

Apples



Malus

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1 Plant background

Belongs to the Malus genus, originating in eastern Turkey, and is a pip fruit, from the Rosaceae family. The main varieties at present are from the Malus domestica group, comprising hundreds of varieties, including a large group of Spur-type that were developed in particular, to improve fertility and create a low, compact tree.

2 Botanical description

A small to medium size tree, up to 4-6m high; tree size depends on the rootstock, variety and pruning method. The leaves are dark green and elliptic in shape. The blossoms grow in clusters of 5 blossoms that grow on spurs and branches – white flowers that change their color to pink. The “king” flower opens first, creating the large typical fruit. Normally all the other blossoms are removed. Most varieties require pollination, which is carried out by bees. In varieties with dwarfed rootstocks, fruit appears after two years, while in normal varieties, fruit appear after 3-5 years.

3 Varieties

The spur-type varieties are prolific and commercial. In the USA, 10 main varieties compose 90% of production. These varieties are: Empire | Gala | Rome | Red Delicious | Granny Smith | Jonathan | Fuji Golden Delicious | Idared | McIntosh | China – the biggest global producer. Washington State – biggest US producer.



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4 Crop climate conditions

The apple acclimatizes to most climates. The best conditions exist between laterals 35°-50° north and south of the equator. Cold units – apples require 1,000-1,600 cold units (with the exception of the Ana variety, which requires very few cold units) and 120-180 days without frost. The best quality is attained where days are

warm, nights are cold and there is maximum radiation. Apples are resistant to frost down to -40°C. Blossoms and fruit-set will suffer damage at -2.2°C – -3.3°C. Apples blossom late in comparison to other deciduous crops, so there is less danger of frost, although in certain varieties and regions, where there is greater danger of frost, a frost protection system is necessary.

5 Leading apple growing countries (2002)

Country	Planted area (ha)	Production (tons)	Yield (T/ha)
China	1,939,000	19,250,000	9,930
USA	162,600	3,867,000	23,790
Ukraine	187,400	534,000	2,850
India	250,000	1,420,000	5,680
Poland	168,500	2,168,000	12,870
Turkey	108,600	2,200,000	20,260
Russia	435,000	1,900,000	4,370
Iran	149,000	2,334,000	15,660
France	78,000	2,478,000	31,770
Italy	60,856	1,944,000	31,950

6 Growing season

Blossoming: April-May in the northern hemisphere and the corresponding months in the southern hemisphere, the main growth stops in July. Cell division ceases three

weeks after fruit-set. Fruit growth is cell growth, therefore it is necessary to maintain conducive moisture and fertilizer conditions throughout the season, in order to attain good quantity and quality yields.

7 Rootstock

There are three groups of rootstock varieties: Malling (the lowest at 0.27m height), Mulling Merton (1.3-2m

height), and Seedling (normally local) (6-10m height). The most common rootstock in dense orchards is M.9, and for medium varieties MM.16.

8 Soil

Optimal pH is 6-7. Medium, well-drained soils are preferable.

9 Nursery

it is common to graft saplings in the nursery, and plant them during dormancy. Saplings are planted with roots

exposed, and not in bags. The rootstock is grown in "mother nurseries". Sapling preparation takes at least two years.

10 Tree treatments

Pruning is done main during the winter, but during the

summer red varieties are also pruned a month before harvesting, to improve radiation through the foliage.



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11 Harvest

In early varieties – 100 days after full blossoming; in late varieties – 180-210 days after full blossoming.

12 Tree spacing

In medium sized varieties, trees are planted 4x5 meters or 2.5x4.0m – 1,000-2,300 trees per ha, and in extra dwarfed varieties: 3x0.90m – 3,000 – 4,000 trees.

13 Irrigation

Irrigation – in the northern hemisphere: irrigation coefficients – Kc

General water requirements for cold-moderate climates: 450-500mm; for a dense orchard: 700-800mm. In regions where there are summer rains – rainfalls exceeding 5mm must be taken into account.

