

Diseases

Cucumbers grown in soil culture are subject to nematodes, Fusarium and verticillium wilt botrytis, leaf mold, foliar and viruses. These can occur as a single problem or a combination of two or more at a time. Total or marketable yields can be reduced by 10 to 80 percent, depending on the severity of one or a combination of these diseases.

Disease	symptoms
Bacterial angular leaf spot	First symptoms are small, water-soaked angular lesions on the leaf underside. Lesions, restricted between the small cucumber leaf veins, turn yellow, develop yellow hollows, and finally disintegrate. Under wet conditions, such as early in the morning bacteria ooze from the lesions which later dry into a white crust.
Gummy stem blight	In older plants lesions produce a characteristic red or brown exudate at the crown of the plant and along the vines. Black spores may be seen around the infected tissue. Initial leaf symptoms are irregular circular dark spots which may be surrounded by a yellow halo, and later dry up and crack.
Downy mildew	Initial lesions, which are limited by the small leaf veins, include irregular to angular, pale green spots which appear on the upper side of leaves near the plant crown. The lesions then turn into yellow angular spots. The underside of leaves later develops a downy white to gray mold, which may turn gray to purple during wet weather. Spores develop in this mold.
Powdery mildew	Symptoms develop primarily in 2-3 week old leaves and on stems. Younger leaves are almost immune to powdery mildew. The disease is characterized by white powdery-like growth, especially on the upper side of leaves, and on stems
Fusarium wilt	Not likely to be a problem in soilless houses. Typical symptoms include a yellowing and wilting of the foliage. Stem tissue near the ground line is likely to show brown streaks.
Gray mold	Very common in both soil and soilless houses. It is usually recognized by a fuzzy, gray growth on the stems or flower pedicels. The leaves turn brown beginning at the tip and progress backward. It becomes a major problem when the house is not ventilated and the humidity is continuously kept at high levels.
Nematode injury	Is likely to be found in soil houses where continuous production has occurred. Plants will wilt rapidly during periods of moisture stress. Leaves turn yellow and may appear to have a nutrient deficiency. Plants become stunted and the roots develop galls or knots
mosaic viruses	Leaf symptoms include mottling, with raised dark green areas and some distortion of younger leaves. Severe symptoms include leaves which may turn downward, become rough, crinkled or corrugated, and may curl downward at the margins. Plants may become stunted.
Southern blight	Is more of a problem in a soil house. Plants wilt and die very rapidly without a distinctive yellowing of the foliage. The stem at the ground line will usually be decayed and covered with a white mold and small light-brown fruiting bodies.
Verticillium wilt	Not likely to occur in soilless systems. The foliage will yellow and wilt. It forms v shaped lesions on the leaves. Internal tissue near the base of the plant will usually show brown discoloration.

Insects

Green house are subject to infestation by aphids, flea beetles, fruit worms, white flies, mites, leaf miners, pinworms and others. A description of these insects is provided in Table below.

Insect	Symptoms
Aphids	Small, soft-bodied, pear-shaped insects with a pair of cornicles (tailpipe-like projections) protruding from the rear end. They may be red, black or green. They may be winged or wingless and feed in colonies on terminals and leaves. Infested leaves often curl and become distorted. Aphids transmit virus diseases.
Leaf miners	The larvae are yellow and about 1/8 inch in length. They tunnel the leaves between the upper and lower surfaces. This damage results in long, white, winding tunnels on the leaves.
Tomato pinworms	The adult moth is gray with a wingspan of 1/2 inch. The mature larvae may be yellow, green or ash gray and covered with dark purple spots. Pinworms can cause whitish leaf streaks, folded and tied leaves, pinholes in stems and fruit and fruit blotches.
Two spotted Spider mites	Outbreaks of spider mites occur occasionally, especially during hot, dry weather. Spider mites feed on plant sap and prefer to live on the leaf underside. Their feeding causes stippling of white areas on the leaves. Heavily infested leaves may turn yellow and drop off prematurely
White flies	There are several species of white flies. They may vary in certain aspects of body shape, such as wing shape. However, they are all small insects with broad wings covered with fine, snow-white waxy powder. Both adults and nymphs may feed on foliage by sucking juices from the underside of the leaf. They produce honey dew which may result in a blackening of the leaf. Some species are also capable of transmitting certain viruses, which greatly damage the plant.
Melon fly	Melon fly damage occurs when adult female flies lay their eggs into fruit and sometimes into stems. An indentation often occurs at the site of oviposition and the fruit may or may not become curved. Attacks are severe on young developing fruit, especially under high humidity conditions after summer rains.
Thrips	Thrips are small, <1/16 inch (15 mm) slender insects. Adults usually have wings with feathery hairs that enable them to fly. The melon thrips (Thrips palmi Karny) and the Western flower thrips (Frankliniella occidentalis) commonly infest cucumber plantings. Melon thrips tend to live and feed on the leaves. Leaf edges tend to curl downward after heavy thrip feeding. Population pressures can be especially high during hot and dry conditions

