulk markets and of unknown origin, Interprolive, in partnership with the Department of Agriculture, has launched the first programme to promote good quality olive oil on the domestic market. This project is taking place over a period of three years, which can be renewed, and its main objective is to raise awareness and encourage the Moroccan consumer to buy packaged olive oil that meets the required health and nutritional standards in force.

QUALITY CONTROL IN OLIVE OIL

MOROCCO FOODEX

Technical monitoring

In accordance with the mission of MOROCCO FOODEX, as a guarantor of the compliance of exported Moroccan products with the regulations and standards of export markets, 19 regional sites have been set up in the country's various administrative regions, close to the various production sites.

Exported olive oils and olive-pomace oils are inspected following specific instructions that refer to the general compliance monitoring procedure for each batch of olive oil intended for export, from the receipt of the raw material to the export stage. It is ensured by traceability and monitoring forms for exported batches, completed for each operation and following the requirements of the IOS 17020:2012 standard, for which MOROCCO FOODEX is currently being accredited.

Olive oil and olive-pomace oil are only exported from Morocco once they meet the requirements of trade standards, and the required phytosanitary and sanitary traceability measures in force in the destination markets. The standards of the International Olive Council, CODEX, and USA are the main references that MOROCCO FOODEX uses to assess the conformity of olive oils with the requirements of the export markets.

With regard to organic olive oils and table olives for export, Morocco is launching an ambitious dynamic for this sector, with the support of Pillar II of the Green Morocco Plan and Morocco's strategy for developing local products, and from the impetus provided by the new inter-professional organisation created and recognized by public authorities. Hundreds of hectares of olive trees have been identified in several olive-growing regions of Morocco as eligible for organic farming and are currently being studied to ensure they meet the conditions for certification.

Analytical monitoring

Since 1986, MOROCCO FOODEX has set up a network of laboratories close to the major Moroccan agricultural production areas to ensure Moroccan products comply with the requirements of international markets.

The Moroccan Foodex laboratory network currently consists of eight laboratories, including three dedicated to specialized olive oil analysis: the Casablanca laboratory in the central region; the Meknes laboratory in the north; and the Agadir laboratory in the south.

These three laboratories have the high-performance equipment (liquid and gas chromatography, mass spectrometer, spectrophotometry, etc.) and human skills (continuous training, qualification) required by international regulations to analyse olive oils.

The laboratories do the following:

- Ensure the quality of olive oils (free acidity, peroxide index, UV absorbance, water and volatile matter content, impurity content, etc.)
- Monitor the purity of the oil (fatty acid composition, sterol composition, wax content, stigmastadienes and unsaponifiable content)
- Check for contaminants (pesticide residues, heavy metals) and additives (tocopherols).

This technical competence in the analysis of fats has been crowned since 2006, with accreditation according to ISO IEC 17025, which recognised the performance of these laboratories to satisfy the consumer and promote trade.

Click here for
'The fruit forestry project of the MCA programme

FRENCH

The sensorial analysis of olives and olive oil

MOROCCO FOODEX has a sensory analysis laboratory and a tasting panel for virgin olive oils, in conformity with International Olive Council guidelines.

The MOROCCO FOODEX tasting panel for virgin olive oils

The sensory analysis laboratory, dedicated to assessing the organoleptic qualities of virgin olive oils, is composed of:

- An analysis room equipped with 10 individual tasting booths;
- A sample preparation room;
- A meeting room;
- Material for sensory analysis that abide by the International Olive Council.

The main objectives of the panel, which has been recognised by the International Olive Council for eight years, are:

- Monitoring the quality of the taste of olive oils intended for export;
- Selecting the olive oils exhibited at various trade fairs both in Morocco and abroad;
- Selecting the best quality extra virgin olive oils in collaboration with the Ministry of Agriculture, Fisheries, Rural Development, Water and Forests;
- Presenting and promoting Moroccan olive oils abroad;
- Helping Moroccan professionals produce extra virgin olive oil.

Members of this panel are also part of the panel made up by the Ministry of Agriculture, Fisheries, Rural Development, Water and Forests.

The MOROCCO FOODEX tasting panel for table olives

In order to keep up with changes in consumer trends in export markets, a phenomenon from which table olives have not been able to escape, MOROCCO FOODEX has begun evaluating and tasting table olives. In March 2017, MOROCCO FOODEX decided to set up a tasting panel for table olives in order to help improve the quality of table olives intended for export.

The following has been done to this end:

- Theoretical training of the panel leader (internally and at the International Olive Council level)
- Constitution and formation of the panel, Practical and technical training on the product
- International Olive Council approval pending

PROMOTING EXPORTS

PROMOTION, SUPPORT AND SPREADING MOROCCAN PRODUCTS TO THE INTERNATIONAL COMMUNITY

MOROCCO FOODEX

MOROCCO FOODEX has been entrusted with improving productivity and the quality of national agri-food products since 2013. This public body is involved in both the Green Morocco Plan and the Halieutis Plan and aims to boost competitiveness, both nationally and internationally, and enhance solidarity in agriculture. It does this by promoting local products, in particular olives and olive oil, and some of the activities it has organised can be seen in figure 1.

Participation in international fairs and exhibitions

In order to further boost the export potential of Moroccan olive products, to strengthen and consolidate their position on traditional markets while also penetrating new markets, international fairs and exhibitions are an important and particularly effective platform to give exposure to exporting companies in the olive sector.

With this in mind, MOROCCO FOODEX carries out targeted promotion and development campaigns

2014
*Organisation of **7** acts, including **2** for olive products*

2015
*Organisation of **11** acts, including **5** for olive products*

JANVIER 2016
Management of all Moroccan agricultural and maritime food exports

2016
*Organisation of **20** acts, including **11** for olive products*

***67** shares in olive products*

2017
*Organisation of **15** acts, including **8** for olive products*

***34** shares in olive products*

Figure 1:
Chronology of MOROCCO FOODEX activity

that meet the expectations and ambitions of public and private actors in olive oil exports. MOROCCO FOODEX does this by taking part in international trade fairs, organising back to back missions and showrooms, and setting up pertinent communications campaigns.

These international meetings allow visitors and consumers to discover and taste Moroccan olive oil. In collaboration with both its Moroccan and foreign partners, more than 100 Moroccan operators have taken part in international fairs and exhibitions organised all over the world, in countries such as the USA, Japan, the UAE, Canada, Italy and France, to name but a few.

Olive exports: sectors and markets

Exports in olive products, such as table olives and olive oil, increased by 16% in 2017 to 91,000 t, compared to 79,000 t in 2012.

In 2017, table olive exports alone reached 70,000 t, or 76% of all olive products exported.

As for olive-pomace oils, exports reached 12,800 t. Olive oils made up 10% of exports of olive products in the same year.

Black olives took up 48% of all table olives exported, totalling 33,700 t, followed by green olives at 46% with 32,100 t. Mixed and stuffed olives took up 5% and 1% respectively.

The European Union was the leading destination for table olive exports in 2017, with a share of 72%, followed by the USA (17%), the Gulf States (3%) and Canada (2%).

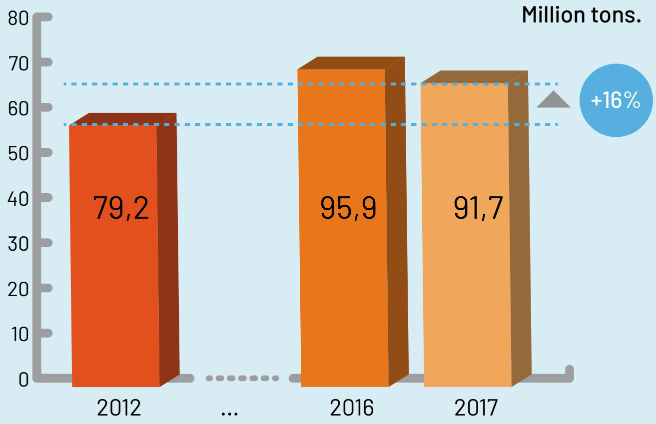


Figure 1: Exports olive products 2012-2017

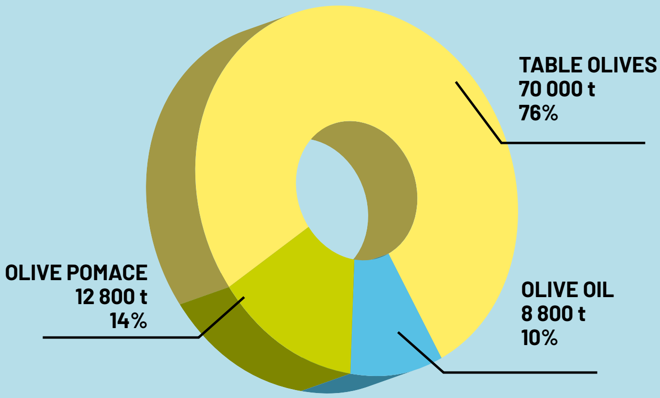


Figure 2 : Exports olive products 2017

In 2017, olive oil exports were mainly destined to the European Union, the USA and Asia, at 58%, 26% and 12% respectively.

The European Union absorbed 11,361 t of olive-pomace oils in 2017, representing a share of around 89%, followed by the USA with 1,381 t.

