

# BELL AND CHILE PEPPERS



*Presented by*



**WIFSS**  
Western Institute for  
Food Safety & Security

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This production summary provides an overview of bell and chile pepper growing, harvesting, and post harvesting practices. There are some common practices that many large commercial growers use when producing peppers, and though there are variations in these practices, having an understanding of the most common methods used will be helpful when carrying out regulatory activities.

## By the end of this summary, you will be able to:

1. List the top producing regions in the U.S. for bell and chile pepper production.
2. Describe the differences between bell and chile pepper production and market structures.
3. Identify the most common farming practices used in the production of bell and chile peppers including the use of equipment and manual labor.
4. Identify the most common farming practices used in different growing regions.

## INTRODUCTION

The United States ranks fifth in the global production of green peppers, which includes both chile and bell peppers. China produces the largest quantity of green peppers followed by Mexico, Turkey, and Indonesia. India is the largest producer and exporter of dried chile peppers.

The top bell pepper states in the U.S. are California, Florida, Georgia, New Jersey, Ohio, North Carolina, and Michigan. The top chile pepper producing states include California, New Mexico, Texas, and Arizona (Fig 1).

Bell and chile peppers are consumed as fresh, dried, ground as spices, and processed (such as canned, pickled, brined, or in salsas).



Bell peppers are grown for both fresh and processed markets. These include varieties with the traditional “blocky” three to four lobe shape as well as longer more pointed varieties known as European Lamuyo types. Both hybrid and open-pollinated varieties are popular, with a trend toward greater use of hybrids. Hybrids have a high seed cost. To control costs, growers use transplants rather than direct seed. Open-pollinated varieties can be either transplanted or seeded in the field.

Common bell pepper varieties used for commercial production include: Aladdin, Aristotle, Brigadier, Double-Up, Polaris, Telestar, and Wizard-X3R to name a few.

Chile peppers comprise a wide variety of pepper types and range in size and shapes. Some are small cherry-like fruits while others are conical forms or slender fruits up to 9 inches long. Their flavor ranges from mild to extremely

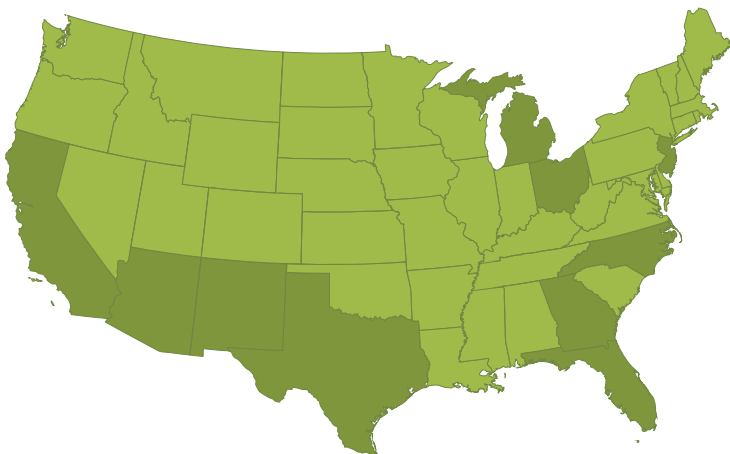


Fig 1 - Top Pepper Producing States in the US

pungent. For example, Anaheim peppers are relatively mild while habanero peppers are extremely pungent. Pungency is associated with the presence of capsaicin, a colorless, odorless alkaloid that is concentrated in the plant tissue.

Common chile pepper groups and varieties include:

1. **Paprika** pods are long dark red with little pungency. They are used for the production of red pigment and flavoring.
2. **Jalapeño peppers** are often harvested as green fruit for fresh-markets. A sizable proportion of the production is also sold to processors.
3. **Anaheim or New Mexican**, are long, cylindrical peppers 7 to 9 inches long. They are harvested green for fresh use as well as canning. Red dried pods are ground and used in sauces.
4. **Wax or banana peppers** vary greatly in size and shape. They are usually yellow when immature and can be sweet or pungent when used fresh or for pickling.

There are many other varieties, including habanero, poblano, and aji chiles, which are used in Tabasco.



Heavier soils can be quite productive, provided they are well drained and irrigated.

