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Greenhouse Production of Parthenocarpic Cucumber

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SUMMARY

Fresh-consumed parthenocarpic cucumbers (*Cucumis sativus*) are a pop-ular and high-value crop sold in local food markets. The parthenocarpic plantcharacteristics and climbing growth habit make cucumbers an ideal crop for high-tunnel production. Major types of parthenocarpic cucumbers include Beit alpha and mini, Dutch greenhouse, American slicer, and Japanese. The details of cultivation practices are very important to get high yields and profits from the parthenocarpic cucumber.

INTRODUCTION

Parthenocarpic cucumbers, alternatively referred to as English Cucumbers, European Cucumbers, or Baby Cucumbers, are exclusively female flower-bearing plants. They produce dark green, seedless fruits, eliminating the need for pollination found in other cucurbits. These cucumbers are consistently uniform in size, shape, and are devoid of bitterness.

Varieties:

Typically, gynoecious, parthenocarpic F hybrids are favored for cultivation within polyhouses, eliminating the need for pollination. Notably, the Pantnagar parthenocarpic cucumber hybrid, released from GBPUAT, Pantnagar, Uttarakhand, is prominent. Other significant hybrids in India include Multi Star and Valley Star from Rijk Zwaan seeds, L.Satis and Keon from Nunhems, Hilton from Clause seeds, and Fia from Enza Zaden. Kuk-9 & Taxi from Yuksel seeds are also commonly cultivated hybrids in India.

Classification of different types of polyhouse cucumbers:

a) Mini Cucumbers: These cucumbers typically measure 18-19 cm in length, exhibit a shiny appearance, may have one or multiple fruits per internode, and possess a sweet and crispy texture with broader leaves.

b) Cocktail or Snack Cucumbers: These are small, crispy cucumbers, measuring around 8-12 cm, with a smooth, thin skin.

c) Parthenocarpic Cucumbers: These varieties exclusively produce female flowers and do not require pollination for fruit development. They are free from issues related to poor pollination, resulting in seedless fruits without a bitter taste. However, when grown in proximity to other cucurbits with male flowers, seed formation can occur, leading to misshapen fruits.

Climate:

Cucumbers thrive in warm climates, with most mini cucumbers being parthenocarpic and performing well at temperatures around 28-32 degrees Celsius. However, they can be cultivated year-round in regions with moderate climates.

Nursery Raising:

Seedlings are typically raised in 98-cell seedling trays using premium seeds of English cucumbers. Cocopeat is commonly used as a growing medium. Seedlings usually germinate within 2-3 days, and once sprouting is observed, trays should be immediately spread out. Seedlings are ready for transplanting approximately 10-13 days after sowing. Alternatively, direct sowing of seeds can also be practiced with successful establishment under favorable conditions.

Bed Preparation:

Land preparation involves plowing, cultivation, and harrowing/rotovating to achieve a fine tilth. Well-decomposed farmyard manure (FYM) can be applied before final rotovating, typically at a rate of 20 tons per acre. Raised beds, 80 cm in width, are prepared with 80 cm walking space between them. In a bay of 8 meters, five beds can be accommodated, achieving a bed height of nine inches.

Fumigation:

In instances where soil-borne pathogens pose a significant threat to crop health and yield, soil fumigation is recommended in protected cultivation. Soil analysis should be conducted to assess the severity of soil-borne pathogen and nematode issues before planting. If pathogen levels are high, beds can be drenched with a 4% formaldehyde solution at a rate of 4 liters per square meter and covered with black polyethylene mulch sheeting. Proper safety precautions, including wearing masks, gloves, and aprons, should be followed during formaldehyde treatment. Basamid can also be utilized for soil sterilization, albeit at a higher cost and requiring specialized application skills. Neem cake enriched with bio-pesticides can be applied to crop beds after ensuring complete removal of residual formaldehyde fumes. Solarization combined with fumigation is a cost-effective method for reducing soil-borne pathogen load. Bio-intensive management with bio-pesticides presents a sustainable alternative to formaldehyde fumigation.

Basal Fertilizer Application:

A basal fertilizer application of 10:8:10 kg NPK per acre is recommended, applied uniformly to beds before transplanting. This typically consists of 50 kg Ammonium Sulphate, 50 kg Single Super Phosphate, and 20 kg Muriate of Potash. Remaining fertilizers are applied through drip irrigation starting 15 days after transplanting.

Application of Neem Cake and Bio-Pesticides:

Application should occur 3-4 days before transplanting.

Laying of Drip Line:

Two 16mm inline drip laterals per bed are placed at a spacing of 40 cm, with emitting points at every 30 cm interval, each with a discharge rate of 2 l/hr. The drip system should be run to ensure uniform discharge, checking for cuts and leakages before covering beds with polyethylene mulch.

Mulching:

Black-silver polyethylene mulch film, 25-40 microns thick and 1.2 meters wide, is used to cover planting beds. Holes with a diameter of 5 cm are made at recommended spacing on the polyethylene film. The film is secured firmly to the soil to cover the beds. Mulching conserves water, suppresses weeds, reduces pest and disease infestations, and improves yield and quality. However, crops can still be grown in polyhouses without mulching.