TABLE 2: EXPORTS OF TABLE OLIVES BY MARKET 2017

MARKET	2017	
	Volume (t)	Part (%)
The EU:	50,567	72
France	28,696	57
Belgium	8,788	17
Italiy	4,807	10
Spain	3,657	7
England	2,000	4
Germany	1,524	3
USA	12.017	17
Gulf States	2.302	3
Canadá	1.505	2
Sub-Saharan Africa	1.008	1,4
Australia	946	1,4
Maghreb	846	1,2
Other	850	1,2
Total	**70. 041**	-

TABLE 3: EXPORTS OF OLIVE OIL BY MARKET 2017

MARKET	2017	
	Volume (t)	Part (%)
The EU:	5,099	58
Spain	3,258	64
Portugal	543	11
Holland	507	10
Italy	479	9
France	114	2
USA	2,311	26
Asia	1,016	12
Canada	302	3
Other	99	1
Total	**8,827**	

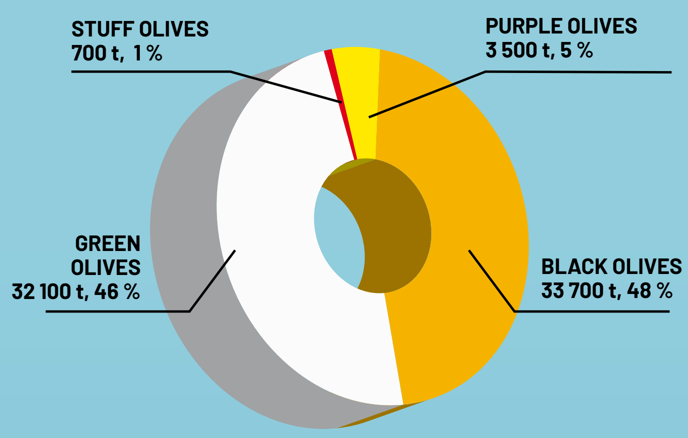


Figure 3: Volume of table olive exports by product in 2017

TABLE 4:
EXPORTS OLIVE-POMACE BY MARKET 2017

MARKET	2017	
	Volume (T)	Part (%)
The EU:	11,361	88.7
Spain	11,338	99.8
USA	1,381	10.8
Other	60	0.5
Total	**12,802**	

Supporting and developing SMEs

In March 2017, Morocco Foodex set up a new support system for SMEs called CAP'EXPORT in order to meet the needs of the sector, specifically a centre to provide support and guidance to small and medium-sized exporters.

The main tasks of this centre are accompanying and developing the skills of SMEs, including pressing and canning units.

In order to ensure permanent, easy and accessible contact, the centre has provided the units with a cheap telephone number and a single mailbox.

During the 2017/18 crop year, the pressing and canning units, along with other areas of activity, benefited from five rich and varied training and awareness-raising programmes on the various export methods and procedures in several Moroccan cities, namely Agadir, Settat, Marrakech, Kenitra and in the margins of the International Agriculture Show in Meknes.

ENVIRONMENT

THE STEPS TAKEN TO PROTECT THE ENVIRONMENT

Ministry of Agriculture, Fisheries, Rural Development, Water and Forests

The olive pressing sector is currently made up of traditional, semi-modern and modern systems. This poses environmental problems related to liquid waste that comes from the olive pressing process. Olive pressing involves nearly 800,000 t of olives per year and generates about 600,000 m^3 of liquid waste, which is mainly made up of the residual vegetable water.

In order to meet this environmental challenge, the Ministry of Agriculture, Fisheries, Rural Development, Water and Forestry, in conjunction with the Ministry of Equipment, Transport, Logistics and Water and the Secretary of State for Sustainable Development, has drawn up a draft decree to regulate the dispersal of these residual liquids on agricultural land. This draft decree is an interesting alternative for the rational and sustainable management of these residues. It was inspired by the regulations and standards applied in other olive-growing countries in the Mediterranean, in particular Italy and Tunisia, where regulations on the use of liquid residues from pressing units have already been adopted. This draft decree is awaiting signature by the relevant ministerial departments.

In addition, with a view to the sustainable management of the by-products of olive pressing, the Ministry of Agriculture, Fisheries, Rural Development, Water and Forests, in collaboration with the Ministry of Equipment, Transport, Logistics and Water and the Secretary of State for Sustainable Development, has set up a draft agreement to collect, treat and repurpose olive by-products.

This draft agreement, currently awaiting signature by the relevant departments, provides for the following:

- Support to acquire tractors to spread the residual vegetable water on agricultural land;
- Support to convert olive pressing units to the two-phase system;
- Support to create units to dry and repurpose wet pomace;
- Help set up joint projects to collect, treat and recover alpeorujo in the regions concerned, to be carried out in partnership with parties involved in the process.

THE PROFESSIONAL ORGANISATION OF THE SECTOR

THE MOROCCAN OLIVE SECTOR'S INTERPROFESSIONAL ASSOCIATION

Subject

Under the provisions of Law 03-12, the Interprolive interprofessional association acts as the framework for consultation between professionals in the sector. It aims to develop and promote the sector, and defend the common interests of professionals within it.

To this end, the association undertakes to:

- Promote olive products on both international and domestic markets ;
- Predict new markets and accompanying professionals from the sector through domestic trade;
- Take part in domestic trade;
- Share information on products and markets;
- Adapt production and logistics to international and domestic demand, according to the laws and regulations in force and market regulations;
- Propose and set up programmes of applied research and product development in the sector;

- Spread rules and standards on the quality, conditioning, packaging, processing and marketing of products;
- Promote and develop distinctive signs of origin and quality of products;
- Accompany professionals in implementing sanitary, phytosanitary and animal health regulations;
- Contribute to training and supervises professionals;
- Promote good practices for protecting and conserving the environment;
- Encourage aggregation as a privileged means of organising professionals in accordance with legislation in force;
- Contribute to the amicable settlement of disputes between professionals in the sector according to Law 03-12.

Composition

Interprolive is made up of the following professional organisations that represent different activities of the sector:

1. For producing olives

- The regional association of olive producers, Fez-Meknes
- The regional association of olive producers, Tanger-Tetouan-Al Hoceima
- The regional association of olive producers of the east
- The regional association of olive producers, Beni Mellal-Khenifra
- The regional association of olive producers, Marrakech-Safi.
- These associations are grouped together in the National Olive Federation.

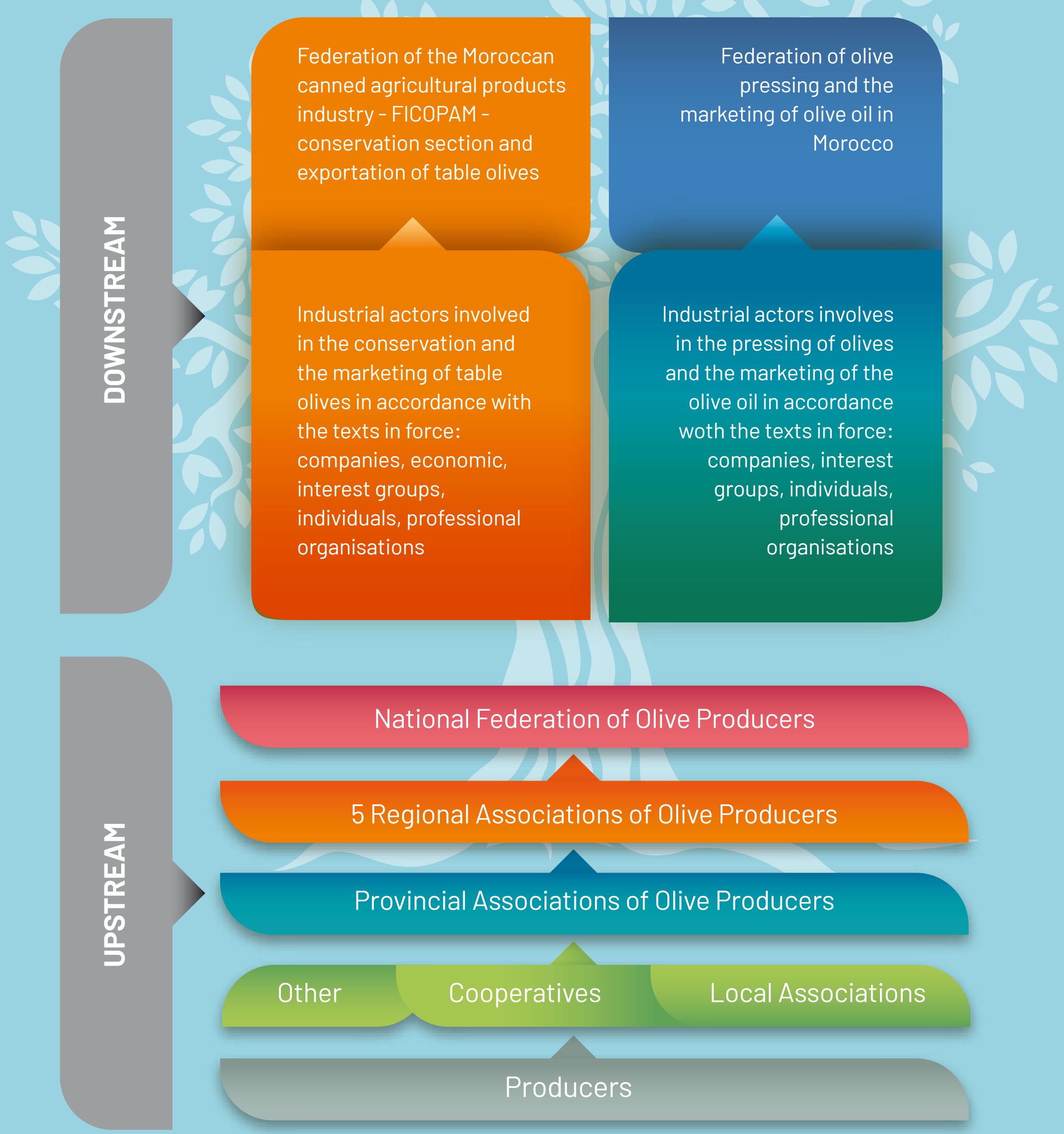
2. For pressing olives and trading olive oil

- The Moroccan federation of olive pressing and olive oil trade

3. For conserving and marketing table olives

- The Moroccan federation of industries for the conservation of agriculture produce through the table olive section as well as other professional organisations operating in the conservation and/or export of table olives.

