



Precision Farming
SWEET ORANGE
With Jain Technology™



JAIN®

Jain Irrigation Systems Ltd.

Small Ideas. Big Revolutions.®



Jain Sweet Orange cultivation Jain Technology

Citrus fruits rank third in area and production after banana and mango in India. Sweet orange (*Citrus sinensis*) are the second largest citrus fruit cultivated in the country. Telangana, Andhra Pradesh, Maharashtra, Karnataka, Madhya Pradesh and Punjab are main sweet orange growing states. It's grown commercially in tropical, subtropical, arid-irrigated and mountains regions in varying soil and weather conditions. Although sweet orange tree does well in dry climate, with rainfall between 750-1250 mm. however the states of Telangana, Andhra Pradesh and Maharashtra have the largest share of cultivation. Among sweet oranges Mosambi (Maharashtra), Satgudi (Andhra Pradesh and Telangana) and Malta and Jaffa (Punjab) are traditionally grown in India. The average yield of sweet orange fruit in India is low (11.6 t/ha) compared to other developed countries like USA and Brazil (22-35 t/ha).

Jain Irrigation systems Ltd. (JISL) have introduced and acclimatized the table as well as processing varieties with the introduction of "Jain Sweet Orange". Jain sweet orange available in five varieties. These varieties are high yielding, early to late harvest type. Farmers with available land with these new varieties can expect to harvest twice that of the current production with the same amount of water resources as of today.



Soil

Sweet Orange grown in a wide range of soils ranging from sandy loam or alluvial soils of north India to clay loam or lateritic/acidic soils in Deccan plateau. Orchards develop well in light soils with good drainage. Deep soils with pH range of 5.5 to 7.5 are considered ideal. However, they can also be grown in a pH range of 4.0 to 9.0. High calcium carbonate concentration in feeder root zone may adversely affect the growth. Soils having a high water-table should be avoided. The sweet orange growing areas of Maharashtra have black soils. Thus, a well-drained sandy loam to clay loam is preferred by sweet orange.

Climate

Sweet orange grow well in tropical and subtropical climates and can withstand on drought conditions. The average temperature for good growth is about 13°C to 37°C. Sweet orange can grow well between altitudes of 500 m to 1000 m. It grows well in drier areas having rainfall up to 500mm.

Varieties

Variety	Flowering to harvesting period
Jain Orange 1	240-270 days
Jain Orange 2	240-270 days
Jain Orange 3	270-300 days
Jain Orange 4	270-300 days
Jain Orange 5	310-340 days

Propagation

Budding, i.e. with 'T' budding and patch budding or shield budding are most commonly used propagation method for sweet oranges. When the rootstock plants of the selected rootstock are one-year-old or come to a budded at a height of about 15-25 cm from the ground level. JISL has standardized commercialized micro-budding practice to produce better plants.

Planting

- Generally planting to be done during June to March month.
- Pits are made of 2x2x2 feet dimension in deeper soils or 3x3x3 feet in shallow soils.
- Fill the pits with a mixture of top soil, 20 kg FYM, 2 kg SSP, 2 kg neem cake, 25 g. phorate & 25 g trichoderma powder.
- Removal of plants with roots from container (Without injuries to root ball) for planting.
- Watering must be done immediately after planting.

