

Apple

Irrigation & Fertigation Guidelines



/ Introduction

Apple growers worldwide are always striving to enhance the size, color and yield of their crop. In parallel, modern intensive orchard cultivation is characterized by crop-specific challenges such as dwarfing rootstock and 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 apples.

/ Drip 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 protect the crop in an environmentally-safe way.

/ Irrigation of Apple Orchards



General guidelines

Below are basic guidelines for irrigating apple orchards with an estimated yield of 40-90 tons/Ha in mild climates such as the Mediterranean. You should adapt your plan according to specific local conditions related to soil type, climate, rootstock, planting patterns, and yield targets.

Irrigation recommendations

- Place the driplines about 20cm from the trunk.
- Most roots of modern apple trees are close to the trunk, and the roots of mature trees can be deep. As such, make sure the driplines are properly installed.
- Micro-sprinkler irrigation requires a 20% additional water dose compared to drip.
- Recommendations are based on zero rainfall and for fully grown trees. If trees 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.
- Convert mm/day or m³/Ha/day recommendations to hours/shift/day via the following formula:

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







Example

- Recommended irrigation dose: 5mm/day = 50m³/Ha/day
- Dripper spacing: 0.5m
- Dripline spacing: 4.5m (usually 2 driplines/crop row are used, so typical dripline spacing is 2.25m)
- Dripper flow rate: 1.0 l/h

$$\frac{1.0}{0.5 \times 2.25} = \frac{0.88\text{mm}}{\text{hour}} = 8.8\text{m}^3/\text{Ha}/\text{hour}$$

$$\frac{5\text{mm}/\text{day}}{0.88\text{ mm}/\text{hour}} = 5.6\text{ hours}/\text{shift}/\text{day}$$

/ Crop Coefficient Per Growth Stage

Growth stage	Dormancy break	Flowering & fruit set	Fruit growth	Harvest	Recovery & leaf drop	Dormancy
Graphic presentation						
Duration (days)	20	20	70	20	40	195
Kc	0	0.2-0.4	0.5-1	0.85	0.3	0
Depletion threshold (%)	50	30	20	15	50	0

/ 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.
- Pre-harvest N application may cause color reduction and delayed harvest. Stop fertigation about four weeks before harvest.

Apple fertigation requirements (Kg/Ha)

Age	N	P ₂ O ₅	K ₂ O
1-4 years	80	10	50-80 from third year
4+ years	80-100	20-60	150-220

Note: recommendations may vary depending on soil analysis results, location and variety.



/ 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 driplines 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.


Example

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

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


- Irrigate for 2.5 hours/shift/day.

Year 1




	Cool			Hot					Cool				
	January	February	March	April	May	June	July	August	September	October	November	December	Sum
L/T/D				5	6	8	9	10	9	8			
N				100 PPM	100 PPM	50 PPM	50 PPM	50 PPM					10/15 T/H
P ₂ O ₅													

Year 2



	Cool			Hot					Cool				
	January	February	March	April	May	June	July	August	September	October	November	December	Sum
L/T/D				5	8	15	17	20	15	10			
N				100 PPM	100 PPM	50 PPM	50 PPM	50 PPM	50 PPM				10/15 T/H
P ₂ O ₅													
K ₂ O													

Year 3

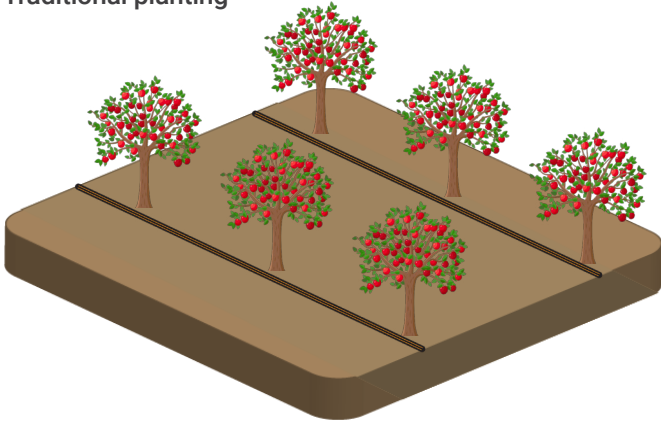


	Cool			Hot					Cool				
	January	February	March	April	May	June	July	August	September	October	November	December	Sum
L/T/D				10	15	17	25	30	25	15			
N				11	11	9	9	9	9	9			50/80
P ₂ O ₅				1	1	3	3	3	2	2			15
K ₂ O				10	20	30	30	30	20	10			150