INTERPROLIVE



EDUCATION AND TRAINING

HIGHER EDUCATION AND PROFESSIONAL TRAINING IN AGRICULTURAL FOR THE MOROCCAN OLIVE SECTOR

Ministry of Agriculture, Fisheries, Rural Development, Water and Forests

Higher education and professional training in Morocco cover all the value chains in the agricultural sectors, including the olive sector. The system goes both upstream and downstream, ranging from agricultural production systems, to the olive harvest and processing chain and the processing of by-products, to the marketing of olive products.

Higher agricultural education

The Moroccan agricultural higher education system consists of three institutions:

- The Hassan II Institute of Agronomy and Veterinary Medicine (IAV) in Rabat, and its Horticultural Complex in Agadir;
- The National School of Agriculture (ENA) of Meknes;
- The National Forest School of Engineers (ENFI) of Salé.

Click here for

'Integrated protection against the enemies of Moroccan olive groves: research findings and prospects'

FRENCH

The IAV in Rabat, its Horticultural Complex in Agadir, and the ENA in Meknes train some 240 engineers every year in fields either directly or indirectly linked to the olive sector, namely: agro-food industries; rural engineering; horticulture; plant protection; soil and water resource management; agro-environment; ecology and natural ecosystem management; plant genetics; seeds and plants; engineering; economic and social development; agro-economic engineering; plant production science and technology; and fruit picking, olive growing and viticulture.

The ENA in Meknes is a centre of olive oil expertise for fundamental and applied research in olive-growing, thanks to the Agropôle Olivier created in 2005 in partnership with the ENA, Meknes, and the agro-industry of the Meknes-Tafilalet region, with the support of the Meknes-Tafilalet regional council and national and international public and private bodies. It constitutes a centre of competence and innovation for the transfer of technology, the development and promotion of the regional and national olive sector and provides the sector with a scientific, technical and relational package.

The Agropôle Olivier covers some 25 ha, and the area includes demonstration nurseries; an international collection of olive varieties; laboratories for genetic marking, in-vitro culture, olive oil analysis, and tasting; a crushing unit that uses the latest techniques and technology; a platform for promoting olive by-products; a nursery; etc. The infrastructure, facilities and equipment available were provided directly by donations from promoters of the project and from the budgets of various research and development projects initiated and developed by the Agropôle Olivier. Two main agreements have made this possible: the Convention of the Founders of the Agropôle Olivier; and the ENA-LCM-Aïcha Convention, between the city of Meknes and the Prefectural Council of Meknes.

Click here for

'Fertiliser for the olive tree: managing NPK in the irrigated olive grove in Marrakech'

FRENCH

Agropôle Olivier's mission:

- Expand and transfer technical and technological knowledge from the national and international olive sector in order to update and develop the sector, through activities such as open days and seminars, demonstrations of cultivation techniques, tasting and sensory analysis training courses, etc.;
- Conduct research and development aimed towards responding to the concerns of the sector;
- Act as a tool to promote 'Olive Oil Meknes' and 'Olive Oil Morocco' (national and international tasting panel and prize for the best olive oil, etc.;
- Implement a system to provide information on olive growing to develop the sector: technical, economic and financial databases, the quality and characteristics of olive oil, etc.;
- Technical, technological, legal, commercial and strategic monitoring.

Professional agricultural training

Some 53 institutions provide professional training in agriculture at two levels: basic training and apprenticeship.

Basic training: training programmes related to the olive sector by level of training:

- Specialised technician level: technical-commercial training in horticultural production, agri-food and laboratory technician in agri-food (available in six training establishments)
- Technician level: horticulture (available in 13 training establishments)
- Advanced level: arboriculture and installation of irrigation systems (available in five training establishments).

Apprenticeships for the sons and daughters of farmers: all establishments that provide professional agricultural training in the sector: arboriculturist, arboricultural worker and olive pressing worker.

INTERNATIONAL OLIVE COUNCIL

Príncipe de Vergara, 154 28002 Madrid, Spain
Tel.: +34 915 903 638   Fax: +34 915 631 263
iooc@internationaloliveoil.org
www.internationaloliveoil.org

LA RECONVERSION DE L'IRRIGATION GRAVITAIRE EN IRRIGATION GOUTTE-À-GOUTTE DÉFICITAIRE : STRATÉGIE PROMETTEUSE POUR L'ÉCONOMIE DE L'EAU ET L'AMÉLIORATION DE LA PRODUCTION ET DE LA QUALITÉ DES OLIVES ET DE L'HUILE D'OLIVE DANS LES ZONES ARIDES ET SEMI-ARIDES

Sikaoui Lhassane[1], Bouizgaren Abdelaziz[1], El Antari Abderraouf Bahri Abdeljabar[1], Hakim Boulal[2], Kerrou Mohamed[2], Vinay Nangia[2]

[1]INRA Marrakech, [2]ICARDA

Au Maroc, les superficies d'olivier irriguées ont augmenté, pour atteindre environ 35 % de la superficie oléicole totale. Toutefois, la disponibilité en eau pour l'agriculture est un sujet de préoccupation croissant, en particulier dans les zones semi-arides. En raison des changements climatiques, ces zones sont caractérisées par une évaporation élevée (plus de 1 500 mm/an), des précipitations faibles et irrégulières (200-300 mm/an) et des périodes répétées de sécheresse. Le système d'irrigation utilisé dans la majorité des cas est le système gravitaire, peu économe en eau. Pour améliorer l'efficience d'utilisation de l'eau, de nouvelles méthodes d'irrigation peu coûteuses, telles que l'irrigation goutte à goutte, ont été préconisées. L'objectif de cette recherche a été d'étudier la réaction des oliviers adultes à la reconversion de l'irrigation gravitaire en irrigation goutte à goutte.

L'expérimentation a été conduite sur une oliveraie irriguée de 36 ans : variété Picholine marocaine, densité 156 pieds/ha, Domaine expérimental de Tessaout de l'INRA à Marrakech. La pluviométrie moyenne annuelle est de 266 mm. Trois régimes d'irrigation sont testés : T1 = irrigation goutte à goutte (100 % ETc), T2 = irrigation goutte à goutte déficitaire (70 % ETc), et T3 = irrigation gravitaire. L'essai a été réalisé en blocs complets randomisés avec trois répétitions et a été évalué durant quatre années consécutives (2012 - 2015). Avant la reconversion, les arbres ont subi une taille sévère et la parcelle a fait l'objet d'un labour profond.

Économie d'eau et rendement en olives

La reconversion de l'irrigation gravitaire en irrigation goutte à goutte a permis une économie d'eau de 38 % et 57 % pour 100 % ETc et 70 % ETc respectivement (Tableau 1). L'irrigation goutte à goutte a induit une nette augmentation du rendement en olives cumulé sur 4 années consécutives, de 40 % et 37 %, par rapport à l'irrigation gravitaire (100 % ETc) et à l'irrigation déficitaire (70 % ETc) respectivement.

Tableau 1 : Quantités d'eau apportées et économisées et rendements en olives par traitements d'irrigation étudiés							
Régimes d'irrigation	Quantité d'eau apportée (m^3/an)	Quantité d'eau économisée (m^3/an)	Rendement en fruits (kg/ha)				
			2012	2013	2014	2015	Cumulé
Goutte à goutte 100 % ETc	6 500	4 000 (-38 %)	7 900	9 300	7 880	8 580	33 660
Goutte à goutte déficitaire (70 % ETc)	4 550	5 950 (-57 %)	7 600	8 900	7 700	8 700	32 900
Gravitaire	10 500	0	4 500	7 900	3 800	7 800	24 000

Calibre, maturité des olives et rendements en huile

Le poids moyen le plus élevé des olives a été obtenu sous les deux régimes d'irrigation goutte à goutte sans différence significative entre 100 % ETc et 70 % ETc. L'irrigation gravitaire a considérablement retardé la maturité des fruits par rapport aux deux régimes goutte à goutte (complète et déficitaire) (Tableau 2). Aucun effet significatif n'a été noté entre l'irrigation complète (100 % ETc) et l'irrigation déficitaire (70 % ETc). Le rendement en huile le plus élevé a été obtenu sous irrigation déficitaire, induisant un gain de 29 % par rapport à l'irrigation gravitaire.