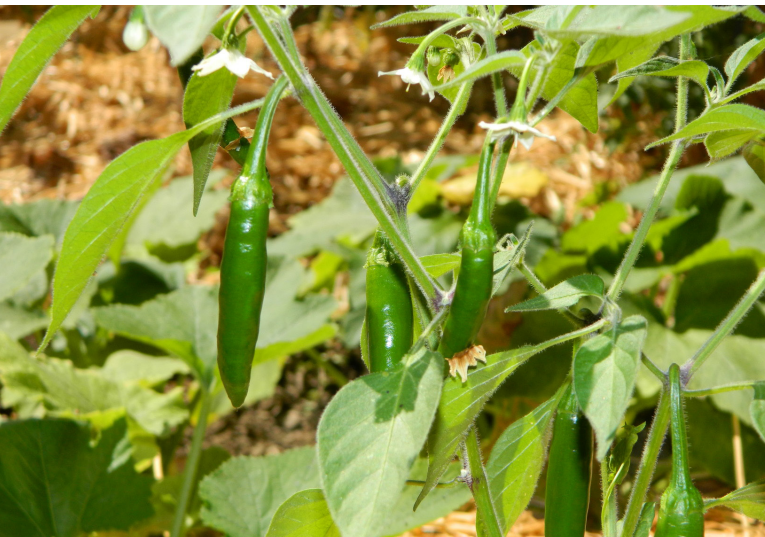
For both bell and chile peppers, raised beds are more efficient since they warm faster, reduce space needed to grow vegetables, reduce irrigation needs, improve drainage, and provide greater weed control.

Raised beds are spaced six feet between each other. Bed width varies from 30 to 72 inches with one or two rows of plants per bed. Plant spacing ranges from 8 to 16 inches in each row. Where direct seeding is done, 0.5 to 2 pounds of seed per acre is used.

Peppers for fresh market are staked for support, particularly in fields to be harvested at mature fruit color. These practices maximize early harvest and yield, which helps to compensate for high cost of land and water.

Peppers grown for processing do not use stakes or plastic sheeting over raised beds. Growers are less concerned with minor quality defects and are more concerned with lowering production costs. Typically peppers destined for processing are harvested once, while fresh market fields are harvested two to three times.

Soil borne fungal diseases can be a serious problem for growers. This is a problem when plants receive excess irrigation or rainfall. Fumigation is used to control soil insects, pathogens, nematodes, and weeds.



## GROWING

Bell and chile peppers are warm-season crops, sensitive to freezing temperatures at any growth stage. The ideal growing temperatures range from 75° to 85°F, with night temperatures ranging between 50° to 60°F. The plants can tolerate up to 100°F but pollination, fruit set, and yield can be negatively impacted.

Many soil textures are used for bell and chile pepper production. Sandy soils are preferred for the earliest plantings because they warm more rapidly in the spring.



### **Bell Peppers Specifics**

In Florida, bell pepper production varies by area. Most of the state's crop is transplanted on raised beds in double rows that are protected with plastic sheets. Beds are usually fumigated before planting to manage for soil insects, pathogens, nematodes, and weeds. In other parts of the state and U.S., growers may not fumigate or use plastic sheets, depending on local conditions.

Protected-culture production practices for bell peppers come in many forms, such as greenhouses and high tunnels. This form of production allows the grower some control of weather events, pests, water, land use, pesticides, and fertilizer inputs. According to A.C. Nielsen data, peppers grown in greenhouses account for more than one-fourth of total pepper sales with volume of sales increasing rapidly from year to year.

Most of California's bell pepper production is irrigated using a drip-irrigated system and, to a lesser extent, furrow irrigated. Drip irrigation consists of a buried water line 2 to 10 inches deep with either one or two drip lines per raised bed. When furrow irrigation is used in other states, water is channeled along parallel trenches on either side of the raised beds. Water seeps into the raised bed to irrigate the plants' roots. An overhead sprinkler is often first used to establish the seedlings until they germinate.

Bell peppers are one of the most heavily fertilized crops grown in California. Soils are normally fertilized with nitrogen, potassium, and phosphorus prior to seeding as a side dressing or through the growing season by drip irrigation.

### **Chile Peppers Specifics**

Growers use a variety of methods to plant chile peppers including direct seed and transplants. There are a host of hybrid varieties, which promise higher yields. Typically, chile peppers are grown as double rows on raised beds, 60

to 72 inches apart, with plastic sheets covering the raised beds and buried drip irrigation. Depending on soil types and locations, much of the acreage is fumigated for insect control or fungus before transplanting. In some coastal regions and especially in California, growers will start plants under plastic tunnels to provide early season frost protection.

Most chile peppers are drip irrigated using buried tape, but some growers prefer furrow irrigation. Care must be taken to not over water based on soil and environmental conditions. Overhead sprinklers are typically first used on starter transplants or seedling plants. They are seldom used for the entire production season due to the potential for inducing rot or other moisture related stress such as reduced fruit set.

Chile peppers require moderate amounts of fertilization. Most growers apply nitrogen and phosphorus before planting that can last throughout the entire growing season. If additional applications are necessary, side dressing or water soluble applications can be added to the drip irrigation system. Side dressing allows the nutrients to leach through the soil to reach the plant's root systems.



In the United States, bell peppers are produced and marketed year round and mostly sold as fresh produce. California's shipping season runs from April to December, with peak volume from May through July. Florida shipments run from October through the following July, with peak volume between March and April. In addition to field-grown peppers, greenhouse bell peppers are marketed throughout the year.

