



Oil palm

Irrigation & Fertigation Guidelines

Introduction

Oil palm growers worldwide are always striving to enhance the size and yield of their crop. In parallel, modern intensive orchard cultivation is characterized by crop-specific challenges such as small root zones, as well as global climate change challenges.

Drip irrigation is a fast-reacting system that enables optimal and uniform soil moisture with outstanding aeration, while directly distributing water and nutrients to the crop's root zone. Increasing yields while lowering nutrient and water usage, drip is the most cost-efficient irrigation solution for growing oil palms.

This document also covers sprinkler irrigation, the preferred method of irrigation for many territories, which offers precision and efficiency benefits.

Precision Irrigation and Fertigation Benefits

- **Higher yields** – Intensive cultivation with drip irrigation and fertigation significantly increases yield.
- **Better quality** – Precise drip and fertigation capabilities improve crop quality.
- **Significant water and nutrient savings** – An efficient subsurface irrigation system leads to water savings and better water use efficiency (WUE) and nutrient use efficiency (NUE) (i.e. mm/ton).
- **Crop protection** – Drip offers an innovative and cost-effective method to apply a wide range of substances that protects the crop in an environmentally-safe way.

Oil Palm Orchard Irrigation

General guidelines

Below are basic guidelines for irrigating oil palm orchards with an estimated yield of 20-40 tons/ha (FFB) in mild climates. You should adapt your plan according to specific local conditions and soil type, climate, planting patterns, and yield targets.

Irrigation recommendations

- Place the dripper lines about 20cm from the trunk.
- Most roots of the oil palm are close to the trunk, and the roots of mature trees can be rather deep. As such, make sure the drip laterals are properly installed.
- Micro-sprinkler irrigation requires ~20% additional water dose compared to drip.
- Recommendations are based on zero rainfall and for fully grown vines.
If vines are already productive but the canopy is not fully developed, reduce irrigation by 10-20% relative to tree size.
- Precipitation factors
 - An effective rain event is >10mm.
 - Rain efficiency should be calculated at a 60% rate for mature orchards and a 40% rate for young orchards.
 - After a significant rain event, resume irrigation either when the topsoil layer starts drying, or according to the soil sensor indication. In the case of light-sandy soil or hot climate, resume irrigation within 1-2 days. In the case of medium-heavy soil or cooler climate, resume irrigation within 2-4 days.

Crop coefficient per growth stage

Growth stage	Vegetative growth	Vegetative growth (Pre-flowering)	Flowering	Fruit growth	Harvest
Graphic presentation					
Duration (days)	30	30	30	60	30
Kc	0.8-0.9	0.8-0.9	0.9-1.0	1.0	
Depletion threshold (%)	50	30	30	20	15
Daily irrigation level (L/palm/day)	90-150	150-200	200-300	300-450	300-500

Irrigation intervals should be determined based on soil type.

Irrigation calculations

Recommended irrigation dose calculation (quantity)

The recommended irrigation dose (= crop water requirements = ETc) is the amount of water a crop needs during its growth cycle to ensure proper development and yield.

The equation includes environmental and vegetative factors:

$$ET_o \text{ (mm/day)} \times K_c = ET_c \text{ (mm/day)}$$

- ET_o = Evapotranspiration
- K_c = Crop factor

Example

- ET_o = 5 mm/day
- K_c = 1

Recommended irrigation dose: 5 mm/day × 1 = 5 mm/day

Application rate calculations (quantity and time)

Convert mm/day or m³/Ha/day recommended irrigation dose to hours/shift/day via the following formulas:

- Application rate calculation

$$\frac{\text{Dripper flow rate (l/h)} \times \text{number of driplines per row}}{\text{Dripper spacing (m)} \times \text{dripline spacing (m)}} = \text{Application rate (mm/h)}$$

- Irrigation cycle duration calculation

$$\frac{\text{Recommended irrigation dose (mm/day)}}{\text{Application rate (mm/h)}} = \text{hours/shift/day}$$

Example

- Recommended irrigation dose: 5 mm/day = 50 m³/Ha/day
- Dripper flow rate: 1.6 l/h
- Number of driplines per row: 2
- Dripper spacing: 0.5 m
- Dripline spacing: 10 m

Application rate calculation:

$$\frac{1.6 \times 2}{0.5 \times 10} = 0.64 \text{ mm/h}$$

Irrigation cycle duration calculation:

$$\frac{5 \text{ mm/day}}{0.64 \text{ mm/h}} = 7.8 \text{ hours/shift/day}$$



Fertigation of Mature Orchards

Fertigation recommendations

- Assume low-to-medium levels of P and K in the soil.
- Apply fertilizer in every irrigation to spread the overall amount across expected irrigation events throughout the relevant period.
- Start fertigation only once the system is fully pressurized.
- After fertilizer injection, irrigate with clean water for at least 30 minutes.
- If fertigation in every irrigation is unfeasible, fertigate at least once a week.
- In the case of rain, skip irrigation but not fertigation, applying a high concentration of fertilizer with a small water volume.

