



Olive Orchards

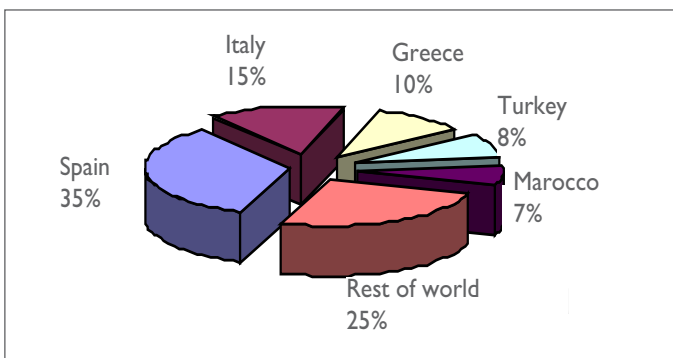
NAANDANJAIN

A JAIN IRRIGATION COMPANY

BACKGROUND

- The history of olive cultivation dates back to 3000 BC. For thousands of years, olives have played an important role in our diet, in cosmetics and are used to produce burning oil for lamps.
- Olive growing is divided into two main categories: olive oil production and table olives.
- The growing demand for olive oil promotes the development of the modern irrigated olive orchards and higher density plantations.
- The olive features in Mediterranean cultures, such as Spain, Greece, Italy, France and Morocco. In the United States, California has the largest area of cultivated orchards. Argentina is the leading producer in the southern hemisphere.
- Today annual worldwide olive production is estimated at 1.7 million tons of table olives and 3 million tons of olive oil, produced from 12 million tons of olives. Total olive-growing area is estimated at 7.5 million hectares. Because of the growing demand for high-quality commercial yields, the need for cultivated areas is also increasing.

Olive production (hectares) in the world



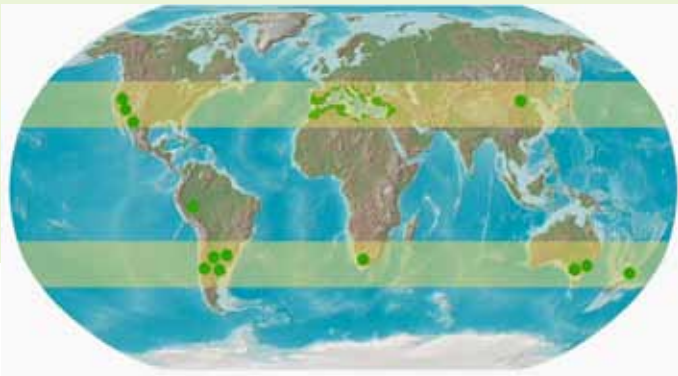
Olive trees can yield fruit for a very long time:

- Initial production in modern plantations commences in the 3rd to 4th year.
- Full production commences after 6 to 7 years.
- Olive trees can continue producing fruit for over a hundred years.

GROWING CONDITIONS

Areas with optimal climate for olive growing

Although these latitudes are ideal for olive cultivation, olives can be grown in any area meets the necessary climatic conditions.



CLIMATE AND GROWING CYCLE

Olive trees thrive in hot summers (up to 45°C) and cool winters with 200-300 hours of temperatures below 12° C. High humidity may cause diseases. Frost conditions below -5°C may damage young shoots. Spring rains or hot, dry conditions during blossoming can cause flower and bud abscission, resulting in decreased yields.

In spring the temperature rises, prompting a wave of accelerated growth, which continues as long as temperatures remain moderate. During the hot summer, growth decelerates and the olive tree channels its resources to developing the fruit and creating oil. In the fall, the intensity of the second wave of growth depends on the temperature (not lower than 18°C) and soil moisture. The new branches, which sprout in the spring and the fall, are the basis for the following year's yield.