Spacing:

Seedlings are planted in paired rows within 80 cm wide beds, with row-to-row spacing of 50 cm and plant-to-plant spacing of 60 cm. This configuration accommodates approximately 8000 plants per acre. Ideal

planting density is around 2 plants per square meter with proper pruning and twining to maintain a single shoot per plant.

Transplanting:

Before transplanting, planting beds should be watered to field capacity. Seedlings, typically 10-13 days old, are transplanted into holes made in the polyethylene mulch film at a depth of 5 cm. Care should be taken to avoid root damage while removing seedlings from individual cells. After transplanting, seedlings are drenched with a 2 g/l Captan solution at a rate of 25 ml per plant. Daily watering of mulched beds with a hose pipe fitted with a rose for a week is essential to prevent heat-related mortality.

Drip Irrigation:

Daily drip irrigation is essential to supply 6000 to 12000 liters of water per acre per day, depending on the season. This translates to running the drip system for 12 to 24 minutes, depending on seasonal requirements.
Total fertilizer requirement is 40:30:50 kg NPK/acre for a 4-month crop. A basal fertilizer dose of 15:15:15 kg NPK/acre is to be given before transplanting in the form of ammonium sulphate 75kg, 100kg single super phosphate and 25 kg muriate of potash. Remaining NPK will be given through water soluble fertilizers with drip irrigation (fertigation) for entire crop growth period, starting from 15 days after transplanting to 105 days after transplanting. Fertigation can be given as per following schedule.
Micronutrient requirement of the crop can be met through foliar nutrition and sufficient application of FYM before planting. However, if the requirement is seen high based on soil test value, following fertigation schedule may be adopted 43 days after transplanting.

Days after transplanting	Number of fertigations	Quantity of fertilizers (kg)/ fertigation	Day of the week
15-28	4 bi-weekly fertigations	2kg19all+1.0kg~KNO_{s}	Mondays & Fridays
29-42	4 bi-weekly fertigations	2.5kg19all+1.0kg~KNO_{s}	
43-105	20 bi-weekly fertigations	3kg~19all+2kg~KNO_{1}	
43-105	10 weekly fertigations	3kg$CaNO_3$	Wednesdays
43-105	10 weekly fertigations	2kg $MgSO_4$	Saturdays

Foliar spray: The crop is sprayed with micronutrient formulation like Arka vegetable special (2g/L) four times at 15 days interval starting from 45 days after transplanting.
Pruning: Cucumber is pruned to single stems. All lateral branches appearing will be removed when they grow to the length of 5 cm.

Weekly once along with 19 All & KNO_3(Monday)	g/acre
Fe-EDDHA/EDTA/DTPA	100
Zinc Sulphate ($ZnSO_2$)	100
Manganese Sulphate (MnSO,)	50
Copper Sulphate ($CuSO_2$)	50
Weekly once along with 19 All & KNO_3 (Friday)	
Ammonium molybdate /Sodium Molybdate	50
Solubor	50

Training Guidelines: Cucumbers should be trained to grow vertically upwards using either polythene twine or a plastic net. This method encourages the main stem to climb towards the overhead wire, which is typically fixed at around 3 meters from the ground and runs along the length of the rows. As the plant matures, the main stem is gently wound around the string to provide support. Support strings should be attached to the plants one week after transplanting, and special plastic clips can be utilized to secure the stem to the string just below the point where a leaf joins the main stem. This prevents the plant from sliding down the string as the fruit load increases. Once the single branch reaches the wire grid, it can be allowed to trail down without causing damage to the vine.

Tips for Roping and Pruning:

- Leave extra rope near the wire for future plant fixation.
- Avoid fruiting within the first 75cm of the plants from ground level.
- Remove all lateral growth.
- Trim 2-3 leaves above the wire.
- Secure the plant with the rope.
- Remove older leaves.
- Maintain proper fruit load to prevent misshapen fruits.
- To prevent flower abortion, consider removing some leaves and cleaning the plastic.
- Promptly remove misshapen fruits to promote the growth of high-quality fruits.

Harvesting and Yield: Harvesting typically begins 35-38 days after planting and should be conducted every alternate day to maintain a preferred fruit size of around 125g. A yield of 40-50 t/acre can be achieved within 100-120 days.

Precautions for Harvesting and Post-Harvest Management (PHM) of European Cucumber Fruits:

- Harvest fruits during morning hours and avoid harvesting after 12 noon.
- Handle fruits carefully during harvesting, using harvesting secateurs if necessary.
- Grade fruits properly (A and B grades) before packing, ensuring separation of misshapen, oversized, small, diseased, and damaged fruits.
- Immediately transfer harvested fruits to shaded areas in plastic crates to prevent sunburn, which can render them unmarketable.
- Avoid immediate packing of fruits after harvest and ensure proper aeration to prevent spoilage.
- Transport fruits in well-ventilated vehicles to minimize damage, and aim to market them as soon as possible to avoid prolonged storage without cold storage facilities.

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