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Grow a Masterpiece

A Modified Umbrella System for Cucumber Production

- A new cucumber production system has the potential to increase yield and lower labor costs.
- Allowing the main stem to continue to grow and produce fruit may result in steady fruit production.
- Using cucumber varieties with more open canopies may reduce the need for labor.

TRELLIS/PRUNING SYSTEMS

Several trellising-pruning systems are used in the greenhouse production of European-style cucumbers (Figure 1). Commonly used are the high-wire system, the umbrella (pinch) system, and the drape system.[1,2] Systems vary in the number of support wires used, the number of lateral vines allowed to develop, and the number of fruit allowed to develop on the main stems and laterals. In some systems, the main stem is pinched (the terminal growing point removed) when the stem reaches the overhead support wire, while in others the main stem continues to grow and produce fruit.

Figure 1. Cucumber vines supported by overhead wires.

Pruning the main stems, laterals, fruit initials, and leaves impacts plant growth and the micro-climate in the canopy. Single-stem plants tend to flower more quickly, produce harvestable fruit earlier, and produce heavier fruit than do multi-stem plants. However, multi-stem plants tend to produce more fruit per plant.[3] The number and size of fruit that a plant produces is affected by the number of leaves on the plant. More leaves can support more fruit, but more leaves also reduce air movement and light penetration, which can lead to more foliar disease and a delay in fruit maturation. Regular pruning of leaves and fruit initials helps maintain the proper balance between fruit load and vegetative growth. Pruning results in an increase in the amount of marketable fruit, increases the percentage of highly marketable fruit (#1 fruit), reduces the risk of certain diseases, and improves the ease of harvest. However, this level of maintenance also results in higher labor costs.[4]

Some operations primarily use compact cucumber varieties with relatively short internodes. These varieties have dense canopies and produce a lot of fruit per square meter, but they require more maintenance including regular leaf, lateral vine, and fruit bud pruning. With the increasing cost of labor, growers in some regions have started using varieties with more open canopy structures. These varieties often do not produce as many fruit per square meter, but the reduced need for labor can result in higher net profits. Using pruning systems that maximize fruit production with more open varieties can help improve profitability.

THE CONVENTIONAL UMBRELLA SYSTEM

In a conventional umbrella system, a main stem is trained to grow up to an overhead support wire. Fruit initials are removed from the first five or six nodes, and lateral vines are pruned out until the main stem reaches the support wire. Once it reaches the wire, the vine terminal 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.

Approximately six fruit develop on the main stem, and three fruit develop on each of the two primary and four secondary laterals. Using open-canopy varieties with this system, the total number of fruit produced in a four-crop season will usually not exceed 160 fruit per m^2. Also, there is a delay between the production of fruit on the main stem and the fruit produced on the laterals in this system.[5]

A MODIFIED UMBRELLA SYSTEM

Some growers have started using a modification of the umbrella system to increase the total number of fruit produced and eliminate the mid-season delay in fruit production. In this 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 (Figure 2). Five primary laterals develop from the main stem, with one trained over the first support wire in one direction. A second lateral is trained over the first wire in the opposite direction. A third lateral