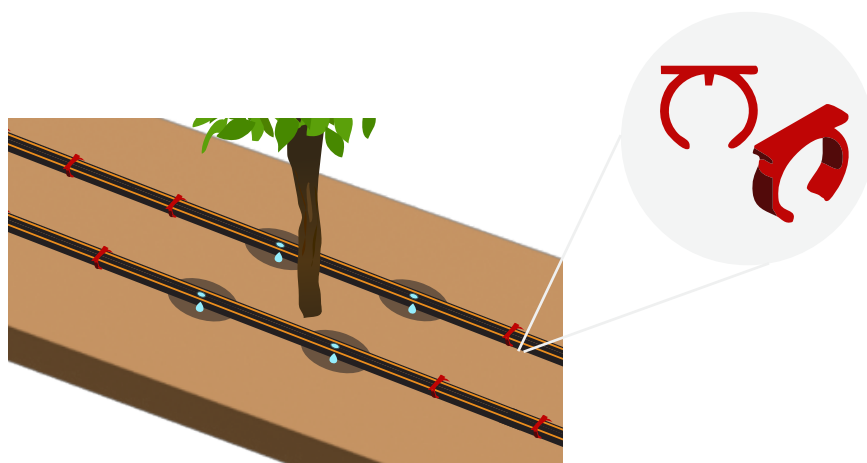
Fertigation requirements (kg/Ha)

	Years 1-4
N (kg/Ha)	140-200
P ₂ O ₅ (kg/Ha)	20-60
K ₂ O (kg/Ha)	250-350

Fertigation of young orchards

Fertigation recommendations

- Ensure that the fertigation dose is close to the trunk and within reach of the young root zone.
- Place all drippers directly above the root zone, and make sure that drops do not slide along the drip laterals and miss their target.
- The root zone diameter is roughly parallel to the canopy diameter, so drippers that are not under the canopy do not effectively reach the root zone.
- Install **cap drippers** between the trees to avoid water and fertilizer waste during the first few years of fertigation. Use dedicated **caps for UniRam™**, and continue opening them as the tree develops.



Oil palm orchard fertigation recommendation doses (years 1-3)

Year 1

		Cool				Hot				Cool				
		January	February	March	April	May	June	July	August	September	October	November	December	Sum
	L/ palm/D	15	20	20	20	25	25	25	30	25	20	15	10	
	N (g'/palm)	20	20	30	30	30	30	30	30	20	20	10	10	16 kg/h
	P ₂ O ₅ (g'/palm)	10	10	15	15	15	15	15	15	10	10	5	5	8 kg/h
	K ₂ O (g'/palm)	20	20	30	30	30	30	40	40	30	30	20	20	20 kg/h

Year 2

		Cool				Hot				Cool				
		January	February	March	April	May	June	July	August	September	October	November	December	Sum
	L/ palm/D	30	40	40	40	50	50	50	60	50	40	30	20	
	N (g'/palm)	40	40	60	60	60	60	70	70	50	50	30	30	36 kg/h
	P ₂ O ₅ (g'/palm)	20	20	30	30	30	30	30	30	20	20	10	10	16 kg/h
	K ₂ O (g'/palm)	50	50	80	80	80	80	100	100	80	80	50	50	45 kg/h

Year 3

		Cool				Hot				Cool				
		January	February	March	April	May	June	July	August	September	October	November	December	Sum
	L/ palm/D	50	60	60	70	70	80	80	100	90	70	50	40	
	N (g'/palm)	60	60	100	100	100	100	120	120	80	80	50	50	60 kg/h
	P ₂ O ₅ (g'/palm)	30	30	50	50	50	50	50	50	40	40	20	20	25 kg/h
	K ₂ O (g'/palm)	80	80	150	150	150	150	180	180	150	150	100	100	80 kg/h

