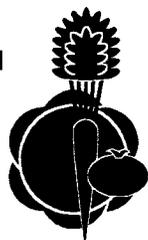


**VEGETABLE RESEARCH
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**Vegetable Production
Series**



PUMPKIN PRODUCTION IN CALIFORNIA

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PRODUCTION AREAS AND SEASONS

Although pumpkins (*Curcubita pepo* L. var *pepo*) are grown in most counties of California, production tends to be concentrated near population centers because most pumpkins are sold in local markets or directly to consumers. San Joaquin County produces the most, followed by Sutter County. Although most pumpkins are grown for the Halloween season, they are also grown for ornamental purposes and for processing. Planting dates depend on the variety's growth rate: most are planted in June or July for Halloween harvest. As with melons and other cucurbits, the buildup of whitefly populations in Southern California's low desert during the spring and summer increases damage and disease to the point where pumpkins cannot be grown for fall harvest.

PUMPKIN ACREAGE AND VALUE

Year	Acreage	Average yield (tons/acre)	Grossvalue/acre
1995	5,381	14.66	\$1,867
1994	5,517	14.05	\$1,370
1993	6,381	13.27	\$1,178

Source: Annual California Agricultural Commissioners' Report Data (Sacramento: California Department of Food and Agriculture, 1994-96).

VARIETIES AND PLANTING TECHNIQUES

The principal Halloween pumpkins are the "jack-o-lantern" varieties and ornamental mini-pumpkins. The most frequently planted jack-o-lantern type is Howden, the long-standing commercial leader. Several cultivars have been developed in recent years with special attention given to improved color, yield, consistency, or size, including Connecticut Field, Kentucky Field, Jack Pot, Happy Jack, Jumpin Jack, Big Autumn, and Aspen. These newer varieties tend to be smaller and the plants more compact and bushy than vining types such as Howden. Jack-o-lantern pumpkins tend to range from 10 to 20 pounds (4.5-9 kg), although size is management related. Characteristics of a high-quality jack-o-lantern include deep, rich orange color, upright

shape, and a strong handle (stem).

Ornamental varieties include Jack Be Little, Mini-Jack, Munchkin, Sugar Pie, and Sweetie Pie (orange mini-pumpkins); Lumina (a white jack-o-lantern pumpkin); and Baby Boo (a white mini-pumpkin). There are also numerous smaller jack-o-lantern or ornamental types weighing from 1 to 10 pounds (0.45-4.5 kg), such as Oz, Spookie, and Little Bear. "Mammoth" varieties have been bred for exceptional size. These Mammoth varieties are not true pumpkins but are *Cucurbita maxima*, which are more closely related to Hubbard squash.

Other varieties such as New England Pie have a high dry-matter content, which allows a pie to cook evenly, and varieties such as Triple Treat and Trick-or-Treat have edible, hull-less seed. If pumpkins are grown for processing, the processor generally specifies the variety or processes a hard squash such as butternut and cans it as "pumpkin."

Pumpkins typically require 90 to 120 days from emergence to maturity. Timing of planting is critical. Although varieties are rated according to the number of days to maturity, the actual growth time varies with average temperatures and solar radiation (more time is required in cooler coastal areas). Halloween pumpkins should be mature and have a good color 1 to 4 weeks prior to Halloween. Because pumpkins store well under ambient conditions, there may be advantages to harvesting the crop early and storing it for a few weeks: early crops may have less damage from insects or diseases and require fewer sprayings. Jack-o-lantern or ornamental pumpkins that fail to mature prior to Halloween have little value.

CULTURE

Vining varieties such as Howden are typically planted in wide rows where vines are allowed to run. Newer varieties that have a more compact, bushy growth habit are more suitable to closer row spacing. Although vining types need more space for optimum production, as the planting density increases, a greater number of smaller fruit are pro-

duced. Growers can manipulate variety, density, irrigation, and fertilization to produce the optimum size desired by buyers.

Vining jack-o-lantern pumpkins are usually grown with spacings of 3 to 5 feet (0.9–1.5 m) between plants and 6 to 10 feet (1.8–3 m) between rows. Some growers hand-plant in hills with these spacings and leave two plants per hill. In some areas growers use the traditional 40-inch (100-cm) beds and plant every other bed. Smaller types and mini-pumpkins, as well as varieties developed for home gardens, may be spaced much closer together, with as little as 2 to 3 feet (0.6–0.9 m) apart in the row and 3 to 4 feet (0.9–1.2 m) between rows. Processing types are generally grown at higher plant populations. Approximately 2 to 3 pounds (0.9–1.4 kg) of seed is required for a final stand of 3,000 to 4,000 plants per acre. Growers commonly plant excess seed and thin plants to the desired plant spacing.