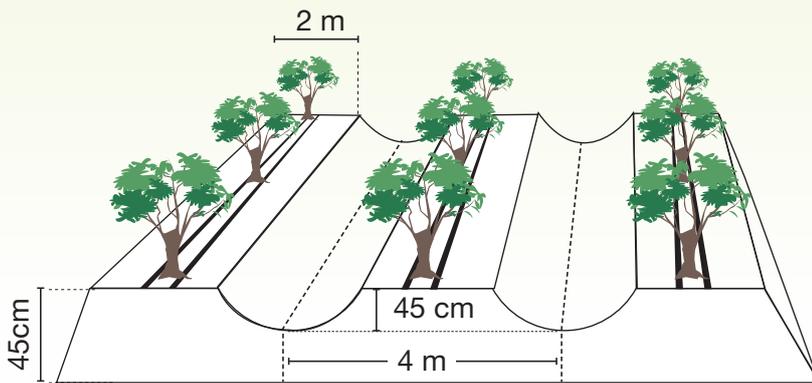
Bedding systems of plantation

- For sweet orange, planting distance of 4x3 m modified raised beds have been prepared. These beds are 2 m wide, 45cm high at the middle (near the stem of the plant) and sloping down both ends. Its purpose to water drains from the beds into furrows.
- A raised bed planting is beneficial for sweet orange cultivation.
- At the time planting, bud union should be 20 cm above from soil.

Comparison of Conventional and Hi tech Jain sweet orange

Conventional sweet orange cultivation	Hi-Tech Jain sweet orange cultivation
Rootstock seedling raised on soil	Rootstock seedling raised in soilless media cups in green house
Rootstock is the cause of spread of diseases	Prevented diseases through rootstock
Mother plants plot is raised elsewhere, without control	Mother plants raised in controlled greenhouse conditions
Virus and Viral diseases not controlled	Virus and viral diseases are controlled
Budding done on raised rootstock on soil	Budding done on raised rootstock in green house through micro budding techniques
No virus indexing of plants	Virus indexing done plants are virus free
Complete growth of budded plants in nursery or open field in poly bags.	Complete growth of budded plants in (root trainer) container in controlled conditions.
Plants uprooted from field cause breaking and injuries to roots.	Plants delivered in 2050 ml. container cups, with well-developed root ball without injuries to roots.
Chances of mortality are more after planting.	Chances of mortality is rare after planting
Promote Phytophthora and gummosis like diseases	To check Phytophthora and gummosis like diseases
Percent of juice is less	Percentage of juice content is more
Commercial production starts late 5-6 years.	Commercial production starts early in 4 th year
Fungal like disease infection start from nursery	Table with container cups used to check fungal attack.
Fruits contains more seeds	Fruits contain minimum seeds or seedless

Layout of drip irrigation for sweet orange



Planting Distance

Jain Sweet Orange high density planting plant spacing should be 4m x 3m (333 plants/acre) .

Rootstock sprouts (water shoot) management and pruning

Sweet orange plants are planted in field. In initial years rootstock exposed to sun cause water shoots emergence on it. To check water sprout the trunk must be covered with polyfilm bags or PVC pipe.

Jain sweet orange high density planting done on 4 m x 3 m distance. Initial first light pruning to be done on third year. After fifth year of age, removal of dried twigs and criss-cross branches are done, immediate after this Bordeaux paste applied and tree canopy like umbrella formed. After harvest, immediately pruning to be done. On big trees water shoots should like dark green in colour such water sprouts removed regularly.

Intercrop

After planting immediately intercrop is not recommended. After first year, seasonal crops below the height of tree can be taken as an intercrop.e.g. Black gram, mung, ground nut & soybean like seasonal crop

can be selected. Strictly avoid seasonal crop e.g. Cotton, chilli, brinjal as intercrop.

Mulching

To protect orchard from weeds and hot sun mulching with wheat husk, dry leaves, sugarcane husk up to 8 cm thick layer on raised beds done also to minimize evaporation rate and help to improve quality of fruits.

Layout of drip irrigation for sweet orange

Initial two years 20 or 16 mm diameter lateral, 4 lit. /plant capacity dripper to be used. After two years use two 20 or 16 mm inline laterals, 40 cm with 4 LPH capacities to be laid both sides of plants, it should be 45 cm away from plant stem.

After two years use two 20 or 16 mm laterals with 4 LPH capacity 3 drippers and keep 50 cm distance between two drippers, likewise other side keep 3 dripper total 6 drippers per plant should be maintained.