Example

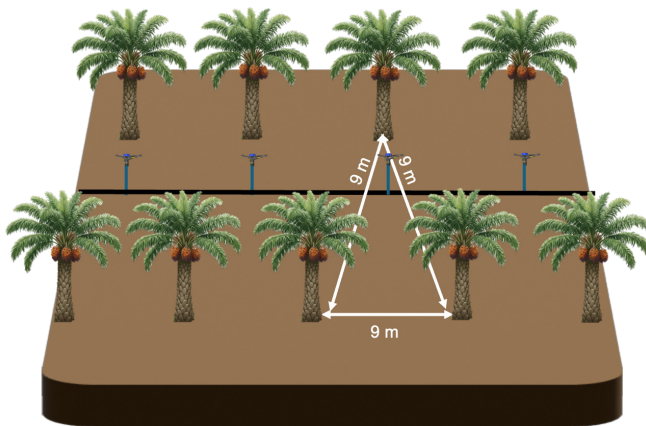
- First-year orchard has 4 × 1.0 l/h drippers near the root zone.
- Recommended irrigation is 10 liter/tree/day (l/t/d).
- 4 drippers per tree × 1.0 l/h = 4 l/h/t drippers flow rate

$$\frac{10 \text{ l/t/d}}{4 \text{ l/t/d}} = 2.5 \text{ hours/tree/day}$$

- Irrigate for 2.5 hours per shift per day

Irrigation Configurations

Sprinkler Irrigation



Field layout: 9x9 m

Crop rows spacing: 3.5-4 m

Sprinklers:

LWP 380 l/h

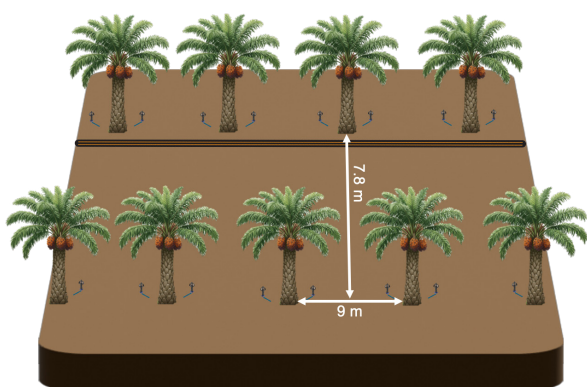
D-Net™ 8550 XU 670 l/h

Micro-Sprinkler Irrigation

Micro-sprinkler irrigation is a versatile and efficient solution for various agricultural applications. It is particularly beneficial where drip irrigation may not be feasible or cost-effective. Given that micro-sprinklers are easy to install and maintain, and can cover tree area efficiently, many growers view them as their preferred irrigation choice. Additionally, the method's visible water distribution assures growers of the system's functionality, providing peace of mind and confidence in their irrigation practices.

Benefits

- **High crop uniformity** - achieved through the unique design of the flow regulation mechanism
- **Localized coverage** - ensures precise irrigation of the targeted area
- **Deflector** - allows for a lower wetting diameter in the initial years, and can be broken to extend the irrigation diameter as needed
- **Pop-up swivel** - features a pop-up mechanism that activates only during irrigation
- **EverSpin technology** - incorporates an upper bearing for higher reliability and longevity, providing excellent clog resistance
- **Stream splitter** - divides the stream to prevent water from reaching the trunk, thereby protecting the tree



Micro-sprinkler configurations

Plant spacing: 9 m

Crop rows spacing: 7.8 m

Drippers: SuperNet™ / GyroNet™

Flow rate: 50-70 l/h

Installation: 1 lateral per crop row +
1-2 sprinklers per tree

Positioning:

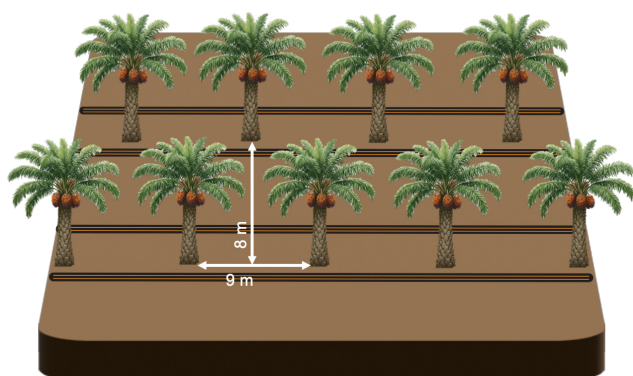
Upright + stake

~50cm from the trunk

Nozzle height above ground: 20cm

Emitter spacing and flow rate should be determined based on soil type, climate and variety.