Tableau 2 : Valeurs moyennes des caractéristiques des olives et des rendements en huile d'olive selon les paramètres d'irrigation étudiés.			
Régimes d'irrigation	Indice de maturité mi-novembre	Poids moyen du fruit (g)	Rendement en huile d'olive (kg/ha)
Goutte à goutte 100 % ETc	3,0	4,9	1 531
Goutte à goutte déficitaire 70 % ETc	2,8	5,0	1 604
Gravitaire	2,2	4,5	1 244

Paramètres de qualité de l'huile d'olive

Concernant l'acidité, les huiles d'olive obtenues sous les trois régimes d'irrigation sont des huiles d'olive vierges extra. Les valeurs des extinctions spécifiques (E232 et E270) des huiles d'olive obtenues sous les trois régimes d'irrigation étudiés intègrent la catégorie des huiles vierges extra (norme du COI), montrant une stabilité potentielle élevée de ces huiles.

La teneur en polyphénols totaux, l'un des paramètres clés de la qualité et de la stabilité, montre les valeurs les plus élevées sous les conditions d'irrigation goutte à goutte 100 % ETc.

Tableau 3 : Valeurs moyennes des paramètres de qualité de l'huile d'olive selon les régimes d'irrigation étudiés

Régimes d'irrigation	Acidité	E232	E270	Polyphénols totaux (ppm)
Traitements d'irrigation	0,25	1,50	0,10	282,5
Goutte à goutte 100 % ETc	0,22	1,64	0,11	236,9
Goutte à goutte déficitaire (70 % ETc)	0,31	1,38	0,18	222,8

Acides gras

Les teneurs en acides gras des huiles d'olive obtenues au niveau des trois traitements d'irrigation sont conformes à la norme du COI. Aucun effet significatif de ces traitements d'irrigation sur la composition en acides gras totaux n'a été enregistré.

Tableau 4 : Pourcentages des acides gras majeurs de l'huile d'olive selon les régimes d'irrigation étudiés.

Régimes d'irrigation	C16:0 (%)	C16:1 (%)	C18:0 (%)	C18:1 (%)	C18:2 (%)	C18:3 (%)	Mono/Poly
Traitements d'irrigation	9,85	0,57	2,32	74,20	11,46	0,97	6,08
Goutte à goutte 100 % ETc	9,95	0,59	2,34	74,73	10,72	0,99	6,52
Goutte à goutte déficitaire 70 % ETc	9,83	0,57	2,62	74,05	11,31	0,97	6,10

Caractéristiques organoleptiques des huiles

Sous irrigation déficitaire (70 % ETc), l'intensité des attributs positifs était plus exprimée. L'intensité de l'amer et du piquant est d'au moins 1 ou 2 unités supérieures par rapport à l'irrigation complète (100 % ETc). Une bonne expression des arômes spécifiques avec l'harmonie et la complexité des attributs a été notée dans les huiles d'olive issues du régime d'irrigation déficitaire (Figures 1 et 2).

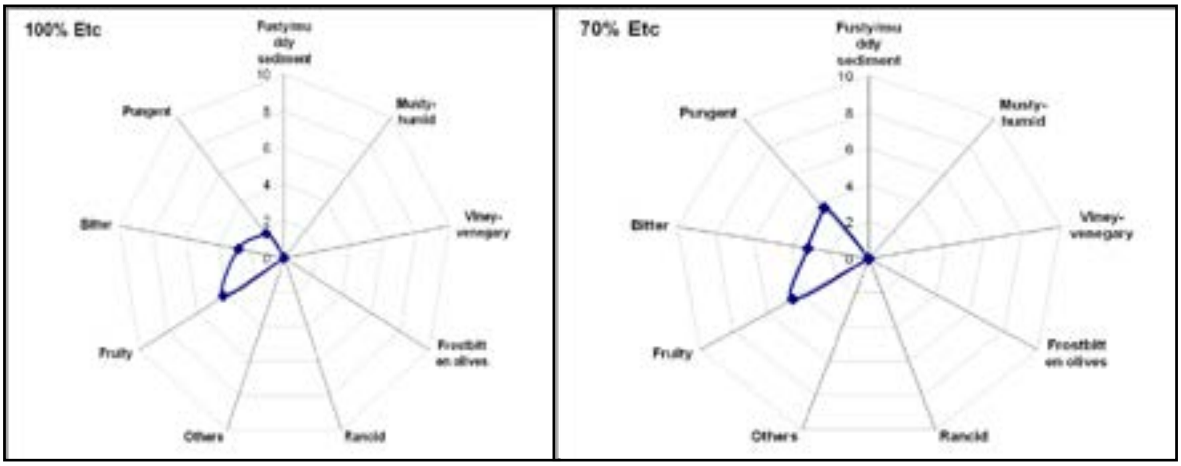


Figure 1 : Profil sensoriel des attributs positifs des huiles d'olive issues des régimes d'irrigation goutte à goutte

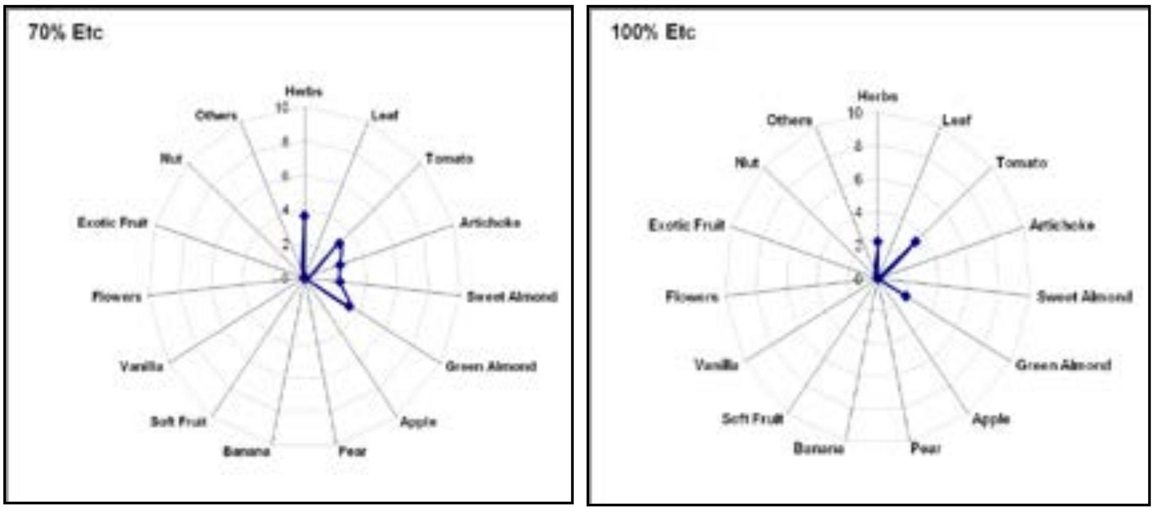


Figure 2 : Profil des arômes spécifiques des huiles d'olive issues des régimes d'irrigation goutte à goutte (100 % et 70 % ETc)

En conclusion, la reconversion de l'irrigation gravitaire en irrigation goutte-à-goutte déficitaire a permis une meilleure stratégie pour l'économie de l'eau, tout en assurant un gain en rendement en olive et en huile d'olive. Cette irrigation déficitaire a induit des effets positifs sur les paramètres de qualité physico-chimique et organoleptique des huiles produites.

OLIVAE
Nº125

Back

L'INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE PROPOSE CINQ NOUVELLES VARIÉTÉS D'OLIVIER

Sikaoui Lhassane, El Antari Abderaouf, Zaher Hayat et Boulouha Belkassem

INRA, Marrakech

Contrairement aux autres pays oléicoles, le profil variétal de l'olivier au Maroc est caractérisé par sa diversité limitée. En effet, le paysage oléicole est dominé par la seule variété « Picholine marocaine » et des variétés issues de la sélection clonale au sein de cette même variété, à savoir Haouzia et Ménara. Ceci est dû à sa très grande adoption par les producteurs pour les raisons de ses atouts tels que la double utilisation, la qualité de ses produits et son adaptation aux conditions locales. La diversité du profil variétal constituerait un grand atout pour l'oliveraie nationale pour i) échelonner la récolte des olives, ii) diversifier les produits oléicoles : olives et huiles, iii) améliorer la pollinisation des oliveraies, surtout pour les cas d'incompatibilité partielle et iv) esquiver les phénomènes d'incidents climatiques de plus en plus fréquents à des périodes variables selon les années.

Durant les dernières années, l'INRA a développé un programme de création variétale ayant pour objectif l'amélioration des performances de nos variétés sélectionnées (Ménara, Haouzia et M26) par croisement avec des variétés européennes dotées de caractères performants touchant la qualité, la quantité de fruit et de l'huile et la résistance au *Spilocea oleaginum.*

Les variétés marocaines Menara, Haouzia et M26, issues de la Picholine marocaine par sélection, caractérisées par leur productivité élevée, une entrée en production rapide, une bonne aptitude à la conserve, une bonne teneur en huile et le fait d'être moins alternantes, ont été croisées avec les variétés étrangères Leccino, Arbequine, Picholine du Languedoc et Manzanilla. Douze types de croisement ont été réalisés (Tableau 1) et 1 600 génotypes obtenus de ces croisements ont été installés au Domaine Tassaout en 1999 pour leur évaluation.