Chemical name	Quantity	To control
Fungicides		
Acrobat	1.5gm/liter	Mildews and leaf spots
Amistar	0.5 ml /liter	Blight and Mildews
Bavistin	1 gm/ liter	Diseases like wilt, root rot and leaf spot.
Copper oxy chloride	2 gm/ liter	Damping off and root rot and collar rot
Dithane M-45	2 gm/ liter	Downey mildew , leaf spot and other diseases
Nativo	0.5 gm/liter	For the Early blight & leaf spot diseases.

Chemical name	Quantity	To control
Insecticides		
Actara	0.5/liter	to control the sucking pests like thrips, white flies, Aphids
confidor	1 ml/liter	to control the sucking pests like thrips, white flies, Aphids
Exodus	2ml/liter	To control the fruit borers and the mites.
Larvin	2 gm/ liter	To control the fruit borers.
Spinosad	0.5 ml/liter	For the Thrips and the caterpillars
Vertimac	0.5 ml/liter	leaf miner and red spider mites

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Introduction: Cucumber known as khira in hindi, is an important summer vegetable crop. Green house cucumbers are parthenocarpic (produce fruit without fertilization of ovules) and the fruit are usually seedless and does not require peeling, when ready for harvest, cucumbers are usually eaten as in salads.

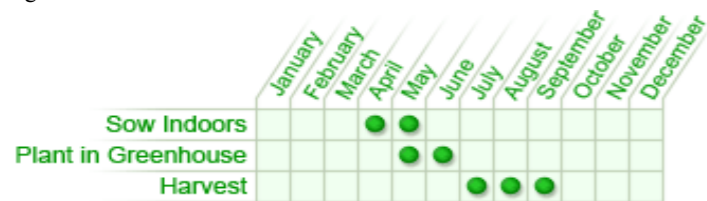
Optimum growing condition for cucumber

Optimum germination soil temperature	20-25°C
Optimum growing temperature	25-30°C
Limiting factors for sowing	Temperature less than 15°C
Seed to transplant	2-3 weeks
Vegetative to flowering	3-4 weeks
Flowering to harvest	3-4 weeks
Duration of harvest	Up to 3 months
Soil pH	5.5 to 7.5
Salinity tolerance	Moderate
Irrigation	Drip irrigation is mostly preferred
Post harvest storage temperature	10-12°C
Post harvest storage humidity	85-95%

Field selection and soil environment: Cucumber prefers light textured soils that are well drained, high in organic matter and have pH of 6.0-6.8. Adapted to wide range of soils, but will produce early in the sandy soils. Cucumbers are fairly tolerant to acid soils. Greenhouse cucumbers generally grow quite well in a wide range of soil pH (5.5-7.5), but a pH of 6.0-6.5 for mineral soil and pH of 5.0-5.5 for organic soil are generally accepted as optimum. EC should around 1mmho. Excess sodium and fluoride may affect proper plant growth. Ideally, the land should be gentle sloping to facilitate drainage.

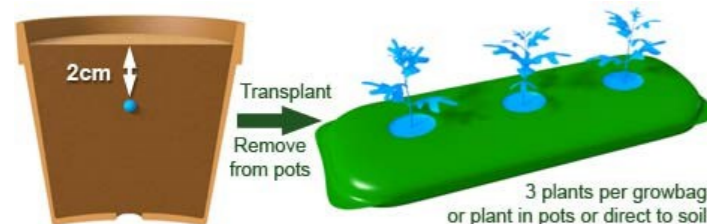
Land preparation: Land is ploughed 4-5 times to a fine filth and well rotten farm yard manure @ 20-25 tones/hac is incorporated in the soil at the time of final ploughing. If soil is infested with nematodes, white ants or red ants apply Carbofuron@25kg/hac. Apply Azospirulum and Phosphobacteria 2 kg/ha and Pseudomonas 2.5 kg/ha along with FYM 50 kg and neem cake @ 100 kg before last ploughing. Application of bio control agents like *Trichoderma viridae* @ 2kg/hac and *Paecilomyces lilacinus* @ 2kg/hac along with 100kg FYM to planting beds, if soil is infested with nematodes

Seed requirement: The amount of seed will be determined by the spacing used. A plant density of 1-2.5 plants/m² is recommended for most regions.