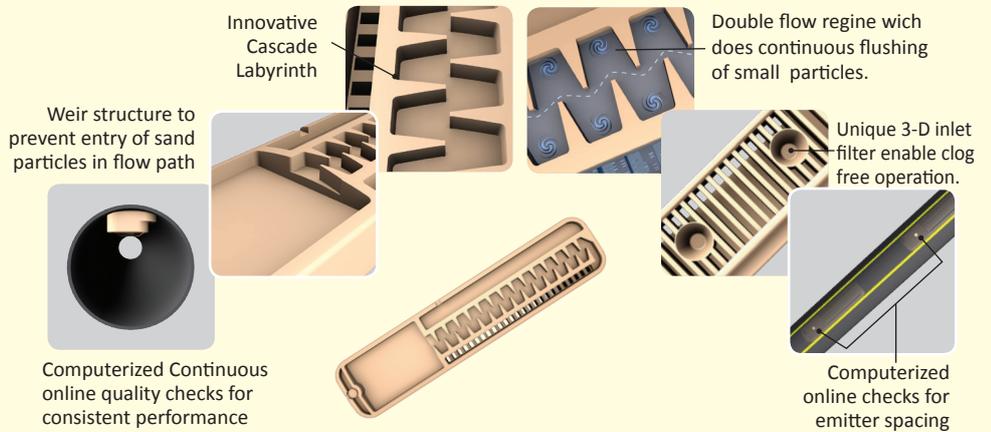


ONE STOP SHOP for Your



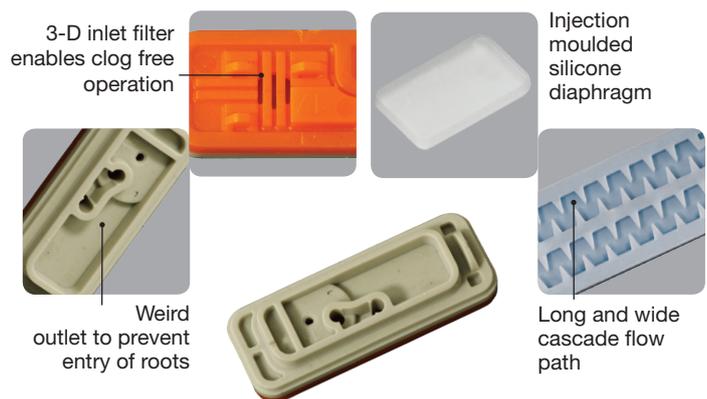
Jain Turbo Excel®

- Five Star rated dripline from worlds renowned institute IRSTEA (Cemagref), France.
- Available discharge rates - 0.85, 1.2, 1.6, 2.1, 4 lph @ 1kg/cm².
- 12, 16, 20, 25 mm nominal diameter.
- Dripper Spacing 15, 20, 30, 40, 50, 60, 75,90 cms.



Jain Turbo Top™

- Available discharge rates – 1.1 & 1.7 lph
- Injection moulded silicon rubber compensates with pressure and discharge gives uniform performance.
- Anti Syphone feature (optional) prevents suction of sand and silt particles inside the dripper.
- Cascade labyrinth gives strong, self-cleaning turbulence.
- Available in 16 & 20mm nominal diameter. (12, 16 & 20 mm in Thin Wall option)
- Suitable for surface as well as subsurface installations.

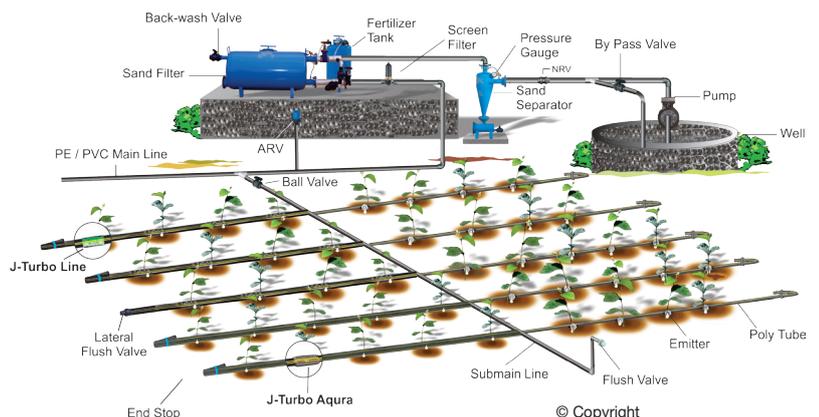


Why Jain Drip Irrigation ?