Tableau 1. Types de croisements réalisés et étudiés	
Leccino x M26	Menara x Arbequine
Leccino x Menara	Menara x Picholine du Languedoc
Leccino x Haouzia	Menara x Manzanille
M26 x Arbequine	Haouzia x Arbequine
M26 x Picholine du Languedoc	Haouzia x Picholine du Languedoc
M26 x Manzanille	Haouzia x Manzanille

Le critère principal de la sélection est la productivité ; en deuxième position, la teneur en huile et sa composition en acide oléique ; et en troisième position, les caractères liés à la vigueur des arbres, à la fertilité et à la régularité de production. L'évaluation des populations obtenues par croisements à la dixième année de plantation a permis de sélectionner cinq variétés, en tenant compte des caractères étudiés :

Variété TASSAOUTE

Issue du croisement entre Ménara et Leccino, cette variété est caractérisée par sa productivité élevée, son entrée en production rapide, sa teneur en huile supérieure à 20 %, une teneur en acide oléique de 69 %, un bon calibre du fruit et une auto fertilité très élevée (92 %).

Variété DALIA

Issue du croisement entre Ménara et Arbequine, cette variété est caractérisée par sa productivité, son entrée en production rapide, sa teneur en huile supérieure à 20 %, une teneur en acide oléique de 68 %, un calibre petit à moyen du fruit et une vigueur moyenne.

Variété MECHKATE

Issue du croisement entre M26 et Manzanille, cette variété est caractérisée par sa productivité, son entrée en production rapide, sa teneur en huile supérieure à 20 %, une teneur en acide oléique de 82 %, un bon calibre du fruit, une auto fertilité élevée.

Le caractère spécifique à ce génotype est sa teneur très élevée en acide oléique (82 %), le composé caractéristique de l'huile d'olive, et des arômes spécifiques de fruits rouges, de pomme, d'amande douce, de tomate, de banane et d'artichaut.

Variété BRAKA

Issue du croisement entre M26 et Picholine du Languedoc, cette variété est caractérisée par sa productivité, son entrée en production rapide, sa teneur en huile supérieure à 20 %, sa teneur en acide oléique de 72 %, un calibre moyen du fruit et une régularité de production supérieure à la Picholine marocaine.

Le caractère spécifique de ce génotype est sa régularité de production, qui permet 45 % de gain par rapport à la Picholine marocaine. Son profil sensoriel est caractérisé par une amertume et un piquant moyen à intense (son huile est plus piquante qu'amère) et des arômes spécifiques de pomme, de fruits rouges, d'amande douce, de tomate et d'herbe.

Variété AGDAL

Issue du croisement entre M26 et Manzanille, cette variété est caractérisée par sa productivité, son entrée en production rapide, sa teneur en huile supérieure à 20 %, sa teneur en acide oléique de 77 %, un calibre moyen du fruit, une auto fertilité élevée, une régularité de production et une vigueur faible à moyenne.	

Ces cinq variétés sont inscrites au catalogue officiel et ont été plantées dans un parc à bois mis en place au Domaine expérimental Saada de l'INRA Marrakech. Les variétés Tassaoute et Dalia ont été mises à la disposition des pépiniéristes pour leur diffusion sous la supervision de l'ONSSA. Des vergers de comportement ont été installés aux Agropôles de Meknès et de Berkane.

OLIVAE

Nº125

Références bibliographiques LES RESSOURCES GÉNÉTIQUES : UN ATOUT POUR LES PROGRAMMES D'AMÉLIORATION GÉNÉTIQUE ET DE SÉLECTION VARIÉTALE DE L'OLIVIER AU MAROC

- Cruz F, Julca I, Gómez-Garrido J, Loska D, Marcet-Houben M, et al. (2016) *Genome sequence of the olive tree*, Olea europaea. GigaScience 5:29.

- El Bakkali A, Essalouh L, Moukhli A, Zaher H, Sikaoui L, et al. (2018) *Towards the authentication of Olive World Germplasm Banks (OWGBs) of Marrakech (Morocco) and Córdoba (Spain).* 6th International Conference on the Olive Tree and Olive Products, OliveBioteq'18-Olive Management, Biotechnology and Authenticity of Olive Products, 15-19 October 2018, Seville- Spain.

- El Bakkali A, Haouane H, Moukhli A, Costes E, et al. *Construction of Core Collections Suitable for Association Mapping to Optimize Use of Mediterranean Olive (Olea europaea L.)* Genetic Resources. PLoS One 8(5): e61265.

- Haouane H, El Bakkali A, Moukhli A, Tollon C, Santoni S, et al. (2011) *Genetic structure and core collection of the World Olive Germplasm Bank of Marrakech: towards the optimised management and use of Mediterranean olive genetic resources*. Genetica 139(9):1083-94.

- Malek GV (2016) *Les ressources génétiques de l'olivier en Turquie*. Olivae N°123: 27-30.

- Trujillo I, Ojeda MA, Urdiroz NM, Potter D, Barranco D, et al. (2014) *Identification of the Worldwide Olive Germplasm Bank of Córdoba (Spain) using SSR and morphological markers*. Tree Genetics & Genomes 10 (1): 141–155

OLIVAE

Nº125

Back

D. PROJET ARBORICULTURE FRUITIÈRE DU PROGRAMME MCA

Ministère de l'Agriculture, de la Pêche maritime, du Développement rural et des Eaux et Forêts

Le Projet Arboriculture fruitière du Programme MCA (PAF/MCA), qui est l'incarnation anticipée d'un des fondements majeurs du Plan Maroc Vert, en l'occurrence le Pilier II entièrement dédié à l'agriculture solidaire, est un projet novateur disposant d'une identité conceptuelle singulière, dont les éléments saillants qui ont prévalu durant toutes les étapes de sa mise en œuvre sont synthétisés comme suit :

- L'application d'une **approche participative** avec l'implication directe des agriculteurs bénéficiaires dans toutes les démarches de mise en œuvre du projet, depuis les études de faisabilité jusqu'aux étapes de sa concrétisation sur le terrain, ce qui confère plus de transparence et d'équité aux activités programmées dans le cadre du projet.
- L'adoption d'une **démarche globale de développement** spécifique centrée sur les filières arboricoles porteuses en zones de montagnes et ce, dans l'optique d'aider l'expression adéquate des fortes potentialités agricoles de ces zones. Cette démarche consiste particulièrement en la mise en place d'un système d'intervention territorialisé intégrant, de manière synergique, au sein d'un même bassin de production, les actions de développement initiées par les différents partenaires (nouvelles plantations, aménagements hydro-agricoles, valorisation de la production, encadrement et organisation professionnelle des agriculteurs, etc.).
- Le **traitement systématique** des chaînes de valeur selon une vision intégrée de l'ensemble des maillons des filières arboricoles ciblées, depuis la mise en terre des plants et la production jusqu'à la valorisation, l'accès aux marchés et la satisfaction des consommateurs.
- La mise en place d'un système d'accompagnement financier pour le fonctionnement des unités de valorisation mises à la disposition des GIE, leur permettant de s'approvisionner auprès de leurs adhérents dans des conditions optimales, avec des prix compétitifs, et de réaliser de bonnes performances techniques.
- La prise en considération de la **dimension environnementale** par l'optimisation des potentialités et des ressources naturelles importantes, notamment la gestion durable des eaux et des sols et la maîtrise des facteurs affectant le milieu.
- La mise en place d'un dispositif rationnel de gestion et d'administration du PAF/MCA avec des structures dédiées (APP, UGP) et des moyens matériels conséquents permettant une autonomie de gestion, une liberté d'action, une motivation judicieuse et raisonnable des ressources humaines mobilisées, précurseurs de la réussite d'un suivi minutieux et rapproché des activités engagées dans le cadre du projet.

Le projet ainsi réalisé a permis, outre la plantation **de 80 000 ha d'oliviers** et des aménagements hydro-agricoles de PMH, la construction de **20 unités de trituration d'olives** d'une capacité de trituration de 60 à 80 t/j chacune et d'une capacité globale de stockage de 600 t d'huile chacune, au profit de plus de **6 843 agriculteurs et de 150 coopératives** organisées en Groupements d'Intérêt Économique (GIE).

Ce projet d'envergure revêt, de par l'ampleur de ses réalisations et ses impacts socioéconomiques et environnementaux positifs, un intérêt particulier pour les populations rurales en zones de montagne, en contribuant substantiellement à la réduction de la pauvreté et à l'atténuation de manière significative des effets négatifs des facteurs de précarité au niveau des zones de montagnes.

Au vu des résultats obtenus jusqu'à présent par le nouveau modèle d'organisation des GIE, les performances de production sont encourageantes car le tonnage trituré avoisine pour ces premières années les vingt mille tonnes annuelles.

La progression de leurs performances depuis la mise en marche de leurs unités de trituration est corroborée par les avancées réelles enregistrées sur plusieurs indicateurs à caractère surtout qualitatif (**78 %** de la production d'huile des GIE est **de qualité vierge extra**, contre une moyenne nationale de **10 %).** Des avancées couronnées de multiples prix et trophées à l'occasion de manifestations nationales et internationales attribués à de nombreux GIE, dont le dernier a été attribué au GIE Chiadma Mogador à l'occasion du concours international Mario Solinas organisé par le Conseil oléicole international au titre de l'année 2018.