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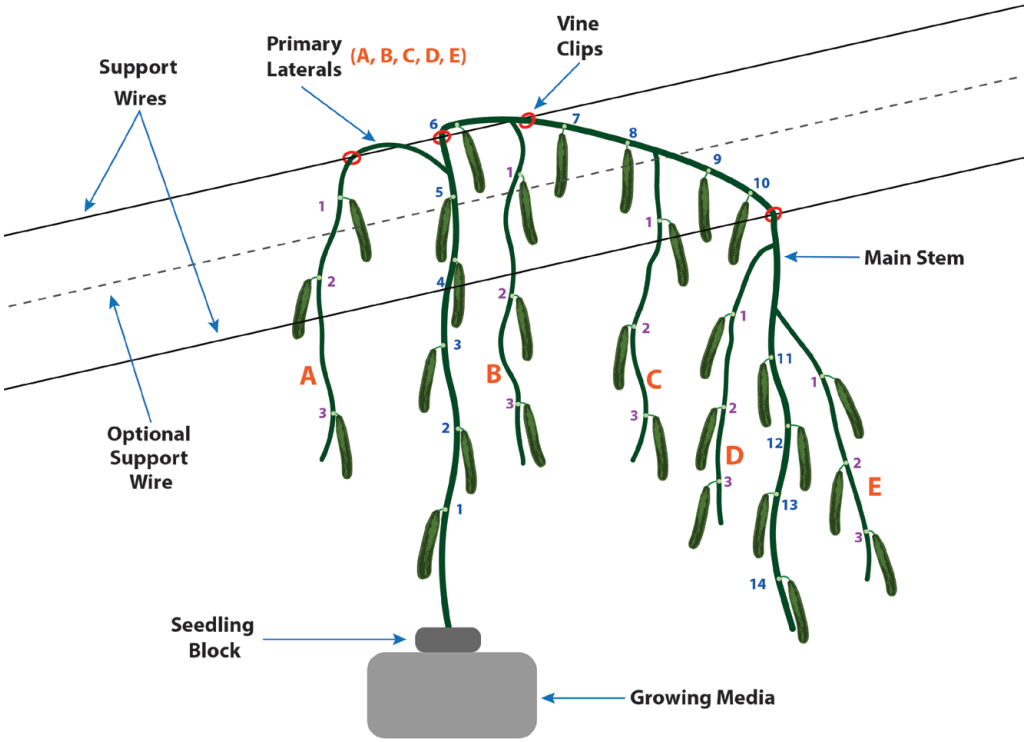

Figure 2. In the modified umbrella production system a total of 29 fruit are produced on each plant.

develops between the two support wires in a two-wire system, or over the second wire in a three-wire system. The fourth and fifth laterals develop once the main stem reaches the second wire, or third wire in a three-wire system.

A potential total of 14 fruit are produced on the main stem. Six fruit can develop on the section of the main stem growing up to the first support wire. Once the main stem has reached the first wire, fruit continue to develop until a total of 14 fruit have formed on the main stem. Three fruit can develop on each of the five lateral vines. In this system, a potential total of 29 fruit [(3 x 5) + 14 = 29] are produced per plant. With open-canopy varieties, a potential total of 175 to 178 fruit can be produced per m^2 in a four-crop season with this system.

ADVANTAGES OF THE MODIFIED SYSTEM

The modified system can potentially produce more fruit per plant (potentially 29 vs. potentially 24). The fruit tend to be larger and have a better shape, with fewer less marketable (#2) fruit. A grower in the Niagara/Ontario region observed a decrease in #2 fruit from 6% to 2% when using the modified system.[6] Another advantage is that there is no mid-season lag in fruit production as fruit continue to develop on the main stem throughout the growing season. Because fruit production can be more even, there can be less stress on the root system, and the healthier root system can result in better plant growth and fruit production later in the season. With the conventional umbrella system, the lag and second flush of fruit production can stress the root system, which can be detrimental later in the season. The modified umbrella system can create a better growing environment, which may lead to stronger plants and a better plant balance to the end of the production cycle. Because of the healthier plants at the end of the cycle, there may be an option to extend production for a couple of weeks vs. traditional umbrella system.

In a high-wire system using compact-canopy plants, fruit production of up to 200 fruit per m^2 can be achieved. However, there are significant labor requirements associated with this system of production. With the increasing cost and limited availability of labor, this system is becoming less profitable and more difficult to accomplish. Using the modified umbrella system with open-canopy varieties results in somewhat lower levels of production, but that production is in a system that may have significantly lower labor requirements resulting from less pruning and easier harvest.

An open canopy results in better air flow and light penetration, often resulting in conditions that are less favorable for disease development. An open canopy also allows better penetration of fungicide sprays, potentially increasing the effectiveness of treatments and reducing the number of sprays needed for disease control.

Sources:

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[4] Antonius. 2013. Pruning cucumbers in greenhouses: Selecting a cucumber pruning system. Commercial Hydroponic Farming. https://www.commercial-hydroponic-farming.com/pruning-cucumbers-greenhouses/.
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[6] Przytocki, Y. 2019. Personal communication.
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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 the grower's fields. 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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