/ Drip Irrigation Configurations

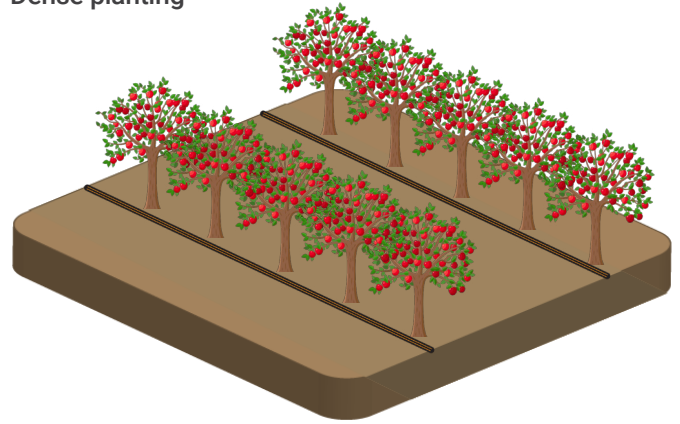
On-surface

Traditional planting



Plant spacing: 2m
Row spacing: 3.5-4m
Dripper spacing: 50cm
UniRam™ / DripNet PC™ 1-2.3 l/h

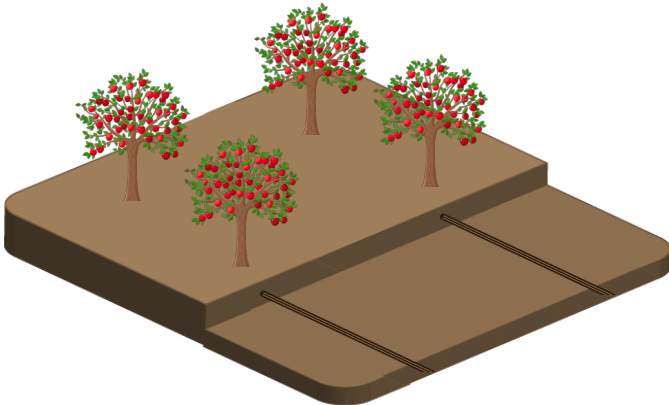
Dense planting



Plant spacing: 0.6-1m
Row spacing: 3.5-4m
Dripper spacing: 50cm
UniRam™ / DripNet PC™ 1-2.3 l/h

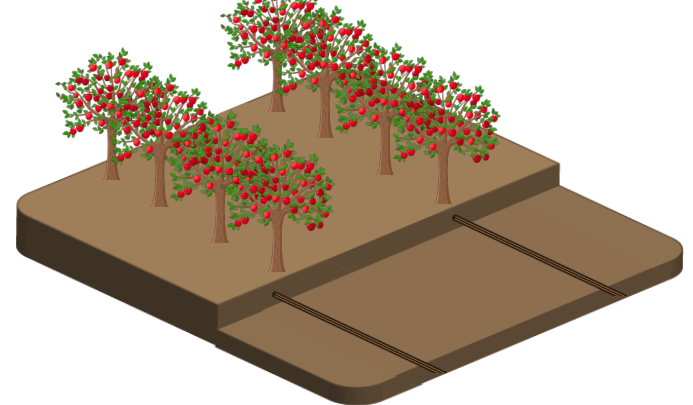
Subsurface

Traditional planting



Plant spacing: 2m
Row spacing: 3.5-4m
Dripper spacing: 50cm
UniRam™XR / DripNet PC™XR 1-2.3 l/h

Dense planting



Plant spacing: 0.6-1m
Row spacing: 3.5-4m
Dripper spacing: 50cm
UniRam™XR / DripNet PC™XR 1-2.3 l/h



/ Subsurface Drip Irrigation (SDI)

Subsurface is a popular drip application method for apples, offering 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.
- **Lower 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.



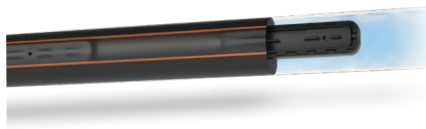
/ Netafim Irrigation Solutions

Multi-Seasonal – On-surface/Subsurface Drip Irrigation Solutions

UniRam™

Large PC dripper

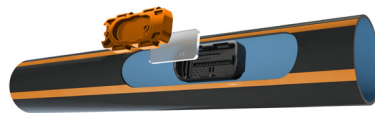
- Wall thickness: 1.0-1.2mm
- Flow rates: 1.0, 1.6, 2.3, 3.5 l/h



DripNet PC™

Compact PC dripper

- Wall thickness: 0.31-1.00mm
- Flow rates: 1.0, 1.6, 2.0, 3.8 l/h



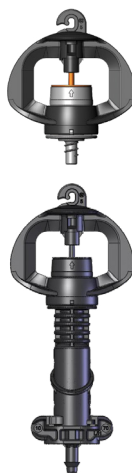
Row spacing and configuration: 1 dripline for every row, 0.5-0.75m distance between drippers (based on soil structure and flow rate)

Multi-Seasonal – Micro-Sprinkler Irrigation Solutions

GyroNet™

Non-PC micro sprinkler

- Localized coverage of irrigated area
- Broad applications
- Flow rates: 27-300 l/h



SuperNet™

PC micro sprinkler

- Localized coverage of irrigated area
- Long dripline
- Flow rates: 20-110 l/h

Pulsar™

GyroNet frost mitigation system

- Localized coverage of irrigated area
- Cutting-edge water-saving technology
- Advanced flow-regulation devices
- Flow rates: 8-35 l/h



Got more questions?
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Check out our digital agronomy
platform - GrowSphere
[Click here >>](#)



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