Water is not the only need of the plant. To uptake this water efficiently, it requires proper air-water balance within the root zone. Drip irrigation, with its low application rate, prevents the saturation of water within the root zone and continuously maintains field capacity. This provides a favorable condition for the growth of the plant. Drip irrigation also helps to use fertilizer efficiently. With drip irrigation water can be provided at frequent intervals which helps maintain required soil moisture level within the vicinity of the plant roots. Jain is the pioneer of drip irrigation. Ours is the only company in the world, which fulfills your entire irrigation system requirement under one roof.

Characteristics of drip irrigation

- 1) Water is applied at a low rate to maintain optimum air-water balance within the root zone.
- 2) Water is applied over a long period of time.
- 3) Water is applied to the plant and not to the land.
- 4) Water is applied at frequent intervals.
- 5) Water is applied via a low pressure network.



Micro Irrigation Needs

J-Turbo Line® Super



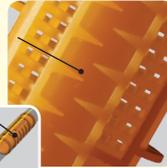
- Available discharge rates (at 1kg/cm²)
12mm - 2.2, 4 lph
16mm - 4, 8 lph
20mm - 2.2, 4, 8 lph
- Available in 12, 16 & 20 mm nominal diameter.
- Suitable for surface as well as subsurface installations.

Straight and wide labyrinth design makes the dripper truly clog resistant.

Computerized online checks for emitter spacing

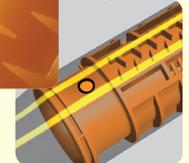
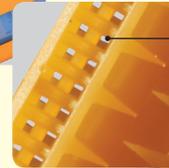


Hydrodynamic through bore design provides least obstruction to flow.



Hydrodynamically designed cascade tooth structure helps to create double flow regime for continuous flushing of dirt.

High precision inlet filters on opposite side prevents entrance of fine particles



Laser Drilled Multiple Outlet Holes

Turboline PC®

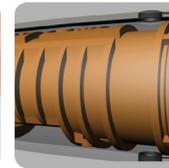
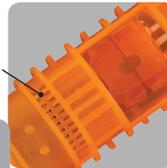


- Available discharge rates - 1.4, 1.8, 2.6 & 4.0 lph within pressure regulation range of 0.7 to 3 kg/cm².
- Injection moulded silicone rubber compensates with pressure and discharge gives uniform performance
- Application on undulating land/ Terrains/ Steep slopes.
- Available in 16 & 20 mm nominal diameter.
- Suitable for surface as well as sub-surface installation.
- Application where ever longer lateral length is necessary.
- Conforming to IS 13488, ISO 8261 Standard.

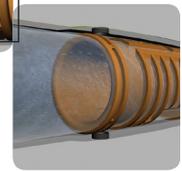
Diametrically placed multiple inlet filters



Injection moulded silicone diaphragm



Dual outlets to break vacuum & prevents soil suction



Smooth hydrodynamic design minimizes frictional losses & helps for longer lateral running length.

