

Crop Water Management

AGLW Water Management Group

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Olive

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Crop Description and Climate

Olive (*Olea europaea*) probably originated from the Eastern Mediterranean East. Present production is about 16 million tons green and black table olive and 2 million tons oil. Of the total production, 95 percent is produced in the Mediterranean and Italy being the main producing countries ([FAOSTAT](#), 2001).

The crop is indigenous to the Mediterranean region with a mild, rainy winter and a hot, dry summer. A dormancy period of about two months with average temperatures below 10°C is conducive to flower bud differentiation. Some cultivars are adapted to areas with low winter temperatures but reduced flowering is noted under these conditions. During the dormancy period, the tree tolerates short periods of frost of -6°C, but during a hard frost causes damage to the fruits which are then only suitable for oil production. High winter temperatures and dry winds cause poor fruit setting and excessive drop of young remaining fruits shrivelling on the tree. A long, sunny, warm summer results in high oil content of the fruit. High humidity at flowering causes flower drop and infection with mould.

The crop produces acceptable yields on poor soil as long as it is deep, well-drained and free from waterlogging. Under waterlogged conditions damage through lack of oxygen and diseases increases sharply. The fertilizer requirements are 200 to 250 kg/ha N, 100 to 150 kg/ha P and 160 to 210 kg/ha K. Nitrogen is applied prior to or during the flower initiation period.

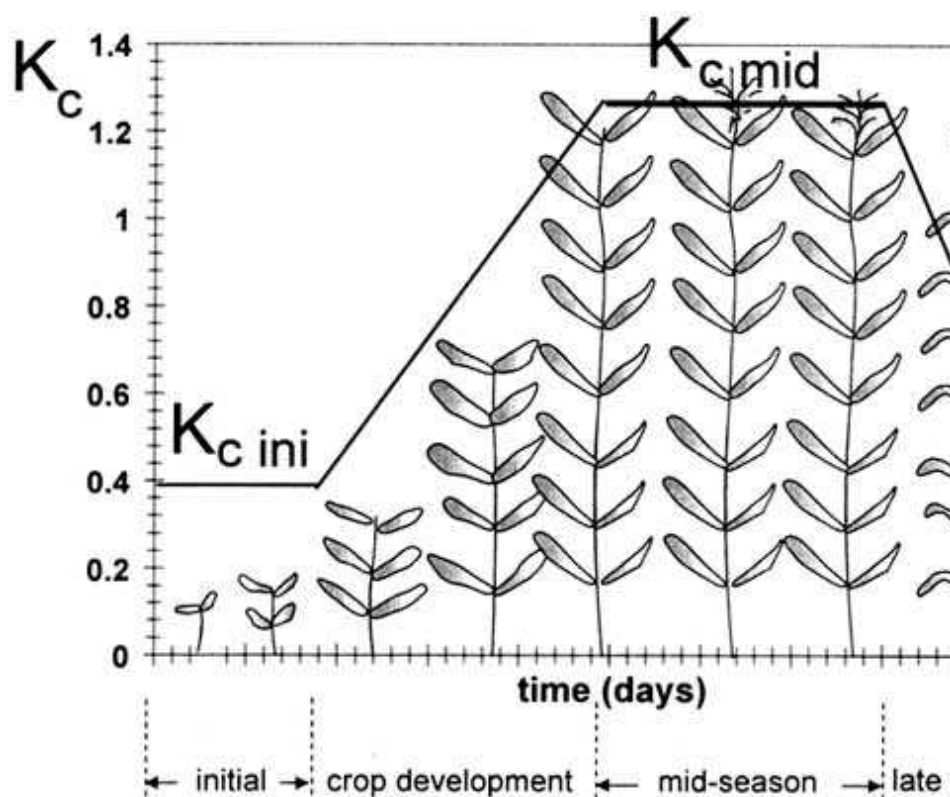
The olive tree is moderately tolerant to soil salinity provided ECe does not exceed 4.5 dS/m but ECe of 4.5 dS/m or less is preferred.

Raised for two years in the nursery, the tree is transplanted early in the season. Planting density is 100 trees/ha under poor rainfed conditions and up to 300 trees/ha under irrigated conditions. Pruning density is also dependent on the method of pruning. Early pruning is not essential but is practised to obtain strong stems. However, for older trees, pruning during winter is essential for high yields. Intercropping with grain forage and vegetable crops is common in some young orchards but is discontinued after 15 to 20 years under rainfed and no irrigation.

More fruits are set than can be supported by sufficient nutrient supply, and increases as the trees get older. Consequently, a small number of flowers per tree and flower drop can be attributed to inadequate pollination, nutrient deficiencies and high temperatures. Late flower and fruit drop is caused mainly by olive moth and olive fly attack. On the other hand, abundant fruiting adversely affects growth of the next year crop and eventually leads to alternate fruit bearing. This tendency

older trees but alternate bearing is less pronounced with good soil and climate management practices. The economic life of a tree is 50 years under rainfed conditions. Under favourable growing conditions it can be much longer. A profitable harvest after 6 years but under more extreme conditions, after 15 to 20 years.