SOILS

Pumpkins are grown on a wide range of soils. Growers on soils with a high clay content may have more problems with root and stem diseases because of the wetter soil surface and higher humidity in the lower canopy. These growers often see a benefit from planting on raised beds. Managing the crop on heavier soils is often aggravated by excessive moisture or poor irrigation management. Sandy soils also require close attention to water management (more frequent irrigation) to avoid moisture stress and interruption in foliage or fruit growth.

IRRIGATION

Water management is critical to the development of vigorous vines and the maintenance of the foliage canopy, which support fruit growth and protect developing fruit from sunburn. Most pumpkins are grown with sprinkler irrigation, but drip and furrow irrigation are also used. Frequent irrigation aggravates root and stem rot problems and increases humidity in the lower canopy, which contributes to foliage and fruit diseases. Irrigation management should emphasize infrequent, deep watering to encourage deep root development and allow time for the soil surface to dry between waterings.

FERTILIZATION

Growers commonly apply 200 to 400 pounds per acre (224–448 kg/ha) of granular complete fertilizer preplant followed by one or two banded applications of nitrogen (N). Nitrogen may also be applied through drip irrigation systems. Typically, total N used by the crop is from 75 to 130 pounds per acre

(84–146 kg/ha). It is best to use soil analysis as a guide to fertilization for phosphorus, potassium, and other secondary and minor elements. Although there are reports that pumpkins respond to potassium fertilization, optimal fertilization rates for pumpkins have not been established in representative growing areas in California.

POLLINATION

Pumpkins require bee pollination to produce optimal yields. For optimal yields of smaller ornamental pumpkins, a much higher percentage of pollinated flowers is necessary than with larger pumpkins. Each flower is only receptive for one day and multiple visits may be required for optimal pollination. Although many growers rely primarily on native bees to provide pollination, it is best to introduce one beehive per acre of pumpkins very early in the blooming period so that adequate numbers of bees are present and the bees can establish a pattern of visits to emerging flowers. Symptoms of poor pollination include misshapen fruit or fruit that fail to enlarge or turn brown at the blossom end.

INTEGRATED PEST MANAGEMENT

Contact the UC Davis IPM World Wide Web site at <http://www.ipm.ucdavis.edu> or your local county Farm Advisor for current pest management information (see *UC IPM Pest Management Guidelines*, DANR Communication Services Publication 3339).

Insect management. The larva of the seed corn maggot (*Delia platura*) feeds on and destroys the germinating seed of pumpkin. Apply registered insecticides at planting if maggots are suspected. Wireworms (*Limonius* spp. and others) can kill young plants and weaken older ones by feeding on the root system. Squash bugs (*Anasa tristis*), which have sucking mouth parts, kill pumpkin leaves and vines. They lay reddish brown, barrel-shaped eggs in masses on leaf undersides, and the juveniles actively feed on the fruit and foliage.

In milder southern and coastal areas, the silver-leaf whitefly (*Bemisia argentifolii*) and greenhouse whitefly (*Trialeurodes vaporariorum*) are not killed by winter temperatures and populations rise gradually throughout the spring. This pest may build to serious levels and require treatment with a registered insecticide. Aphids also cause problems by weakening the plant through feeding, and both whiteflies and aphids are also vectors of viral diseases.

Leafminers (*Liriomyza* sp.) may damage cotyledon leaves. Natural predators are usually able to control leafminers as long as the predators are not eliminated by repeated applications of broad-spectrum

insecticides. The western spotted cucumber beetle (*Diabrotica undecimpunctata*) and western striped cucumber beetle (*Acalymma trivittatum*) can attack in large numbers and feed on younger and older plants. The larvae feed on the roots and underground parts of the stem, and the adults feed in flowers (causing blossom drop) and on developing fruit. Cucumber beetles may be present in large numbers on young seedlings and often require spraying with a registered insecticide for sufficient control to avoid serious economic losses.

Several species of armyworm (*Spodoptera* spp.) and looper (*Trichoplusia* spp.) larvae can also damage pumpkins. These larvae feed on foliage and occasionally damage fruit. They can be controlled with registered insecticides and biological controls such as *Bacillus thuringiensis*.

Disease management. Powdery mildew (*Erysiphe cichoracearum*) is common in pumpkin fields throughout the growing season. This fungal disease can be a problem at any time in coastal growing areas and in late summer and fall in the inland valleys. Growers recognize it as a white powdery growth on upper and lower leaf surfaces. If not controlled, the disease completely destroys the foliage, and any fruit that survives will be sunburned and discolored. The loss of productive vines also severely restricts fruit yield and size. At present fungicides are the only control for powdery mildew, although seed companies are attempting to develop mildew-resistant varieties. Fields should be frequently and carefully scouted and registered fungicides applied at the first sign of the disease.