Widest Choice ! Customized Irrigation Solutions

Online Dripper & Spray Heads



Jain Filtration Equipment



Jain Fertigation Equipment



Jain Rainport / Micro Sprinkler



Jain PVC/PE Pipes & Fittings



Automation Equipment



Water requirement

Water requirement 1- 4 th year age of plant (lit./plant/day)									
Bahar water requirement									
Month	Evaporation (mm)	1st year	2nd year	3rd year	4th year		Mrug Bahar	Ambia Bahar	Hasta Bahar
January	2.86-4.60	7	14	20	30		87-97	17-20	77-93
February	3.38-5.90	9	19	30	40		104-114	35-38	82-95
March	3.69-7.29	12	24	36	48		126-136	62-68	91-104
April	6.69-8.38	15	29	42	55		Stress	91-104	101-111
May	7.54-9.32	17	36	52	60		Stress	120-143	120-143
June	5.97-7.45	12	24	36	48		21-24	101-111	126-143
July	4.24-7.47	9	19	30	40		25-35	83-105	91-104
August	3.22-7.84	9	18	27	40		39-54	80-109	Stress
September	3.57-7.78	8	17	25	36		64-72	96-108	Stress
October	4.44-7.87	9	19	30	40		77-93	96-108	39-54
November	3.48-3.84	9	18	27	36		82-95	Stress	64-72
December	3.15-3.90	7	14	20	30		76-95	Stress	64-72

Fertigation management and dose

(kg/acre/week)

Year	Month	Total dose	Urea	Phosphoric acid	12.61.00	MOP
1 St.	Jul - Sept	12	1.3	1	0	0.48
	Jan - Apr	16	1.8	0	1.2	0.78
2 nd.	Jul - Sept	12	1.9	1	0	0.55
	Jan - Apr	16	2.5	0	1.2	0.9
3 rd.	Jan - May	20	2	1.5	1.7	2.5
	Jun - Sep	16	1.5	0	0	2.5
4 th	Jan - Apr	20	3.0	2.3	00	3.5
	June-Sep	20	2.5	1.8	0	
	Jun - Sep	16	2	0	2	3
5 th	Jan - May	20	3	2.3	0	3.5
	Jun - Sep	16	2.5	0	2.66	3.5



Fertilizer

Year	g/plant			FYM/Kg
	N	P	K	
First	58	30	43	10
Second	87	30	43	20
Third	90	75	60	30
Forth	114	90	60	40
onward	140	117	72	40

Micronutrient

A composite nutrient spray prepared and spread twice or thrice at 20 to 25 days interval commencing from the appearance of new flush will correct deficiencies and increase the yield and quality of fruits. It prepared as follows.

Zinc Sulphate	500 g
Copper Sulphate	250 g
Magnesium Sulphate	200 g
Ferrous Sulphate	200 g
Borax	100 g
Lime	900 g
Urea	1 kg
Water	100 lit.

Principle of Drip Irrigation & Fertigation

Exact volume of water needed by the plant is delivered at regular intervals to the root zone. Only the root zone is wetted. Rest of the field remains dry.

Plant nutrients are supplied with irrigation water to the root zone.



N= Nitrogen, K=Potassium, P=Phosphorus, +=Micro elements

Benefits of Drip irrigation for sweet orange

- Increases leaf yield up to 50%
- Reduces water used for irrigation up to 50%
- Increased fertilizer uptake by plants when fertigation is practised Increased fertilizer use efficiency through fertigation.
- Consequently a reduction of up to 30% of applied fertilizer from the recommended dose is possible.
- Reduces NO₃-nitrogen leaching (thereby nitrate pollution) avoided by 50% when fertigation is practised.
- Controls weed growth as water is applied only to the root zone.
- Allows for intercropping during the early years.

Following table shows micronutrient for soil application

Age	Copper Sulphate	Ferrous Sulphate	Zinc Sulphate
1 and 2 year	25	25	25
3 to 4 year	50	50	50
5 year	100	100	50
Onward	150	150	100

Pest and Diseases

Lemon Butter fly

Symptoms

Pest attacks on tender leaves, larvae being feeder cause severe defoliation of plants.

Management

- Limited use of chemical fertilizer
- Collect and destroy
- Insecticidal spray when butterfly laid eggs on leaves

Infestation

- Throughout the year

Control

- Spray Quinalphos 25% EC 2ml/lit of water.

Leaf Minor

Symptoms

Newly emerged larvae mines under surface of the leaf in zigzag way. Mines on the underside of leaf are silvery in colour. Attacked leaves curl-up from the margins towards inner side, eventually dry up and fall down.