Drip Irrigation Configurations



On-surface

Plant spacing: 9 m

Crop rows spacing: 8 m

Dripper: UniRam™

Flow rate: 1-2.3 l/h

Dripper spacing: 0.5-0.6 m

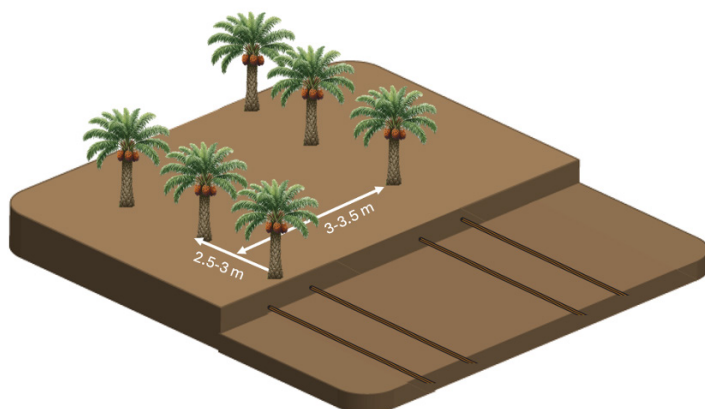
Driplines per crop row: 2

Dripper spacing and flow rate should be determined based on soil type, climate and variety.

Subsurface drip irrigation (SDI)

Applying subsurface drip irrigation for oil palm offers several advantages.

- **Easier cultivation** – SDI eliminates the need to move or adjust driplines prior to above-ground tractor operations to facilitate the cultivation process.
- **Lower physical and mechanical damage** – SDI protects driplines and cultivation equipment from physical damage, and enables full harvesting operations without damaging the drip system.
- **Less disease** – SDI reduces the level of humidity near the tree trunk to lower the prevalence of disease.
- **Fewer weeds** – SDI ensures that the irrigated water remains underground in the root zone to ensure a clean, relatively weed-free orchard.



Plant spacing: : 2.5-3 m

Crop rows spacing: 3-3.5 m

Dripper: UniRam™

Flow rate: 1-2.3 l/h

Dripper spacing: 0.5 m

Driplines per crop row: 2

Dripper spacing and flow rate should be determined based on soil type, climate and variety.

AS/XR features are an optional addition to the drippers.

Netafim Solutions for Oil Palm



UniRam™ PC

Integral pressure-compensated (PC) dripline, ideal for deciduous plantations, tree irrigation, and permanent subsurface row crop applications. The ultimate solution for subsurface drip irrigation.



Pressure compensated



Self-flushing mechanism



DripNet™ PC

Integral, compact pressure-compensated (PC) anti-siphon mechanism dripper for semi-permanent drip applications for growers seeking a rapid ROI. Ideal for field crops in complex topographies and subsurface applications.



Pressure compensated



Self-flushing mechanism



Drainage mechanism



SuperNet™

Pressure-compensated (PC) micro-sprinkler that provides localized irrigation for tree plantations over long lines.



Pressure compensated



Reduces maintenance



Higher reliability & longevity



GyroNet™

Non-pressure-compensated (NPC) micro-sprinkler that provides localized irrigation for tree plantations in flat terrains.



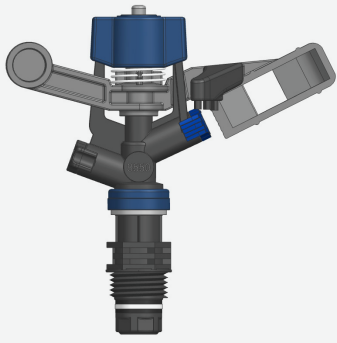
Anti-ant mechanism



High clogging resistance



Higher reliability & longevity



D-NET™

Ultra-durable 1/2" and 3/4" impact sprinkler with a unique 3D arm and 240° water trajectory angle, designed for field crops and vegetable irrigation. Ensures uniform water distribution for large and varied spacing up to 14x16m.



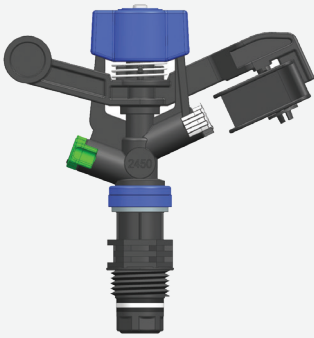
Very high
water distribution
uniformity



Robust &
long lasting



Reduced
labor cost



LWP 2450

Low working pressure 1/2" impact sprinkler with 24° water trajectory angle for field crops and vegetable irrigation.



Low operation
pressure



Robust &
long lasting



Reduced
labor cost



Got more questions? Consult our global expert.

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