UC CE UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources UC Cooperative Extension

Soil Nutrient Management for Olives

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Soil Test Interpretation

Values for saturated paste test method	Unit	Low	Optimal	High	Olive Notes
pH		<6	6-7.8	>7.8	Ideal pH 6.5-8.5. Grow well in calcareous soils (pH>7).
Electrical Conductivity (EC)	dS/m	<0.7	0.7-2.0	>2	EC>4 may impact yields.
Organic Matter (OM)	%	<1.5	1.5-4	>4	
Nitrogen (NO_3-N)	ppm	<10	10-30	>30	Do not require a lot of N compared to other fruit tree crops. Sensitive to both N deficit and excess.
Phosphorus Bray (PO_4-P)	ppm	<30	30-50	>50	P deficiency not observed in CA olives. In general, P<10 ppm is low for orchards, low levels associated with poor drainage.
Phosphorus Olsen (PO_4-P)	ppm	<12	12-25	>25	
Potassium (K)	ppm	<100	100-300	>300	Monitor for deficiencies, especially in sandy soils. Recommend new plantings in soils with at least 125 ppm.
Magnesium (Mg)	ppm	<12	12-122	>122	Deficiencies not observed in CA olive orchards.
Calcium (Ca)	ppm	<100	100-600	>600	Deficiencies not observed in CA olive orchards.
Sodium (Na)	ppm		<70	>115	Tolerant of saline and sodic soils. Toxicity not observed in CA olive orchards.
Sulfur (SO_4-S)	ppm	<10	10-15	>15	Deficiency not likely to occur in CA olives.
Zinc (Zn)	ppm	<0.8	0.8-1.5	>1.5	Deficiencies not observed in CA olive orchards.
Manganese (Mn)	ppm	<1	1-5	>5	Deficiencies unknown in CA olives, but generally occur in soil pH>8. Toxicity generally occurs in acidic soil.
Iron (Fe)	ppm	<5	5-15	>15	Deficiencies unknown in CA olive orchards. Monitor for toxicity in poorly drained, waterlogged, and acidic soils.
Copper (Cu)	ppm	<0.5	0.5-1.2	>1.2	Deficiencies unknown in CA olive orchards.
Boron (B)	ppm	<0.5	0.5-1.5	>1.5	Olives are relatively tolerant of high B. Toxicity may occur B>2 ppm but is not common in CA. Monitor for deficiencies, especially in sandy, acidic soils where B is leached out of the root zone.
Chlorine (Cl)	ppm	<178	178-355	>355	Toxicities not observed in CA olive orchards.

Leaf tissue analyses should be used in addition to soil tests for guiding fertilizer decisions in olives.

Cation Exchange Capacity (CEC)

CEC measures the soil's capacity to retain and release cations such as K, Ca, Mg, and Na. CEC influences soil fertility, nutrient availability, and the soil's ability to buffer pH changes. Soils with high CEC, such as clays, have more exchange sites for nutrients.

Soil Texture	Typical CEC Range (meq/100g soil)
Sand & loamy sand	2-6
Sandy loam	3-8
Loam	7-15
Silt loam	10-18
Clay	15-30

Common Nutrient Deficiencies

In CA olive orchards, the most common nutrient deficiencies are N, K, and B. A combination of soil sampling and leaf tissue analysis can be used to address nutrient deficiencies. Leaf tissue analysis directly measures tree nutrient status and diagnoses tree nutrient imbalances. Soil sampling and fertility testing assesses soil nutrient status and availability. . Using both leaf and soil testing gives you a full picture of nutrient needs. Soil sampling in the spring will better reflect available nutrient levels for crop uptake after winter rains have leached nutrients such as N, however fall sampling provides more time to plan and drier sampling conditions. Whatever you choose, sample at the same time every year so results are comparable over time. Foliar fertilizer applications may be helpful in certain situations when nutrient uptake from the soil is limited, however soil applications are often sufficient for long term management.

Nitrogen

Olives do not have a high N requirement and are sensitive to both too much and too little N. Soil and irrigation water N may be enough to meet crop requirements without additional fertilizers, therefore soil and water tests are crucial in N management planning. High N may lead to excessive shoot growth and adversely impact oil quality. For high density plantings, apply ~40-100 lb N/ac; for lower density plantings, start at a rate of 0.5-1 lb N/tree or as needed annually based on leaf tissue analysis. N can be applied through fertigation or broadcast. Because N is highly mobile in water, avoid fall applications to reduce loss through leaching and begin applications in Feb or early spring. 1 ppm of NO3-N per foot of soil is approximately 3.5-4 lbs N/acre. For example, 5 ppm NO3-N in the top foot of soil corresponds to about 17.5-20 lbs N/acre.

Potassium

If a K deficiency is detected with leaf analysis, a banded application of 500-1,000 lbs K_2SO_4/ac or fertigation application of 200-300 lbs K_2SO_4/ac can be applied to the soil and may be sufficient for several years. The goal is to replace the K removed from the orchard from harvest. Apply banded K in early winter and fertigated K throughout the growing season.

Boron

If B deficiency is detected, apply 5-10 lbs/ac actual B or ~25-50 lbs/ac or ~0.5-1 lb/tree of 14-20% borax to correct. This should be sufficient for several years. Be careful to not apply too much B to avoid toxicity. B can be broadcast as solid fertilizer within the wetted area of the drip line. Apply B in late winter to avoid loss by leaching while still allowing time for B to move into the root zone by rainfall.

Resources:

CDFA Fertilization Guidelines - https://www.cdfa.ca.gov/is/ffldrs/frep/FertilizationGuidelines/Olives.html
J. Connel, Olive Mineral Nutrition -https://ucanr.edu/sites/default/files/2011-05/90442.pdf
E. Andrews, Organic Nutrient Management in Olives, presentation
R. Rosencrance, Olive Nutrition with Richard Rosecrance - https://www.youtube.com/watch?v=MQyITVphsGU
UCANR, Olive Production Manual 2nd ed.