Management

- Inspect big trees on February and August.
- Larvae attack more in March and September

Infestation

- June –July, January- February

Control

- Prune heavily infested branches destroy them and spray should be aimed at young flush only.

- Spray Neem oil 10 ml/lit. of water on new flush.
- Spray Diamethoate 30% EC 2 ml. or Dichlorovos 76WSC 1ml. /lit. of or Imidacloprid 17.8% SL 0.3 ml./ lit of water

Citrus Psylla

Symptoms

Nymphs and adult in flocks of tens and hundreds suck the cell sap from young twigs, leaf and flower buds that results into heavy drop of young flush and fruits and drying of twigs.

Management

- Inspect during new flush emergence on tree.
- Psylla cause spreading greening diseases so always use disease free and healthy plants for planting.

Infestation

January- February, October to December

Control

Spray Quinalphos 25% EC 2 ml. or Cholopyriphos 2 ml./ lit or Profenophos 50% EC 2 l./lit. of water

Thrips

Symptoms

The nymphs and adults suck the sap from fully developed flower and leaf buds, young leaves and grown-up fruits. The leaves become cup shape and leathery.

Management

- Limited use of chemical fertilizer
- Inspect during new flush emergence on tree

Infestation

- January- July-November

Control

- Spray Quinalphos 25% EC 2 ml. /lit or Imidacloprid 17.8% SL 0.3 ml. /lit of water

Viral Diseases

Citrus species trees are prone to the attack of many viral diseases. Phytophthora, Cholototricum, fusarium and etc.

Mode of disease spread

- Flood irrigation and flat bed system
- Retention of water for longer period in beds
- Prolonged period of wet weather
- Repeated use of same land for orchard

Symptoms

Phytophthora causes foot rot, root rot; gummosis, leaf fall and brown rot disease in well grown orchards Foot rot lesions develop as high as 60 cm from the ground level on the trunk and may extend below the soil on crown roots as crown rot. On scraping the dark bark.

Cultural management and care

- Always use root trainer container plants for planting.
- Plants should be selected from Phytophthora-free certified nurseries.
- Plant should have be budding (above 6" ht.).
- At the time planting, care should be taken to keep bud union as high as possible.
- Selection of soil should be kept well drained and flood irrigation and stagnation of water for longer period in the basin should be avoided.
- Injuries to trunk and root system by farm operation should also be avoided.
- Disease free and insect free planting material should be selected for planting
- Use drip irrigation system to control irrigation.
- Regular monitoring for the disease symptoms should be done to control the disease at its initial stages.

Disease management

- Disease-free planting material should be selected for planting.
- Flood irrigation in order to check water logging and water stagnation for longer period should be avoided.
- Tree trunk should not be allowed to come in contact with irrigation water.

Chemical Control

- Copper fungicides are used as foliar spray.
- Fungicidal drenching at basins of tree.
- Fungicidal pasting to disease affected trunks and twigs.
- During monsoon season, alternate 40 days spraying whole plant of Redomil 2.5 g/lit or Mancozeb 2.75 g/lit.
- Bordeaux paste should always be applied before onset of monsoon on tree trunk.
- Alternate use of both fungicides should be practiced to minimize the risk of the development of fungicide resistance.

Production

Particular	Conventional planting	High density planting
Planting distance (m)	6 x 6	4 x 3
Plant population/ Acre	111	333
Production starts in	4-5 years	3-4 years
Commercial production start	6-7 years	5-6 years
Orchard life	25 years	15-20 years
Approximate production/acre (Ton/acre)	4-5 ton	10-12 ton
Approximate annual income Rs./acre (Rs.20/kg)	Upto 1 lakh	Upto 2.25 lakh
Approximate cost of production Rs./acre	40,000	80,000
Approximate annual profit Rs./acre	Up to 60,000	Up to 1,45,000

Yield

Bearing starts from 3rd year. Expected commercial yield start at 4th year 5-6 tons /acre. 5th year and onwards 8-12 tons/acre.

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