Nursery management: Trays can be used for growing seedlings. Watering will be done lightly using a watering can and timed in the morning to avoid conditions conducive for the development of diseases. It will take about a 20 day before the seedlings are ready for transplanting.

Transplanting: The seedlings need about 20 days of growth before they are ready for transplanting. Transplanting is best done in the evening when the weather is cool. Transplant directly into already prepared holes Spacing ranges from 90x45 cm, or 90x60 cm depending on soil condition and water availability.



Agronomic practices.

Agronomic practices include: nutrient management, irrigation, support, pruning, weeding, pest and disease management, harvesting.

Nutrient management

Fertilization of Soil Systems

For growing cucumbers in greenhouses with soil, add as much of the required calcium and phosphorus as possible as a base dressing, because these nutrients store effectively in the soil and their absence from liquid feeds prevents most clogging problems of the irrigation system. Provide calcium in the form of finely ground calcite lime @ 800kg/hac and phosphorus in the form of super phosphate @ 250kg/hac. Also, supply a good portion of potassium sulphate @500kg/hac and magnesium sulphate @ 250kg/hac. The ratio of potassium to magnesium in the soil should be 2:1. For supply of nitrogen, pre plant application of ammonium nitrate @150kg/hac. Make the final decision on the base fertilization after receiving the soil test results.

To correct micro-nutrient deficiencies, foliar feeds can be applied alongside the regular pesticide applications. Avoid excessive Nitrogen; it leads to excess vegetative growth, poor fruit set, smaller fruits, hollow fruits and poor keeping quality.

Fertigation by Quantitative Delivery: Recommended fertilizers for quantitative nutrition of soil grown green house cucumbers.

Growth stage	Recommended fertilizers kg/hac/stage			
	Potassium nitrate (13-0-46)	Mono ammonium phosphate (12-61-0)	Ammonium nitrate (33-0-0)	Magnesium nitrate (11-0-0-16mgo)
Establishment	130	16	42	60
Vegetative development	300	33	---	250
Flowering- fruit set	430	33	---	190
Production	215	33	---	190
Total	1075	115	42	690

*The application rate is based on the quantity per area regardless of the concentration in the irrigated water. The fertilizers should be applied every 1-2 irrigation cycles

Fertilization of Soilless Systems

When soilless systems are used, a plumbing system must be provided that allows frequent deliveries of water-soluble nutrients to the root zone. Soilless systems require that appropriate concentrations of each of 13 nutrients be supplied to the plants. The required concentration varies with each nutrient. In most cases, the best way to accomplish this is to purchase pre-mixed, water soluble nutrients and mix them into the appropriate water volume suggested by the manufacturer.

Fertigation of soilless grown cucumber in different growth stage

Growth stage	Nutrient concentration in ppm=g/m ³				
	N ⁺	P	K	Ca	Mg
Establishment-flowering	150	45	220	100	40
Fruit set – Production	200	50	330	140	70

- 80-90% as NO₃⁻, 10-20% as NH₄⁺

Micronutrients should be maintained at the following levels (ppm) throughout the growth period:

Fe	Mn	Zn	Cu	B	Mo
ppm=g/m ³					
0.9	0.55	0.32	0.05	0.25	0.05

When growing cucumbers on soilless media, special care must be taken in monitoring the nutrients that the crop receives, as there is no soil to compensate for the spent nutrients.

The following factors should be taken in account:

- **pH:** The pH in the nutrient solution should be maintained at 5.5 – 6.5.
- **Electrical Conductivity (EC):** The EC of the nutrient solution and the root zone should not exceed 2.2 and 3.0 dS/m, respectively.

- **Nitrate (NO₃):** The level of nitrate in the drain water should be 200 – 300 ppm depending on the nitrate level, which changes according to the growth stage.
- **Nitrate/Ammonium ratio** should not be lower than 5:1.
- **Nitrite (NO₂):** The level of nitrite should be zero, because its presence in the growth medium impairs root functioning.
- **Ammonia (NH₃) and ammonium (NH₄):** high level of either ammonia or ammonium interferes with the ability of the roots to absorb K.

