Cultivation Insights

Cucumber

Greenhouse Production of Long English Cucumbers

- Long English cucumbers are well suited for protected culture (greenhouse) production.
- Several options for growth media and vine training production systems are available.
- Environmental conditions and cultural procedures can affect the yield potential and fruit quality of Long English cucumbers.

Long English (European seedless) cucumbers are a popular choice for greenhouse production. These varieties are seedless, with a mild flavor and thin edible skins. The fruit are usually harvested when they are 12 to 14 inches long (Figure 1).[1] Long English cucumbers are parthenocarpic, producing fruit without being pollinated (fertilized), which is why the fruit are seedless.[1,2] The plants are also gynoecious (producing only female flowers) or predominantly gynoecious (rarely producing male flowers), minimizing the chance of flowers being pollinated (Figure 2). Long English varieties also have indeterminant growth; the vines will continue to grow until the terminal bud is removed.[1]



Figure 1. Long English cucumbers growing in a hydroponic system.

Production Systems

Cucumbers are grown in several greenhouse hydroponic production systems, including open trough, bag culture, nutrient film technique (NFT), upright containers, and rockwool blocks. The growth media used include perlite, coconut fiber (coir), composted pine bark, peat mixes, and rockwool.[1] The number of crop cycles per year can also vary. Two-crop systems start with planting in January and harvesting from mid-February to mid-July or August. A second crop is planted in August with harvesting from late September through November. In three-crop systems, the first crop is planted in December, with harvest from January to May. The second crop is planted in May with harvest ending in August, and a third planting in August with harvest ending in December. Some operations use a four-crop year-round cycle starting with larger transplants to allow earlier and shorter harvest periods.[3] Supplemental light is usually required for production during the winter, especially in northern areas.

Plant Raising

Seeds are started in soilless peat-based mixes or vermiculite in flats, or in rockwool or foam blocks.[1,3] With high seed costs and near 100% germination, usually only one seed is placed in each container with some overplanting (4 to 8%) to make up for any losses. Seedlings should be started in separate houses or areas well isolated from production areas to help maintain proper sanitation and disease management protocols. Seeds typically germinate in two or three days if incubated at temperatures from 80 to 85 °F (26 to 28 °C).[1,2,3] After germination, the temperature should be lowered to 74 to 77 °F (23 to 25 °C).



Figure 2. Male (left) and female (right) cucumber flowers.

Seedlings should be well irrigated and fertilized to minimize water and nutrient stress. If seeds are started in flats, seedlings are subsequently transplanted into rockwool blocks, at which time the nighttime temperature should be reduced to 70 to 73 °F (21 to 23 °C).[3] Seedlings should receive at least 16 hours of light per day, using supplemental light if needed. Some operations place seedlings in production houses when they reach the four- to five-leaf stage. Other operations transplant at the three- to four-leaf stage, but the younger seedlings require more care to ensure good root growth.[3] Staking the seedlings to help them maintain upright growth can help reduce damage when the plants are ready for stringing in the production house.[1,3]

Spacing

In rockwool or coir slab systems, seedlings are placed on slabs that are 36 to 40 inches (90 to 100 cm) long by 8 inches (20 cm) wide, with two to three plants per slab. The slabs are spaced to achieve the desired plant density.[3] The spacing/plant density used depends on the available light levels and the vine-training system used. In umbrella systems, plants are spaced more closely (0.14 to 0.15 plants/ft^2, 1.5 to 1.6 plants/m^2) during the spring and summer when light levels are high. Wider spacings (up to 0.10 plants/ft^2, 1.1 plants/m^2) may be needed when light levels are lower.[3] Larger spacings also can help improve fruit quality, length, and color.[3] Closer spacings (0.23 to 0.27 plants/ft^2, 2.5 to 3.0 plants/m^2) are typical in high-wire training systems.

Vine Training

Greenhouse-grown cucumbers are almost always produced on indeterminant vines trained to grow up a string attached to a wire seven to eight feet above the plant row.[2] In a conventional umbrella system, as the main stem grows up to an overhead

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support wire, fruit initials are removed from the first four nodes (first six nodes in low light conditions), and lateral vines are pruned out until the main stem reaches the wire. At that point, the vine terminal bud is removed, and two lateral vines from nodes just below the termination point are allowed to develop. The laterals are trained to grow in opposite directions along the support wire, and two secondary laterals develop from each of the primary laterals.[2] In a modified umbrella system, the main stem continues to grow after it reaches the support wire, and this stem is trained over a second, and optionally a third, overhead support wire.[2,3]

In a V-cordon system there are two support wires above either side of the row, spaced 30 inches apart. Plants are trained to grow up a string at an angle to one of the support wires with every other plant in the row trained to the right or left wire, forming a V-shaped arrangement down the row.[1,2,3]

In a high-wire system, vines grow up a string attached to the support wire. When the tip of the vine nears the support wire, the string, which is on a spool, is let out to lean and lower the vines, and the spool is slid down the wire. Lower leaves are periodically removed to improve airflow and light penetration.