The graph below depicts the crop stages of olive, and the table summarises coefficients used for water management.



Crop characteristic	Stages of Development					Plant date
	Initial	Crop Development	Mid-season	Late	Total	
Stage length, days	30	90	60	90	270	March
Depletion Coefficient, p	-	-	-	-	0.65	
Root Depth, m	-	-	-	-	1.7	
Crop Coefficient, Kc (40 to 60 % ground cover)	0.65	>>	0.70	0.70	-	
Yield Response Factor, Ky	0.2					



Water Requirements

Olive trees are commonly grown without irrigation in areas with an annual rainfall of 400 mm but are even found in areas with about 200 mm rainfall. For high yields, irrigation is required. The crop coefficient (k_c) relating maximum evapotranspiration (E_{To}) is between 0.4 and 0.6.



Water Supply And Crop Yield

The annual growth cycle of the olive tree in the subtropics with winter rain, timing of cultivation practices, is shown in the figure below.

Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Active Vegetative Growth			Reduced Veg. growth		Active Veg. growth		Resting/		
Diff.	Flowering (2)		Yield Formation (3)			Ripening (4)			
			Stone hardng.		Colouring		Vernaliz:		
	Critical for Nitrogen		Critical for waterdeficit						
	(*)		*		(*)		Har		
(*) Irrigation if needed									

In the subtropics with winter rain, adequate soil water is generally available of the summer. For high yields, adequate water is required from the start of hardening onward until the end of yield formation (3). During the yield form adequate water supply increases fruit size and the flesh/pit ratio but the rip prolonged and the colouring of the fruit is delayed. Table olives, with a high require more water during the yield formation period (3) than olives produc subtropical climates with little winter rain, water supply is also needed prior Water deficits during the flowering period (2) may result in increased flower Where needed, irrigation prior to the, start of flowering is recommended be during the flowering period (2) may lead to leaching of the essential supply

Yields are strongly affected by twig growth during spring and early summer in the northern hemisphere) and adequate water should be avail-able durin applies also to the winter period because water deficits in winter cause redu defoliation. Further, this also causes a large percentage of imperfect flowers retarding flowering.

Adequate water supply during the active growth periods tends to reduce alt cycles. Water deficits in the spring adversely affect lead development and a causing a reduction in yield during the same year and possibly also the nex grown fully under irrigation, application of water could be discontinued only between start of f lowering and the beginning of stone hardening.

Excess water results in short twigs, dense foliage with short and narrow leaf yields.

Under conditions of limited water supply, overall production is increased by and partially meeting crop water requirements, rather than by meeting full requirements over a limited area.



Water Uptake

After 3 to 4 years the tree forms a fascicular root system which continues to grow in heavy textured and poorly aerated soils, roots are concentrated near the surface and are found at a greater depth in light textured soils. Lateral roots can be up to 1.5 m, thus explores a large volume of soil for nutrients and water. Generally, water uptake over the first 1.2 to 1.7 m of soil depth ($D = 1.2$ to 1.7 m). Under condition of evapotranspiration (ET_m) is 5 to 6 mm/day, the rate of soil water uptake by roots reduce when some 60 to 70 percent of the total available soil water has been used.



Irrigation Scheduling

With winter rain of about 500 mm, irrigation is applied during and after storage. In conditions of little winter rain, irrigation is applied during bud differentiation to flowering (early summer) and during yield formation and particularly during ripening. Irrigation is also applied at (a) two to three weeks before flowering; (b) when the fruit is one third its full size; and (c) when the fruit reaches almost full size.

For oil production, irrigation supply must be discontinued early enough to guarantee ripening. This will have little effect on the oil content but will reduce the size of the fruit.

Irrigation is applied by different surface methods, but when limited water is available, drip irrigation is preferred.



Yield

The fruits of irrigated trees reach a high oil content later in the season than non-irrigated trees. Also, for irrigated trees the change of fruit colour from green to black is delayed. The oil content as percentage of fresh fruit weight tends to be higher for irrigated trees, but little difference is noted with oil content expressed as percentage of dry weight.

Time of picking depends on the use of the harvested product. Varieties with a high flesh/pit ratio and uniform shape are used for table olive production. In the Northern Hemisphere, green table olives are harvested from mid-September onward, the time being determined when the fruit colour changes to green-yellow. Black table olives are harvested in December. Olives for oil are harvested from mid-December until the oil content is independent of the time of harvest.

Maximum oil content and weight are reached six to eight months after flowering. Olives can be harvested long before they fall naturally.

Yields vary from year to year and from tree to tree. Good commercial yields are 50 to 65 kg/tree of fruit with a possible maximum of 100 kg/tree of fruit. Oil content of fresh fruit ranges from 20 to 25 percent. The water utilization efficiency for fresh olives containing about 30 percent moisture is 1.5 to 2.0 kg/m³.



Related links

- Search the [bibliographic database](#) for olive on water related matters
- See what [WCA InfoNET](#) has on olive
- See the profile of olive prepared by [EcoPort](#)
- Browse [FAOSTAT](#), an on-line and multilingual databases currently containing over 100 million time-series records covering international statistics.



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Last update: 27 August, 2002

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