SOIL

The olive tree can adapt to most soil types, although well-drained soil is preferable. Planting is not recommended in soil with a clay content of over 60%. The ideal pH is slightly alkaline, but should not be above 8.5. The olive tree is not sensitive to lime and is relatively resistant to salinity.

PLANTING

Two factors should be taken into account with tree spacing: convenient access for harvest and optimal exposure to light; a key requirement for flowering and growth.

In the past, non-irrigated groves were planted at a wide spacing of 10 m x 10 m (100 trees per hectare). Today, the emphasis is on commercial orchards, which benefit from all the modern technological advances in agriculture and irrigation. These include: multiplying the number of trees per hectare, developing new varieties, applying advanced irrigation and fertigation systems, and mechanical harvesting.

Typical tree spacing:

Traditional (non-irrigated): 10 m x 10 m



Intensive: 7 m x 4 m



Super-intensive: 4 m x 2 m

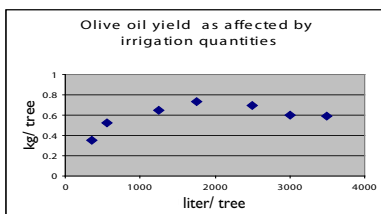
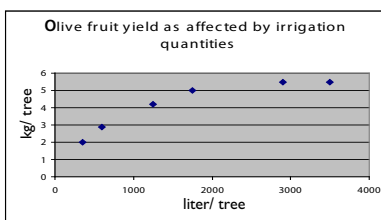
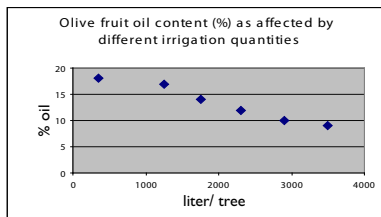


IRRIGATION AND FERTIGATION

IRRIGATION EFFECT ON YIELD AND QUALITY

The hardy olive tree has survived for centuries, bearing fruit without additional water or nutrients. However, its growth is slow and yields are low and irregular. Studies show that correct application of water and fertilizers, which are adapted to the tree's needs, result in greater leaf surface area, facilitating photosynthesis and transpiration throughout the entire growing period. This leads to increased total production per tree, substantially increasing fruit weight, volume and pulp-pit ratio. Although oil percentage in the fruit may be negatively affected by increased water quantities, production per tree is increased.

Young orchards at 2nd harvest



Oil quality

High-quality extra virgin oil can be produced under different irrigation regimes. Irrigation quantities clearly affect the sensorial parameters of the oil produced. Water deficits are detrimental to the production of phenolic compounds in the fruit, which affect flavor. With efficient irrigation management, growers can achieve high yields with the expected sensorial parameters and minimum use of water and fertilizers.

REGULATED DEFICIT IRRIGATION (RDI)

This irrigation technique is based on creating water stress during those phenological stages in which the yield quantity will be least affected. The objectives of RDI are to increase the quality parameters and reduce water and energy consumption. With olives grown for oil production, creating water stress leads to higher polyphenol content in the oil produced. These important ingredients not only contribute to the sensorial parameters, but also to oil stability and resistance to oxidation. The recommended period for creating such deficit is during pit hardening, since in that time there is minimal shoot and fruit growth. In olives grown for oil production, irrigation should be stopped two weeks before harvest. This is in order to reduce the water content of the fruit.

WATER REQUIREMENTS

Annual water requirements in Mediterranean conditions are approximately 800-1000 mm for table olive plantations and 400-600 mm for oil production plantations. This is true only for mature orchards, providing they receive winter rains of minimum 500 mm that last until the beginning of spring. Irrigation should start three weeks after the last effective rain. Avoiding water stress during flowering is crucial for achieving maximum yields.

The pump flow rate and system design capacity are generally based on peak water requirements. The maximum expected ET can be assessed by referring to the data from the peak period of a normal year.