Harvest dates	Spring		Summer			Autumn	
	April	May	June	July	August	September	October
10/6	0.2	0.5	0.75	0.55	0.4	0.2	0.2
20/8	0.2	0.35	0.5	0.7	0.7	0.5	0.2
10/9	0.2	0.3	0.45	0.7	0.7	0.8	0.6
21/9	0.2	0.3	0.45	0.7	0.7	0.77	0.4
Extremely dense orchard	0.2	0.3	0.7	0.7	0.7	1.1	0.6

14 Critical stages for water stress in the soil in apple orchards

Water stress during the critical stages could result in leaves dropping off, a reduction in yields and low income,

mainly during the blossoming and fruit-set stages, fruit development stages, and also towards the end of the growing season.

15 Irrigation management with water shortages in apple orchards – deficit irrigation

Following are several means of action that will enable deficit irrigation, while reducing economic damages to the orchard and to the yields.

- a. Apportion water based on profitability of the sections, according to tree conditions and harvest dates, wherein the better sections will receive the necessary water quantities, at the expense of the poorer sections.
- b. Water is apportioned according to expected yields in the orchard sections. Sections where a high yield is expected, will receive water at the expense

- of sections, where expected yield is low.
- c. It is recommended to thin out the fruit, removing the small fruits and leaving the large fruits on the branches. This can be done manually or chemically.
- d. Reduce the canopy by pruning, thus reducing the tree's water consumption. When pruning apple trees and other pip fruits, it is important not to cut strong branches, as this causes excessive vegetative growth.
- e. Green pruning is preferable, and in early varieties, summer pruning is recommended.
- f. The yield must be adapted to the allocated water allowance, and not the water to the yield.

16 Recommended irrigation method

One lateral per row, distance between drippers: 0.5m. Discharge rate will be according to soil type, normally 1.6-

2.3 l/h. Irrigation frequency will be according to soil type, every 1-3 days. The accepted equipment in mountainous regions is Ram, and in level terrain Tiran, and UniRam for subsurface drip. Irrigation rate: 0.7-1.0 mm/h





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17 Fertilization application

Before planting: N – 200-300 kg/ha; 400-600kg/ha K₂O
Young trees (1-4 years): N – 90 kg/ha | P – 30 kg/ha |
K – 120 kg/ha

Mature trees: N – 100 kg/ha | P – 60 kg/ha |
K – 180 kg/ha

18 Yields

Differ according to variety, climate and density of trees in the orchard. It is possible to receive yields of 60-80 tons/

ha, but to improve quality and fruit size, yields should be reduced to 30-40 tons/ha.

19 Main diseases

Apple scab, powdery mildew, apple bitter rot, black rot, sooty mold, sclerotium root rot.

20 Main pests

Cydia pomella, Lyonetia clerkella, aphids, fruit flies (anastrepha), mites.

21 Frost protection

It is recommended to use SuperNet SR LR 4.0 mm/h for every tree, with a wetting diameter of 4m.

22 Recommended irrigation equipment for apples

Drip Irrigation

Netafim produces and markets a very broad range of products, with the aim of providing solutions for every irrigation need. Therefore, for every region, soil type, farmers' demands, etc., we are capable of providing a solution tailored to these needs.

Following are the general recommendations for three types of equipment, which, according to our experience, can provide the most suitable solutions for crop and grower demands. However, these are not the only possible solutions.

UniRam compensated drippers, with a self-cleaning mechanism, ensure identical applications of water and fertilizers, regardless of inlet pressure (as long as the pressure is within the recommended limits) and/or topography throughout the irrigation cycle. In addition, this equipment has the following properties: (a) anti-siphon mechanism – to prevent dirt being sucked into the dripperline from outside when the irrigation cycle is completed, which could create a vacuum in the dripperline due to the steep topography, and (b) non-leakage (CNL) mechanism that prevent the dripperline

from emptying out at the end of the irrigation cycle, which means that the dripperlines are ready and waiting for the next irrigation cycle, ensuring uniform opening – ideal for short and frequent irrigation applications.