L'obtention de ces résultats est également le fruit d'un système d'accompagnement financier innovant pour les petits producteurs, qui permet aux GIE d'accéder à des avances sur marchandise **(ASM)** pour financer la campagne oléicole à hauteur de 5MDH par GIE. L'utilisation de ce dispositif, mis en place par le CAM conformément à la convention de financement du projet, connait une évolution importante aussi bien en termes de nombre des GIE utilisateurs et des montants utilisés par les GIE qui ont atteint respectivement 16 GIE/20, avec un montant global qui avoisine 30 MDH au cours de la campagne écoulée. Ce mode de financement innovant, fortement sollicité par de nombreux GIE comme condition *sine qua non* pour un fonctionnement performant de leurs unités et une production importante d'huile d'olive de qualité supérieure, a été adopté progressivement par les GIE, avec l'instauration d'une relation de confiance mutuelle entre les GIE d'une part et l'organisme de financement d'autre part.

On soulignera au passage un élément important qui caractérise ces unités de trituration mises à la disposition des GIE en rapport avec la préservation de l'environnement et la valorisation des sous-produits de la trituration, en particulier les grignons et les noyaux. Disposant de bassins d'accumulation des margines et des grignons, de séparateurs de noyaux et de plateformes de séchage des margines, de nombreux GIEs oléicoles se sont d'ores et déjà lancés dans la valorisation des sous-produits et diversifient ainsi les sources de revenus avec l'installation d'unités annexes pour la fabrication des buches à base de grignons et de noyaux. On citera à ce titre l'exemple des GIE Ziz Guir, Al Alfia, Bni Mellal, etc.

Outre leur activité principale de production d'huile d'olive, certains GIE, profitant de leur base adhérente et de leur ancrage au niveau des bassins de production pour diversifier leurs productions et leurs sources de revenus, se sont ouvert à d'autres activités agricoles et en particulier à la production d'olives de table. On citera à titre d'exemple le cas du GIE AHLAF Taourit.

Les témoignages de nombreux GIE oléicoles confirment une forte appropriation de leurs projets par leurs adhérents et les agriculteurs au niveau des bassins de production qu'ils couvrent et dont les effets positifs directs commencent à se faire sentir, à savoir :

- Le captage de la plus-value suite à la révision à la hausse des prix des olives et de l'huile d'olive au cours des trois dernières campagnes ;
- La valorisation *in situ* de leurs productions avec une réduction des frais de transport ;

Ceci, sans perdre de vue l'importance des volumes des productions attendues pour les campagnes futures, avec l'entrée en pleine production des nouvelles plantations des périmètres installés dans le cadre des projets PII (MCA et autres).

Par ailleurs, l'adoption d'un nouveau modèle organisationnel, qui s'articule autour d'organisations professionnelles agricoles de second ordre comme acteur axial de développement dans les zones de montagne, s'est soldée par **un bilan globalement positif**, avec des prémisses d'une nouvelle reconfiguration des rapports de force régissant le fonctionnement de la filière oléicole, en faveur des petits agriculteurs, à travers le renforcement de leur pouvoir de négociation et la réussite de leur ancrage aux nouvelles instances de gouvernance de la filière avec les pouvoirs publics.

Ainsi, nous considérons que les actions engagées, notamment celles concernant l'extension et l'entretien des jeunes plantations, le renforcement des infrastructures des unités de trituration installées ainsi que d'autres relatives à l'assistance technique dédiée au renforcement des aptitudes professionnelles et des capacités managériales des agriculteurs bénéficiaires avec l'appui et l'accompagnement du MAPMDREF, ont constitué un facteur clé dans la poursuite du processus de développement initié et dans la sécurisation, *in fine*, des investissements considérables consentis.

L'instauration de ce modèle novateur, initié pour la première fois dans le cadre du PAF/MCA, requiert pour son opérationnalisation et son adoption complète par les agriculteurs, un effort soutenu de persuasion et d'accompagnement technique et financier qui s'inscrit dans la durée.

OLIVAE

Nº125

Back

E. FERTILISATION DE L'OLIVIER : OPTIMISATION DE LA GESTION DES ÉLÉMENTS NUTRITIFS *NPK* DANS LES OLIVERAIES SOUS LES CONDITIONS IRRIGUÉES DE LA RÉGION DE MARRAKECH

Bouizgaren Abdelaziz[1], Sikaoui Lhassane[1], El Antari Abderraouf[1], Boulal Hakim[2]

et El Ghaross Mohamed[2]

[1]INRA Marrakech [2]IPNI North Africa

Malgré l'importance de l'olivier au Maroc en termes de superficie et les efforts déployés par l'État pour la promotion de cette culture, les rendements en olives restent très faibles (1,5 à 3 tonnes en irrigué). La principale raison de cette faible production est liée, entre autres, à la gestion inadéquate de la fertilisation pratiquée par les agriculteurs. En fait, la fertilisation est négligée dans la plupart des oliveraies. En outre, la gestion actuelle de la fertilisation repose principalement sur les pratiques traditionnelles des agriculteurs, répétant le même programme de fertilisation chaque année, et dépend parfois de la disponibilité des engrais. En conséquence, une grande proportion des oliveraies présente des carences en potassium, phosphore et magnésium dans les systèmes irrigués et pluviaux (Sikaoui *et al*., 2014 ; El Gharous et Boulal, 2016), ce qui aurait des effets négatifs sur la qualité de l'huile d'olive (Fernández-Escobar *et al*., 2006 ; Fernández-Escobar, 2008).

Pour atteindre une production optimale en olives, un programme de recherche sur l'optimisation de la gestion des nutriments NPK chez l'olivier conduit en irrigué a été mené en collaboration entre l'INRA de Marrakech et l'IPNI, en adoptant le concept « 4R Nutrient Stewardship ». L'objectif est de développer des recommandations pour une meilleure gestion de la fertilisation des oliviers pour une production d'olives durable.

Expérimentation On-farm :

Une expérimentation a été conduite On-farm en irrigué dans la région de Marrakech, sous le système fertigation sur une plantation adulte de 18 ans de la variété. Haouzia avec une densité de plantation de 204 arbres/ha. L'expérimentation a été évaluée sur quatre années consécutives (2014 - 2017) et a comporté quatre traitements de fertilisation :

- T1= Témoin (sans apport d'engrais).
- T2 = Engrais apportés selon la pratique de l'agriculteur (apport d'azote)
- T3= Engrais apportés selon la méthode de diagnostic foliaire effectuée en juillet
- T4= Engrais apportés sont estimés selon la méthode des exportations.

Tableau 1 : Quantités, dates d'apport et forme des fertilisants NPK apportés par traitement et par année (kg/arbre)												
	2014			2015			2016			2017		
Traitements de fertilisation	N	P	K	N	P	K	N	P	K	N	P	K
T1 : Témoin (sans apport)	0	0	0	0	0	0	0	0	0	0	0	0
T2 : Pratique de l'agriculteur (N seul)	0,66	0	0	0,66	0	0	0,66	0	0	0,49	0	0
T3 : NPK calculée selon le diagnostic foliaire	0,7	0,3	0,7	0,46	0,15	0,36	0,49	0,16	0,39	0,5	0,18	0,79
T4 : NPK calculée selon les exportations	0,8	0,4	0,85	0,51	0,2	0,43	0,52	0,22	0,45	0,52	0,25	0,88

Dates d'apports	Forme de fertilisants :
N : 25% mars, 25 % avril, 25 % mai, 25 % septembre	N: Ammonitrate 33 %
P : 50 % mars, 50 % mai	P: Acide phosphorique 54 %
K : 25 % mai, 25 % juin, 25 % septembre, 25 % octobre	K : Solu-potasse 52 %

Les quantités de nutriments, les dates d'apports et les formes des fertilisants NPK apportés par traitement et par année sont données dans le Tableau 1.

Rendement en olives :

L'application des fertilisant NPK selon les traitements T3 et T4 a considérablement augmenté les rendements en olives (Tableau 2). Le meilleur rendement a été obtenu par T3 avec une production en olives cumulée de 168,6 kg/arbre, contre 98,0 et 136,3 kg/arbre avec T1 et T2 respectivement, soit une augmentation respective de 72 % et 23 %. Il convient de noter que les faibles rendements obtenus au cours de l'année 2016 sont dus au phénomène d'alternance, conjugué à des conditions climatiques défavorables (chocs thermiques).

Tableau 2 : Rendements en olives selon les traitements de fertilisation (kg/arbre)

Traitements étudiés	2014	2015	2016	2017	Cumul
T1 : Témoin (sans apport)	15,0 a	34,0 a	4,8 a	44,2 a	98,0 a
T2 : Pratique de l'agriculteur (N seul)	33,4 b	47,7 b	5,6 b	49,8 b	136,3 b
T3 : NPK calculée selon le diagnostic foliaire	42,6 c	59,0 c	7,4 c	59,7 c	168,6 c
T4 : NPK calculée selon les exportations	44,2 c	50,5 d	7,6 c	58,5 c	160,7 c

**les chiffres de même lettre ne diffèrent pas significativement*

Poids de 100 fruits :

Une amélioration nette du poids des olives a été obtenue sous l'apport de NPK selon le diagnostic foliaire (Tableau 3). L'augmentation de ce paramètre est évaluée à 17 % par rapport au témoin.