Growing Conditions

The air temperature has a large effect on the balance between vegetative and generative (fruit-producing) growth, and the length, color, and development rate of the fruit. The 24-hour average temperature, as well as the day/night temperature differential, affect plant and fruit growth. A 24-hour average of 70 °F (21 °C) is optimal for cucumber production. Temperatures below 65 °F (18 °C) can slow growth, and above 95 °F (35 °C) can affect fruit set and quality.[1,2,3] Even day/night temperatures help promote vegetative growth and stand establishment early in the season. Increased day/night differentials help plants transition into generative growth for the harvest period. In the initial harvest period, day/night temperatures of 74/70 °F (23/21 °C) are recommended, while 74/64 °F (23/18 °C) might be used during peak production.[3] Avoid rapid temperature changes to help prevent dew formation on the leaves, stems, and fruit that can promote disease development.

Most greenhouse cucumber production involves hydroponic systems to supply levels of water and nutrients.[2] Complete nutrient solutions contain the macronutrients N, P, K, S, Ca, and Mg, as well as the micronutrients Fe, B, Mn, Cu, Zn, Mo, and Cl, which are required for optimal plant growth.[4] The pH of the nutrient solution (dripper) should be 5.3 and between 5.2 and 6.0 in the root zone (drainage). Nutrient levels, indicated by EC values, should be 2.2 mS/cm at the dripper and 3 mS/cm at drainage for inert substrates (rockwool) and 1.4 mS/cm for organic substraits (coir).[5] Cucumber plants can use three to four liters of solution per day to maintain adequate moisture levels. However, water and nutrient requirements vary with the environmental conditions and growth stages of the plant.[1,3,4] Lower nutrient levels can be used early in the season, as plants are becoming established, and increased up to full levels as the plants develop and enter the reproductive phase.[4] The water used for irrigation should be tested periodically, as water quality and pH can affect the availability of nutrients to the plant, and some nutrients may already be present in the water in low levels.[1,4] Plant tissue nutrient analysis during the season can be used to ensure that the appropriate levels of nutrients are being supplied to the plants. With a few exceptions, foliar nutrient applications are ineffective and do not usually result in increased yield or fruit quality.[4]

Fruit Development and Harvest

Some fruit initials may need to be removed to maintain a balance of vegetative and generative growth. The amount of pruning can vary depending on the production system and the time of year (light levels and temperature). Higher levels of fruit production can often be achieved in the summer as compared to winter production.[1,3] Because pollination of the fruit can result in distorted and off-flavor fruit, bees and other pollinators should be prevented from entering the house. Any distorted fruit should be removed immediately.[1]

Marketable cucumber fruit are usually ready for harvest 8 to 12 weeks after seeding (as soon as 10 to 11 days after anthesis), and maximum fruit length and diameter are usually reached 14 days after anthesis. Fruit should be harvested before any yellow color starts to appear at the blossom end.[1,2,3] Fruit usually need to be harvested three to four times per week, but daily harvest may be required at the peak of the season. Prompt harvest helps minimize the retardation of younger fruit and problems with over-maturation.

Once harvested, the thin-skinned fruit need to be covered and placed out of the direct sun to help prevent moisture loss. The fruit are often individually shrink-wrapped to help prevent desiccation and extend their shelf life. The optimum temperature for storage is 55 °F (13 °C) at 80 to 95% relative humidity (RH). Avoid exposing the fruit to ethylene gas, and do not store or ship cucumbers with fruits or vegetables that give off ethylene. Exposure to ethylene can cause cucumbers to turn yellow.[1,2,3]

Sources

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[2]Johnson, H. and Hickman, G. Greenhouse cucumber production. Aggie Horticulture. https://aggie-hort.tamu.edu/greenhouse/hydroponics/cucumber.html.
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Websites verified 10/22/1014

For additional agronomic information, please contact your local seed representative.

Performance may vary, from location to location and from year to year, as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on their growing environment. The recommendations in this article are based upon information obtained from the cited sources and should be used as a quick reference for information about greenhouse cucumber production. The content of this article should not be substituted for the professional opinion of a producer, grower, agronomist, pathologist and similar professional dealing with this specific crop.

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