Bell peppers may be harvested when they reach the immature green stage or after they mature to their full color,

red or yellow, depending on the variety. It is not uncommon for immature and mature peppers to be harvested from the same field. This decision depends on current market price. Processing peppers used for freezing or dehydrating provide a secondary market for bell peppers.

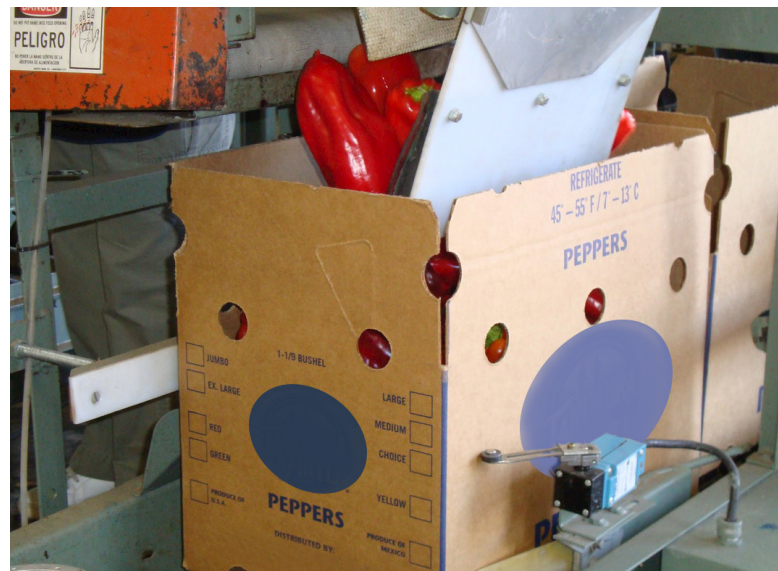
Fields of fresh-market peppers are harvested by hand every week over four to six weeks. Nearly all bell peppers are harvested by hand and packed into bulk bins or trailers for transit to a packinghouse. A limited number of growers pack in the field from a mobile packing platform.

Most of the crop is sold as mature green peppers, but growers receive a premium for a limited amount of other colors. Colored bell peppers follow the mature green state and color up as they ripen on the vine. The premium reflects the fact that bright-colored bell peppers (red, yellow, orange, purple, brown, and black) are costlier to produce, field losses are higher, and yields are lower than those harvested at the green stage.

Chile peppers destined for the fresh market are harvested two to four times at 10 to 15 day intervals, while peppers destined for processing are picked once or twice.

Many chile peppers are harvested green before the development of the mature color. However, some chile types, such as Paprika and Anaheim, are harvested in the mature red color. There are many industrial uses for the red pigment that Paprika possesses, such as food coloring. A large percentage of chile peppers in California and New Mexico are harvested for processing into salsas or canned whole. The remaining peppers are harvested for the fresh market.

Nearly all chile peppers are harvested by hand into bulk bins or trailers for transit to the packinghouse. Mechanical harvesting equipment has limited use and is primarily used for chile peppers that will be further processed.



## PACKING

Post harvesting techniques for both bell and chile peppers include washing peppers with water containing 75 to 100 ppm chlorine. Excess water is removed.

The fruit are graded by size and condition.

The standard unit of sale is a carton holding approximately 26 to 28 pounds of fruit. Some growers of specialty bell peppers pack fruit in smaller cartons.

Chile peppers for processing are packed into bins and transported to processing plants for canning, brining, freezing, and drying. Some chile peppers may be exported.

Shippers may apply a food-grade wax to the majority of commercially produced bell or chile peppers to reduce moisture loss and scuffing during marketing. This can also extend storage life, which under ideal conditions can range up to three weeks.

Cartons are palletized and, when cooled, are shipped primarily by truck to terminal markets or wholesale receivers across the United States.



Field heat is removed to improve post-harvest quality. Peppers are cooled before shipment or storage either by hydrocooling or by forced air. Peppers are sensitive to chilling injury below 45°F.

Typical transit and storage conditions are 45° to 55°F, with high humidity of 90 to 95%.

Fresh market chile peppers are cooled by forced air methods. Ideal storage and transit temperatures range between 45° to 50°F. When held at proper temperature and humidity, storage life can be extended by two to three weeks. Chilling damage can occur if temperatures drop below 45°F. Conversely, if temperatures exceed 50°F, the fruit can prematurely ripen causing flavor and discoloration issues.

All peppers are sensitive to ethylene producing fruit such as tomatoes, avocados, or cantaloupes. Exposing or storing peppers with these other fruits can hasten shelf life.



**Having a basic understanding of the way bell and chile peppers are grown, harvested, and cooled will provide the basic background information that will be helpful to regulators when completing inspections or investigations in the field.**

*The agricultural practices described in this production summary are common on most large commercial farms like those found in major peppers producing regions in the United States. There are undoubtedly variations in these practices depending on the region, operation size, and individual grower preferences. This is especially true of farms outside of the U.S.*

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