Tableau 3 : Poids de 100 fruits selon les traitements de fertilisation (grammes)

Traitements étudiés	2014	2015	2016	2017	Moyenne
T1 : Témoin (sans apport)	327,9 a	356,7	354 a	220,5 a	314,8 a
T2 : Pratique de l'agriculteur (N seul)	349,1 b	345,15	370 b	230 a	323,6 a
T3 : NPK calculée selon le diagnostic foliaire	433,6 c	392,2	381 c	266 b	368,2 b
T4 : NPK calculée selon les exportations	427,2 c	369,5	394 c	260,5 b	362,8 b

**les chiffres de même lettre ne diffèrent pas significativement*

Gain du rendement en huile d'olive :

Une bonne gestion de la fertilisation permet une nette amélioration du rendement en huile. Cette augmentation est d'environ 9,8 % et 10,8 % par T3 et T4 respectivement par rapport au témoin (T1) (Figure 1).

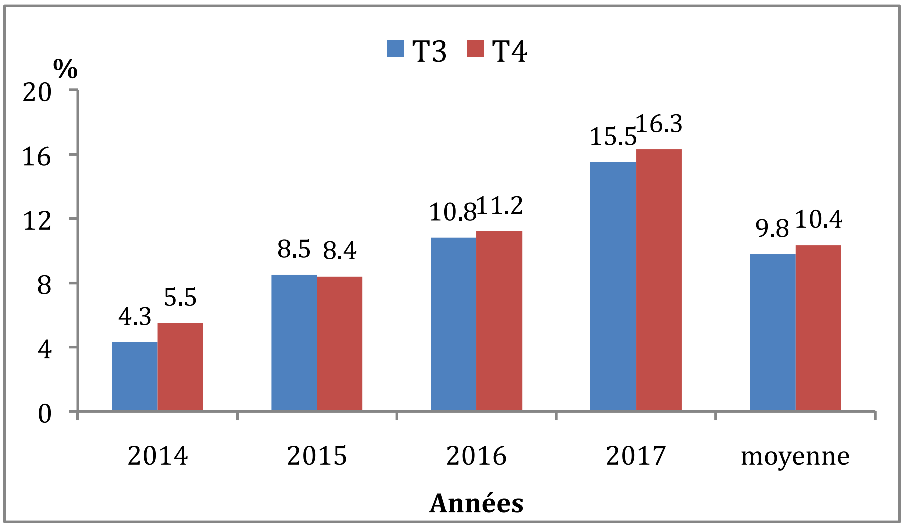


Figure 1 : Gain de rendement en huile d'olive selon la méthode d'estimation des fertilisants

Teneur en phénols et chlorophylle des huiles d'olive :

La teneur en phénols des huiles d'olive produites a augmenté de 48 % et 52 % respectivement sous les traitements T3 et T4 par rapport au témoin (Tableau 4).

Tableau 4 : Teneur de l'huile d'olive en phénols (PPM)

Traitements étudiés	2014	2015	2016	2017	Moyenne
T1 : Témoin (sans apport)	271,0 a	179,5 a	175,0 a	291,5 a	229,3 a
T2 : Pratique de l'agriculteur (N seul)	283,5 b	254,5 b	260,5 b	353,0 b	287,9 a
T3 : NPK calculée selon le diagnostic foliaire	293,5 c	331,5 c	356,0 c	376,5 c	339,4 c
T4 : NPK calculée selon les exportations	308,0 c	322,0 c	324,0 d	443,0 d	349,3 c

**les chiffres de même lettre ne diffèrent pas significativement*

La teneur en chlorophylle de l'huile d'olive n'est pas affectée par les traitements de fertilisation étudiés (Tableau 5).

Tableau 5 : Teneur de l'huile d'olive en chlorophylles (PPM)

Traitements étudiés	2014	2015	2016	Moyenne
T1 : Témoin (sans apport)	3,3	10,3	11,0	8,2
T2 : Pratique de l'agriculteur (N seul)	3,5	9,7	10,2	7,8
T3 : NPK calculée selon le diagnostic foliaire	4,1	11,2	8,2	7,8
T4 : NPK calculée selon les exportations	3,6	10,3	9,9	7,9

Indice de peroxydes :

L'indice de peroxydes a légèrement augmenté avec l'apport de fertilisation NPK selon les modes de calcul par diagnostic et les exportations par rapport au témoin, tout en restant dans la catégorie des huiles d'olive vierges extra (Tableau 6).

Tableau 6 : Indice de peroxydes (meq of O_2/ kg)

Traitements étudiées	2014	2015	2016	Moyennes
T1 : Témoin (sans apport)	8,10	7,40	6,68	7,39
T2 : Pratique de l'agriculteur (N seul)	8,79	8,43	7,16	8,13
T3 : NPK calculée selon le diagnostic foliaire	10,15	10,31	7,48	9,31
T4 : NPK calculée selon les exportations	10,23	11,15	7,53	9,63

Composition en acides gras

La fertilisation NPK a induit une légère augmentation des teneurs en acides gras palmitique, linoléique, linolénique et arachidique (Tableau 8). Cette augmentation est positive, notamment pour les acides gras essentiels. Toutefois, les valeurs obtenues pour tous les acides gras analysés correspondent aux normes établies par le COI.

Tableau 8 : Composition acidique selon le mode de fertilisation

Traitements étudiés	Palmitique C16 :0	Stéarique C 18:0	Oléique C18 :1	Linoléique C18 :2	Linolénique C18 :3	Arachidique (C20:0)	Gadoléique (C 20:1)
T1	10,89	2,53	71,32	12,27	0,765	0,188	0,331
T2	10,85	2,43	71,80	12,94	0,845	0,280	0,326
T3	11,05	2,45	71,44	13,34	0,940	0,420	0,327
T4	11,05	2,48	71,43	13,84	0,965	0,265	0,328

Norme du COI

- Palmitique 7,5 – 20
- Stéarique (0,5-5,0)
- Oléique (55-83)
- Linoléique (3,5-21)
- Linolénique (<1)
- Arachidique <0,6
- Gadoléique <0,4

Conclusion

L'optimisation des nutriments NPK des oliveraies basée sur les deux méthodes (analyse foliaire et estimations des exportations) a amélioré la production en olives, le rendement en huile et sa qualité. Cette dernière n'a pas été affectée par les quantités de fertilisants apportées. Pour une meilleure gestion de la fertilisation, et compte tenu du coût des fertilisants, la technique de l'analyse foliaire fournit une indication de l'état nutritionnel des oliviers et constitue une méthode optimale pour la programmation de la fumure, permettant d'obtenir un meilleur équilibre entre les rendements en olives et en huile d'olive et d'améliorer leur qualité, avec un coût de fertilisation raisonnable.

Références

– Boulal Hakim, Lhassane Sikaoui and Mohamed El Gharous, 2013. Nutrient Management: A New Option for Olive Orchards in North Africa. Better Crops/Vol. 97 (2013, No. 4).

– El Gharous Mohamed and Hakim Boulal, 2016. IPNI North Africa Challenges in nutrient management under rainfed agriculture of Morocco. Procedia Engineering 138 (2016) 332 – 336.

– Fernández-Escobar R., Beltrán G., Sánchezzamora M.A., García-Novelo J., Aguilera M. P., Uceda M., 2006. Olive oil quality decreases with nitrogen over-fertilization. HortScience 41(1), 215-219.

– Fernández-Escobar R., Ortiz-Urquiza A., Prado M., Rapoport H.F., 2008. Nitrogen status influence on olive tree flower quality and ovule longevity. Environ Exp Bot 64, 113-119. doi:10.1016/04.007.

– MAPM, 2016. Contrat programme Olivier. Bilan et perspectives.

Boulal H., Sikaoui L., Bouizgaren A., El Gharous M., 2014. Nutritional status of olive orchards in rainfed and irrigated area of Tensift-Haouz region in Morocco. Proceedings of the 5th the International Conference, Olive, culture, Biotechnology

OLIVAE

Nº125

Back

F. PROTECTION INTÉGRÉE CONTRE LES ENNEMIS DE L'OLIVIER AU MAROC : ACQUIS DE RECHERCHE ET PERSPECTIVES

Yamna Ouguas /INRA, Marrakech

Au Maroc, les déprédateurs de l'olivier causent des dégâts d'importance variable d'une année à l'autre. L'INRA a mis en place un programme de recherche ambitieux pour une lutte intégrée en vue d'améliorer l'état sanitaire des oliveraies. Les axes de recherche prennent en compte les différents aspects biologiques, écologiques, les relations déprédateurs-olivier et les moyens de contrôle. Cet article est une synthèse des résultats des recherches sur la lutte contre les principaux ennemis de l'olivier:

LUTTE CONTRE LES PRINCIPAUX INSECTES RAVAGEURS

•*Bactrocera oleae* Gmel. (Diptera: Tephritidae) : mouche de l'olive

La mise au point d'un système de piégeage de masse de la mouche des olives a permis de contrôler efficacement les populations de ce ravageur.

