GROWERTALKS

Features

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Dialing in the Heat

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More consumers are interested in the home-gardening experience and producing their own containerized edible crops in non-traditional garden spaces like outdoor patios, balconies, sunrooms, under indoor grow lights and even the kitchen counter. The term "container edibles" refers to fruiting and vegetable crops, culinary herbs and sometimes leafy greens, which are intended to be grown in containers by consumers instead of being transplanted into a landscape. These varieties are often bred to be more compact and are marketable when they display a mix of flowers and ripening fruit.

Compared to traditional flowering crops, compact container vegetables can be tricky for greenhouse growers to schedule because you must account for the time required to produce both flowers and ripe fruit. Successfully hitting critical market windows requires precise knowledge of crop timing and how it's influenced by environmental parameters like temperature.

In this article, we share findings from our recent ASHS research publication in HortTechnology titled "Short Report: Temperature Effects on Plant Development Rate and Quality of Compact Container-grown Cucumber and Hot Pepper." This research quantified how temperature drives the development of compact cucumbers and peppers, and provides guidelines to help growers accurately schedule these crops.

Temperature: The driver of plant development

Temperature is the main driver of plant development, essentially governing the speed at which a plant moves through its life cycle. As temperature increases, the rate of development typically speeds up for the production of new leaves, flowers and fruit. This acceleration occurs up to a certain point, after which the plant becomes heat stressed and development begins to slow. Past research in floriculture has established clear relationships between 24-hour average daily temperature (ADT) and development rates. This information allows growers to manipulate greenhouse setpoints to speed up or slow down a crop to meet specific deadlines.

The "base temperature" refers to the low temperature at which the plant stops developing. Growing crops below this

floor will likely stall growth. This number also indicates the temperature at which growers can begin to hold crops. It can also help in categorizing crops as either cold-sensitive (high base temperature) or cold-tolerant (low base temperature), which may influence how you zone your facility or where you place crops. Growing close to the base temperature might save on the heating bill, but growers should be careful the resulting delay in production doesn't cost more in lost bench turns than the energy savings were worth.

For container fruiting and vegetable crops, the stakes of temperature management are similar to floriculture crops. For example, excessively high temperatures can cause flowers and fruit to drop, as well as poor pollination, ruining the crop before retail. Depending on the plant species, too much or too little heat can significantly delay the crop, and too much heat can cause flowers and fruit to be smaller with shorter longevity.

A closer look at the research

To help growers dial in their scheduling, we conducted trials at the University of Arkansas evaluating temperature effects on timing and quality for compact cucumber, pepper and tomato. This article focuses on Patio Snacker Cucumber and Taquito Hot Pepper (Kitchen Minis line, PanAmerican Seed), selected for their consumer popularity and their contrasting short (cucumber) and long (pepper) crop timings.

The research was conducted across five greenhouse compartments with temperature set-points ranging from 68F (20C) to 86F (30C). Patio Snacker seed and Taquito transplants were grown in 6-in. and 4.5-in. standard containers, respectively. Cucumbers were trellised and pinched at 18 in. per commercial guidelines. All plants were grown on flood benches and sub-irrigated with a 17-5-17 water-soluble fertilizer solution. We defined a "marketable" plant based on retail standards: for Patio Snacker, the first fruit reaching 3 in. (7.6 cm) in length, and for Taquito, when at least one fruit had fully transitioned from green to its final ripe red color. We also tracked total fruit count and average fruit weight at finish.

Key findings: Speeding up the crop

Increasing the greenhouse temperature significantly accelerated development and shortened crop timing for both species. Cucumber plants reached marketability in 29 to 57 days, while pepper plants required 56 to 109 days. These wide ranges illustrate exactly how much control you have over your bench turns by managing the average daily temperature.

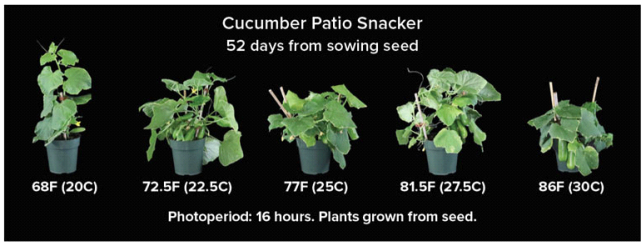
Our research estimated a base temperature of 64.8F (18.2C) for Patio Snacker Cucumber and 64F (17.8C) for Taquito Hot Pepper. Since these values are relatively high, we categorized these as cold-sensitive crops. A practical strategy for these varieties is to ensure nighttime heating setpoints stay at or above 64F (17.8C) to avoid significant delays and low-temperature stress.

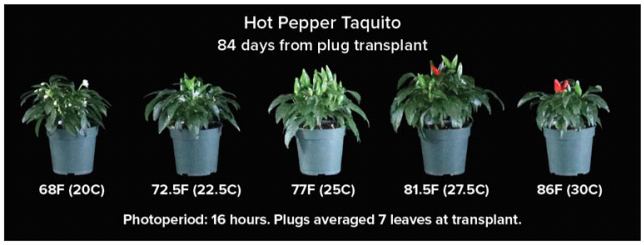
Table 1

	Days to a marketable and finished crop				
Crop	68F (20C)	72.5F (22.5C)	77F (25C)	81.5F (27.5C)	86F (30C)
Patio Snacker Cucumber	57	42	35	32	29
Taquito Hot Pepper	109	83	71	63	56

Scheduling cheat sheet

To simplify crop scheduling, Table 1 serves as a "cheat sheet" showing the expected crop times at various temperature set-points. As the data shows, bumping the temperature from 68F (20C) to 77F (25C) shaves nearly three weeks off a cucumber crop and nearly six weeks off a pepper crop.





Finding the "sweet spot"

While plants finished the fastest at 86F (30C), pushing the heat that high revealed several quality trade-offs, including significantly smaller fruits and a lower total fruit count per plant. At these high extremes, the plant's reproductive balance shifted—instead of setting fruit, the plants produced more flowers that ultimately failed to set. This is likely due to heat stress and a natural "flushing" or abortion phenomenon common in peppers and cucumbers. Pollination also suffers under these high temperatures.

We found that growing these container vegetables at approximately 77F (25C) resulted in the near-optimal combination of a short crop time, large fruit size and a high fruit/flower load at finish. This "sweet spot" allows growers to maximize production speed without sacrificing the quality customers expect. Other practical tips include providing a high daily light integral (DLI), avoiding over-fertilization with nitrogen and keeping nighttime temperatures above the 64F (17.8C) base temperature floor. **GT**

Access the full research publication HERE.

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