UniRam equipment can be used at flow rates of 1.0, 1.6, 2.3 & 3.5 l/h. Spacing between drippers is between 0.5 – 0.75 cm. Flow rate and spacing between drippers will be determined according to the soil type and the total hours available for irrigation.

UniRam equipment is produced in two wall thicknesses: 1.2 and 1.0 mm. The wall thickness determines the maximum work pressure. These dripperlines, when laid out/rewound and maintained according to instructions, will ensure many seasons of precise and reliable operation.

Ram compensated drippers, with a self-cleaning mechanism, to ensure that all plants in the field will receive identical applications of water and fertilizers, regardless of inlet pressure (as long as the pressure is within the recommended limits) and/or topography throughout the irrigation cycle.

Ram equipment can be used at flow rates of 1.2, 1.6, 2.3 & 3.5 l/h. Spacing between drippers is between 0.5 – 0.75 cm →



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13 Recommended irrigation equipment for apples (continued)

Flow rate and spacing between drippers will be determined according to the soil type and the total hours available for irrigation.

Ram equipment is produced in three wall thicknesses: 1.2, 1.0 and 0.9 mm. The wall thickness determines the maximum work pressure. These dripperlines, when laid out / rewound and maintained according to instructions, will ensure many seasons of proper operation.

P.C.J.-C.N.L. online drippers are compact anti-drain, pressure-compensated drippers that ensure that the same quantity of water and fertilizer will reach each tree, regardless of inlet pressure (as long as the pressure is within the recommended limits) and/or topography throughout the irrigation cycle.

P.C.J.-C.N.L. online drippers equipment can be used at flow rates of 1.2, 2.0, 3.0, 4.0 & 8.0 l/h. Drippers can be inserted on the polyethylene pipes at the desired spacing. Flow rate and spacing between drippers will be determined according to the soil type and the total hours available for irrigation. It is possible to insert a few drippers when the trees are young, and add drippers in accordance with the trees' growth rate.

The non-leakage characteristic prevents water from emptying out of the dripperline at the end of the irrigation cycle, leaving it full of water and ready for uniform opening and to immediately begin a new irrigation cycle, making it ideal for short and frequent irrigation cycles.

In addition to using drip irrigation, another option is the use of micro-sprinkler irrigation in deciduous orchards.

Micro-sprinkler Irrigation

For Irrigation and Fertigation- Flow compensated sprinklers

- SuperNet – one sprinkler per tree from 20 to 110 l/h with wetted diameter of 1.5m up to 8.0m. It is also

available with an upside-down option with insect proof swivels.

- SuperNet – provides full coverage and full overlap of 2X2 up to 6X6 upright or upside-down. Same flow rates and swivels available.
- PowerNet FC for full overlap irrigation with 9-15° and 24° trajectory and 180l/h up to 340L/h

For Irrigation and Fertigation with Micro sprinklers

- GyroNet - one sprinkler per tree from 27 to 300 L/h with wetted diameter of 1.5m up to 8.0m. It is also available in an upside-down option with insect proof swivels.
- GyroNet - full coverage and full overlap of 2X2 up to 6X6 upright or upside-down. Same flow rates and swivels available.
- GyroNet Turbo - full coverage and full overlap 200-250-300 L/h of 4X4 up to 7X7.
- PowerNet for full overlap irrigation with 9-15° and 24° trajectory and 180L/h up to 460L/h

For Frost protection, coloring and cooling

- SuperNet LR and GS for full above canopy frost protection and cooling in marginal and irregular topography.
- PowerNet FC for full above canopy frost protection and cooling in marginal and irregular topography.
- GyroNet and GyroNet Turbo for above canopy frost protection and cooling with very low pressures.
- SuperNet UD (Upside-down) for under canopy frost protection in marginal and irregular topography.
- GyroNet UD for under canopy frost protection and cooling with low pressures.
- CoolNet for evaporative cooling under canopy, especially with marginal.

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