Gummy stem blight (*Mycosphaerella melonis*) can cause serious problems on stems, leaves, and fruit of pumpkins. This fungal disease is often first noted as a developing rot in the lower vine stem area but also may affect foliage. If infection comes late in the season, fruit may soften or discolor or the stems of the fruit may shrivel, reducing the value of the fruit. Fruit may appear normal at harvest but may collapse in the stem scar area after shipment or sale.

Charcoal rot (*Macrophomina phaseoli*) affects pumpkins and other cucurbits. Leaves of the crown area turn yellow and wither. If the disease spreads, vines may wilt and die. The causal organism is a soilborne fungus with a wide host range and is common on most soils in the Central Valley. The fungus tolerates high temperatures and dry soil, and the disease is favored by water-stressed plants and high temperatures.

Phytophthora root rot (*Phytophthora capsici* and others) is a serious fungal disease of pumpkins and squash where soils are wet for extended periods.

Phytophthora may cause root rot, stem lesions, or foliar blight. Fruit may also be severely infested and rot. Warm temperatures of 68° to 80°F (20° to 27°C) and poor drainage favor development of this disease. *Phytophthora* can move rapidly, and disease incidence may be higher in fields planted after tomatoes or peppers.

Fusarium crown and root rot, also called *Fusarium* fruit rot (*Fusarium solani* f. sp. *cucurbitae*) may affect the lower stem or crown area, causing plants to wilt and die. Fruit in contact with the soil may also be affected by dry ring-shaped lesions, diminishing the market value of the fruit. The fungus survives on soil and seed and is most common on the central coast. Control of *Fusarium* depends on long-term rotation out of cucurbits (four years or more) and the use of clean seed.

Like many other cucurbits, some of the most serious diseases of pumpkins are caused by viruses. Of the viruses affecting pumpkins in California, those of most importance are transmitted by aphids, whiteflies, leafhoppers, and beetles. Virus transmission is specific, however. Viruses such as cucumber mosaic virus (CMV), watermelon mosaic virus (WMV), zucchini yellow mosaic virus (ZYMV), and papaya ringspot virus (PRV) are transmitted by aphids in a nonpersistent manner, requiring only seconds to a few minutes for the aphids to probe the leaf surface and transmit the virus. Conversely, the recently discovered cucurbit aphid-borne yellows virus (CABYV), which has proven to be particularly widespread in California pumpkins, is transmitted only when the cotton melon aphid (*Aphis gossypii*) feeds on the plant phloem.

Many of these viruses are present in native plant species, in rangeland, or in other crop plants and are readily transmitted to developing pumpkins as the insect vectors move into pumpkin fields. If possible, other cucurbits should not be grown in the same area prior to planting pumpkins to avoid movement of virus from one crop to another. It is always desirable to plant succeeding crops of pumpkins or other cucurbits upwind of previously planted cucurbit crops. Other crops such as peppers may also harbor a number of viruses that can also affect neighboring cucurbit crops.

HARVESTING AND HANDLING

Pumpkin production across a broad range of environments has shown that the jack-o-lantern types such as Howden or Connecticut Field will typically yield 1,000 to 2,500 marketable fruit per acre weighing a total of 10 to 25 tons (11–27.5 t). Smaller varieties will produce 2,000 to 6,000 marketable fruit per

acre weighing a total of 5 to 10 tons (5.5–11 t).

Pumpkins can be harvested when the outer skin is even-colored and hard. (The side touching the soil may be lighter colored.) The fruit should be cut from the vine leaving 3 to 5 inches (7.5–12.5 cm) of stem. Harvesters should try to avoid handling fruit by the stem.

Optimal storage conditions for pumpkins are 50° to 55°F (10° to 13°C) at 50 to 70 percent relative humidity. Pumpkins are sensitive to chilling injury at low temperatures. Many pumpkin producers in California find that pumpkins will hold for 3 to 6 weeks in early to mid-fall simply by keeping them on racks or in bins in a well-ventilated shaded area. Pumpkins generally cannot be held beyond 90 days even in ideal storage conditions. A 10- to 20-day curing period at 75° to 80°F (24° to 27°C) to cure mechanical injury and mature the fruit before storage is sometimes recommended for pumpkins and

winter squashes. Experiments in New York state, however, have shown that preliminary curing for 3 weeks at 80°F (27°C) before refrigerating did not markedly improve storage.

MARKETING

In California, about 90 percent of pumpkins are grown for the Halloween market, when they are often sold directly from the field or farm stand to the public. Some farm stands and “U-Pik” operations have created pumpkin festivals such as the one in Half Moon Bay, where sales increase markedly due to the large number of people who turn out for the event. When pumpkins are shipped to the wholesale market, they are shipped in bulk bins or stacked loose in trailers. California has recently increased its share of national pumpkin production to 25 percent, followed by Texas, Washington, Michigan, and New York.