CROP COEFFICIENTS FOR MATURE OLIVE PLANTATIONS

Crop type	Required water quantities	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Table olives	Full irrigation	0.4	0.4	0.5	0.5	0.55	0.55	0.55	0.4
	Supplementary	0.35	0.35	0.3	0.3	0.5	0.55	0.45	0.2
Olives for oil production	Full irrigation	0.2	0.3	0.2	0.2	0.3	0.3	0.3	0.2
	Supplementary	0.18	0.27	0.1	0.1	0.2	0.15	0.15	

* Based on Mediterranean data

Daily water requirements can be calculated by multiplying daily evaporation by crop coefficient:

Daily evaporation (mm) X Crop coefficient = Daily water requirements (mm)

CRITICAL GROWING STAGES FOR IRRIGATION

In hot, dry days during blooming, irrigate for a few hours in the middle of the day, even if an irrigation dose was given before. This is in order to raise humidity, thus preventing flower drop. High soil moisture must be maintained during three critical growing stages:

1. Spring – the blooming stage
2. Flowering and fruit set
3. Fruit ripening – shorter irrigation intervals to fill the fruits before harvest

Critical stages for irrigation under Mediterranean conditions



IRRIGATION OF YOUNG ORCHARDS

During the first three years, irrigate every 3-7 days. Increase water quantities and irrigation frequency as temperatures rise and transpiration is accelerated. Decrease again towards the beginning of winter.

First year: 5-10 liters/tree/day

Second year: 7-20 liters/tree/day

Third year: 15-40 liters/tree/day

PLANT NUTRITION

Young orchards consume mainly nitrogen, but in fruit-bearing orchards potassium plays an important role in yield formation. Phosphorus is moderately consumed and should be applied only when needed, especially before the planting of new trees. Since olive trees usually grow in alkaline soils, microelement deficiencies can be effectively corrected via foliar spraying. Foliar analysis is the best way to monitor deficiencies and determine an adequate fertigation program. However, standard recommendations, soil analysis, local knowledge and experience can also suffice.

FERTILIZATION GUIDELINES

GENERAL RECOMMENDATIONS FOR MATURE ORCHARDS

Nitrogen: Fertilization with 200-300 kg pure N per hectare, combined with irrigation. Apply 25% of the quantity in the spring. Apply the remainder continuously throughout the summer to encourage new growth.

Phosphorus: Fertilization with 30-80 kg/ha P_2O_5 , especially in light soils or when foliar analysis indicates a deficiency. Use phosphoric acid, which also helps clean the irrigation system.

Potassium: Fertilization with 200-300 kg/ha of K_2O , combined with irrigation. In light and medium soil, spread the fertilizer portions out over the entire season. In clay soil, fewer portions can be applied.



GENERAL RECOMMENDATIONS FOR YOUNG ORCHARDS

Apply 40 – 50 m³/ha of organic manure during soil preparation. Only apply phosphorus and potassium if soil analysis indicates a deficit. Apply them as a base dressing or via fertigation during the first two months after planting. During the first three years use mainly nitrogen. Apply 150kg-200kg of nitrogen/ha/year, spread out over the season.

FERTIGATION

Fertilizer application via the irrigation system is considered the most effective method of fertilization. A good irrigation system facilitates accurate fertilizer application, precise timing and quantities, without additional manual labor costs. Constant and balanced nutrition results in optimal plant growth and yield and prevents nutrient loss due to leaching. In this way, growers benefit economically and prevent the pollution of underground water, which is harmful to the environment.

NAANDANJAIN IRRIGATION SOLUTIONS

Because growers face varying conditions and challenges, NaanDanJain offers a wide range of irrigation and fertigation solutions. Our experienced team will help you find the ultimate solution to fit all your needs.

When choosing an irrigation method for olive orchards, bear these facts in mind:

- The effective root zone is at a depth of 0-40 cm and is widely spread around the tree.
- Olive trees are highly sensitive to lack of oxygen, so avoid long periods of saturation.
- Olive trees can be irrigated with relatively salty water, but it is important to leach accumulating salt.
- Accurate location of water and fertilizers will enhance their efficiency and prevent weed development.