Piège alimentaire suspendu à l'olivier

Adultes de *B. oleae* capturés par le piège

Les attractifs alimentaires qui s'avèrent les plus performants sont le sulfate d'ammoniaque et l'urée. Un certain nombre de mouches s'échappant des pièges, la réduction du diamètre des trous des pièges de 30 à 10 mm a permis de doubler la capture des adultes de *B. oleae*. L'augmentation de la concentration de l'attractif alimentaire améliore la capture. Cependant, les pièges avec des concentrations de 10 % séchant rapidement, la concentration de 5 % est la plus recommandée. La densité d'un piège par arbre diminue la proportion de fruits infestés et permet de capturer plus de mouches et d'assure un contrôle plus efficace de la mouche. Cette technique a été vulgarisée afin de minimiser les traitements insecticides, réduire les charges de production et contribuer à la protection de l'environnement. Elle reste facile à utiliser, efficace, durable et économique. Le coût annuel du piégeage de masse de la mouche est en moyenne inférieur à 150 MAD/ha, contre 600 MAD/ha pour le traitement chimique.

Enfin, le labour du sol après la récolte permet de préciser la localisation exacte des pupes hivernantes. Les résultats de recherche ont montré que le sol peut être peuplé à une profondeur dépassant 10 cm et à proximité des pieds des oliviers, d'où l'intérêt du travail du sol autour des arbres comme lutte culturale contre les stades hivernants de *B. oleae*. Cette pratique perturbatrice du milieu d'hivernage de l'insecte induit une forte réduction de la réserve en pupes hivernantes.

•*Prays oleae* Bern. (Lepidoptère : Yponomeutidae)

La lutte microbiologique de la teigne (*P. oleae*) s'effectue à l'aide de *Bacillus thuringiensis.* Le traitement à l'aide de cette bactérie en poudre mouillable à la dose de 70 g/l permet de contrôler les populations de la teigne en réduisant les infestations à des niveaux tolérables allant de 70 à 78 % selon les années et les sites. L'estimation du coût de ce traitement représente la moitié du coût d'un traitement chimique par Fenthion, sans compter les effets indirects de l'utilisation des pesticides comme les intoxications humaines, la réduction des populations d'ennemis naturels et la perte de ruchers.

Adultes de *Prays oleae*

• La cochenille noire *Saissetia oleae* (Homoptère : Coccidae)

L'élagage reste la technique la plus recommandée pour lutter contre la cochenille. Bien que cette pratique soit utilisée au niveau de plus de 50 % des oliveraies à l'échelle nationale, elle reste insuffisante, eu égard à ses effets bénéfiques. En effet, dans des oliveraies très infestées par la cochenille ou délaissées, l'élagage sévère permet la reprise de la végétation, la survie es oliviers et entraîne une réduction de 2/3 des populations de la cochenille, en particulier des stades œufs et larves

Population de *S. oleae* sur olivier

• **Psylle de l'olivier *Euphyllura olivina* Costa (Homoptère : Psyllidae)**

Les recherches au niveau national ont montré que le seuil de nuisibilité de cet insecte est de 10 larves par grappe florale. Dans les cas extrêmes d'attaque, ce seuil n'a jamais été atteint, ce qui est en faveur de l'économie de traitements pesticides.

Adulte de *E. olivina*

Les produits naturels (extraits phénoliques, huiles essentielles, extraits de plantes, etc.) ont un grand potentiel pour être utilisés en lutte biologique propre et efficace pour lutter contre ce ravageur. En effet, l'efficacité de l'extrait naturel de *Capsicum frutescens* L., *Allium sativum* L., *Allium cepa* L., et de celui de *Thymus satureioidaes* L. a été évaluée contre cet insecte en plein champ. Les produits testés affectent significativement le niveau de populations du psylle.

• **Autres ravageurs :**

Eu égard aux changements climatiques et la rareté des précipitations, des ennemis qui étaient autrefois secondaires ont commencé à prendre de l'ampleur. *Hylesinus oleiperda* Bern.

(Coléoptère, Curculionidé). Le chaulage des troncs d'olivier et l'élagage permettent une bonne protection contre cet insecte ravageur.


Adulte d'*H. oleiperda* et dégâts sur tronc d'olivier

• ***Xylomedes Coronata* (Marseul, 1883) (Coléoptère, Bostrichidae) :**

Se développe dans les branches mortes comme dans les branches vivantes, attaque plusieurs arbres fruitiers et divers agrumes.

Adulte de *Xylomedes*

Galerie après la sortie de l'adulte

L'incidence d'attaque peut atteindre 47 % et la sévérité au sein d'un même arbre peut entrainer une perte importante de la production d'olives. L'élagage et le traitement des haies d'acacia permettent une bonne protection contre ce ravageur.

• ***Acherontia atropos* Linnaeus (Lépidoptère, Sphingidés)** :

Les chenilles se nourrissent de feuilles et se servent de leurs mâchoires puissantes pour dévorer chaque feuille jusqu'à la nervure médiane plus coriace. Elles s'attaquent aux très jeunes plantations, entrainant leur défoliation totale. Dans les oliveraies attaquées, des *cover-cropages* périodiques en début d'été ont été recommandés pour entrainer la mortalité des chrysalides avant l'émergence des adultes, en plus du ramassage des larves et leur destruction en cas de nouvelle apparition.

Larve et adulte de *A. atropos*

LUTTE CONTRE LES PRINCIPALES MALADIES

• ***Verticilium dahlia :***

Le pourcentage d'attaque des oliveraies est généralement faible mais il peut atteindre 50 %. En effet, si les bonnes conditions s'établissent, cette maladie pourrait constituer un fléau difficile à contrôler en absence de lutte directe et indirecte à court, moyen et long terme. En attendant la mise sur le marché de variétés ou porte-greffes résistants et afin de contrôler l'extension de la maladie, les recherches de biologie moléculaire ont souligné la diversité génétique plus ou moins importante chez les souches de ce parasite isolées de l'olivier. Après isolement et caractérisation, une collection de 5 champignons antagonistes au *V. dahlia* in vitro a été établie. L'effet antifongique des huiles essentielles de plantes aromatiques et médicinales de la famille des Lamiaceae (*Lavandula angustifolia*, *Mentha pulegium* et *Salvia officinalis*) sur le Verticilium in vitro a donné des résultats prometteurs.

• ***Spilocea oleagina :***

Ce champignon est l'agent responsable de la chute précoce des feuilles de l'olivier. Les résultats ont montré que la densité de plantation accentue l'attaque par ce champignon et les traitements cupriques à semi-dose ont une efficacité identique au traitement à pleine dose.

Les racines d'olivier sont sujettes aux attaques des champignons telluriques, notamment l'agent causal du flétrissement de l'olivier ; *Phytophtora palmivora* qui a été signalé en 2013 dans différentes régions oléicoles du Maroc. Cette maladie entraine la chlorose des feuilles, la défoliation, le flétrissement et le dépérissement des rameaux d'olivier. Le champignon a été isolé à partir des racines et des rameaux des plants d'oliviers en pépinière et de vergers de différentes régions avec des taux d'infestation variables. D'autres espèces ont été isolées dans différentes régions : *Alternaria alternate, Colletotrichum gloeosporioides*, agent causal de l'antrachnose de l'olivier, *Circinella sp.*, *Ulocladium sp.*, etc.

• **Nématodes** :

L'identification pour la première fois de 7 taxons de nématodes sur l'olivier au Maroc en 2014 a montré que les Tylenchidae, Hoplolaimdae et Tylotylenchidae dominent dans 80 % des sols examinés, alors que les nématodes à galle *Meloidogyne spp*. ont été détectés dans 40 % des échantillons. Le développement des Heteroderidae et Longidoridae est favorisé sur les oliviers sauvages, alors que les Pratylenchidae et les nématodes à galle se multiplient sur l'olivier cultivé. En effet, trois espèces de *Meloidogyne* ont été identifiées : *M. javanica* sur olivier sauvage et cultivé au sud et au centre du Maroc et *M. arenaria* et *M. halpa* sur olivier sauvage au nord du pays. Ces nématodes affectent les oliviers en pépinière et entrainent des pertes économiques importantes. Les variétés Picholine marocaine, Menara, Haouzia, Picholine du Languedoc sont attaquées par les différentes nématodes, alors que la variété Manzanille est attaquée par Xiphinema spp.

LUTTE CONTRE LES PRINCIPALES PLANTES PARASITES

• ***Cuscuta monogyna :***

Les résultats des prospections ont montré que cette plante parasite occasionne des dégâts non négligeables et parfois catastrophiques. Son développement coïncide avec le grossissement des olives et leur maturation, ce qui a un effet néfaste sur la production. Les moyens de sa dissémination sont principalement les eaux d'irrigation, les oiseaux et les plantes-hôtes, à savoir l'aubépine et le jujubier. La lutte chimique contre la cuscute à l'aide du glyphosate à 400-500 mg/l, à raison de 3 l par arbre en 3 applications espacées de 10 jours - lorsque le parasite est encore peu développé (à la base de l'arbre et avant sa floraison) - a donné des résultats satisfaisants dans le contrôle de cette espèce.

Tous les efforts de recherche déployés par l'INRA en matière de lutte contre les ennemis de l'olivier ont pour finalité la réduction des attaques de ces ennemis en concordance avec les principes d'une production intégrée, durable et respectueuse de l'environnement.

OLIVAE

Nº125

Back