Irrigation: Maximum yields and fruit quality will be realized only if the plant receives adequate and timely moisture when fruit begins setting and maturing. Depending upon the soil type and growth conditions, approximately 25-50 mm of water per week is needed to obtain high quality cucumbers.

Trellising, training and pruning: Several training systems exist for net house and greenhouse cucumber. The basic principle in developing a training system is to uniformly maximize the leaf interception of sunlight throughout the house. The selection of a system will largely depend on the greenhouse facility, the production system, and grower preference.



The most common pruning system is vertical cor-don, which Allow only one main stem to develop by pruning all lateral vines the main stem is allowed to run vertically on support nylon cord or twine to the overhead crop support. Continue to remove all lateral vines on the main stem throughout the life of the crop. The fruits on the base 30 inches of the main stem should be pruned off as soon as they appear. This allows the plant to vigorously produce early vegetative growth that is essential for maximum fruit production. Fruits above the basal 24-30 inches of the main stem are then allowed to develop.



V-cordon trained plants is known as the umbrella system. In this system, all lateral branches are pruned out as they appear until the main stem reaches the overhead wire. The growing point of the main stem is removed when one or two leaves have developed above the wire. Two lateral branches near the top of the plant are allowed to grow and are trained over the overhead wire resulting in these two branches growing downward. The growing point of each lateral is removed when nearly to the ground. Fruits are developed at the node of each leaf. The productivity of the laterals is generally less than the main stem.

Important note: Greenhouse cucumbers are naturally parthenocarpic varieties need to be isolated from standard varieties to prevent cross pollination and development of fruits that do contain seeds and may be deformed by greater growth in the pollinated area.

Fruit physiological disorder

Cracking: A serious physiological disorder, results in decreased yields and reduced quality of greenhouse cucumbers. Curvature in fruit begins at an early stage--often when the ovary is less than 1/2 inch long--and remains throughout maturity. Slight curvature (up to 1 inch per 12 inches of fruit length) is tolerable in first-grade fruit, but excessive curving or cracking reduces market value.

Weed Control:

Weed control in a soil system is very much like cultivation in the field, because there are no herbicides labeled for greenhouse use. However, fumigation will reduce the requirement for weed control. Cultivation can begin when weeds and grasses are very small, and should be done as shallow as possible to reduce root damage. Cultivation is usually accomplished by running a rototiller between the rows. Soilless systems normally do not require weed control programs because the system itself usually prevents weed growth.

Harvesting:

Cucumbers are harvested as immature fruit when full length has been reached. At suitable harvest maturity, a jellylike material has started to form in the seed cavity. Cucumber production will be reduced if the fruit are left on the plant for too long. Cucumbers are hand harvested, normally 3 times per week, depending on the weather and growth stage of the plant.

Post harvest handling: Cucumbers lose moisture quickly and have the tendency to soften during storage. Marketable cucumbers should be sorted according to size and quality and individually wrapped in clear plastic. The optimum storage temperature for cucumbers is 10-12.5°C, at relative humidity of 95% RH. Storage or transit temperatures below this range should be avoided as this will result in chilling injury after 2-3 days.

General Management of pest and diseases

Pests and diseases remain the greatest challenge in Tomato production. Appropriate and timely management makes all the difference between good production, poor production or total crop failure. Proper identification of the pest and disease is critical in a control strategy. The general principles in pests and disease management include;

- **Practicing crop rotation.** Observe minimum 2 year rotation program
- **Planting resistant varieties** - Use certified disease-free seed treated with an approved fungicide to control seed rots and post emergence damping off
- **Field hygiene**-old crop should be removed from the fields, control weeds and crop debris since these are source of pests and diseases. Staking and pruning are also key to disease incidence reduction
- **Using proper crop production practices** that provide the right growing conditions for plants (sufficient water and balanced fertilization), particularly when crops are young. Strong healthy plants are more likely to withstand pests and diseases.
- **Irrigation management;** poor irrigation timing and scheduling may lead to disease, overhead irrigation in the evenings can encourage early blight.
- **Ensure regular crop scouting** for pest and disease as well as weed and nutrient deficiencies. Proper pest and diseases identification is the first and critical step in their management. This helps to detect problems early and take control measures on time.

NOTE: Use registered products at the recommended rates observing the PHI; Refer to product label.