DRIPLINE SYSTEMS

Advantages

- Efficient, uniform fertigation, with water and nutrients delivered directly to the root zone
- Laterals lie flat on the surface and do not interfere with the harvesting process
- Dry paths between tree rows
- Relatively low costs in purchasing, installation, operation, and wear and tear.

Guidelines

- For traditional and intensive orchards: Use two laterals
- For super-intensive orchards: Use one lateral
- Adapt dripper spacing to soil type:
 - light soil: 50-75 cm
 - heavy soil: 75-100 cm
- Recommended dripper flow rate: 1.6-3.8 l/h
- For new orchards: Design dripper spacing in conjunction with tree spacing to ensure that the drippers are next to the young trees.
- After one year: Move the lateral to 50 cm-75 cm from the trunk. Bear this in mind when planning subsurface drip systems.
- In existing orchards with irregular spacing, use a button dripper or a ring of drippers

SUBSURFACE DRIP IRRIGATION (SDI)

Advantages

- Free cultivation and machinery movement in all directions
- Protection from damage by machinery, animals, harvesting and cultivation
- Water and fertilizer saving due to optimum nutrient absorption
- Dry soil surface prevents weed growth
- For variable topography or long laterals, use AmnonDrip PC AS
- For plot design that doesn't require PC drippers, use non PC dripper

AmnonDrip PC & PC AS

- Pressure-compensating dripline for long laterals and variable topography
- Self-cleaning cascade labyrinth
- Anti-siphon (prevention of dirt suction) for SDI

16, 17, 20 mm



1.6, 2.2, 3.8 l/h

Naan PC

- Heavy-duty, pressure-compensating dripline
- Variable discharges for different soil types and plot planning

16, 20 mm



1.6 l/h

2.2 l/h

3.5/3.8 l/h

TifDrip

- Non PC cost-effective dripline
- Highly clog-resistant
- Variable discharges for different soil types and plot planning

16 mm



2.0 l/h

4.0 l/h

MICRO-SPRINKLER SYSTEMS

Advantages

- Simple unit operation and inspection during irrigation
- Moderation of extreme climatic conditions (frost or heat wave)
- Creation of larger moisture storage in supplementary irrigation conditions
- Prevention of soil erosion
- Improved manure absorption in organic orchard cultivation
- Highly resistant to clogging
- Effective for salt leaching
- Wetted area is widely spread in correlation to the olive root zone

2002 AquaSmart

- Flow-regulated micro-sprinkler
- Uniform irrigation and fertigation in all topographical conditions
- Olive model with 28-95 l/h for 3-7.5 m coverage
- Insect-proof nozzle
- Sturdy and solid structure
- Two-stage wetted diameter control to suit tree development



Dan-Jet PC

- Pressure-compensating micro-jet
- Uniform irrigation in all topographical conditions
- Olive model for dense spacing with 19-76 l/h
- Different distribution pattern for 3-5 m coverage
- Highly cost-effective
- No moving parts – very low maintenance





NaanDanJain is committed to finding the ideal solution for your olive orchard, tailored to your local climatic conditions, soil and water properties, and budget.

Contact our office or your local dealer for further information.

0314 NAANDANJAIN PI10904

© 2014 NaanDanJain Ltd. All rights reserved.

All specifications are subject to change without notice.

All information should be used only as a guideline.

For specific recommendations contact your local agronomist.

NAANDANJAIN
A JAIN IRRIGATION COMPANY

NaanDanJain Irrigation Ltd.
Post Naan 7682900, Israel.
T:+972-8-9442180, F:+972-8-9442190
E: mkt@naandanjain.com www.naandanjain.com



THE STANDARDS INSTITUTION OF ISRAEL



THE STANDARDS INSTITUTION OF ISRAEL