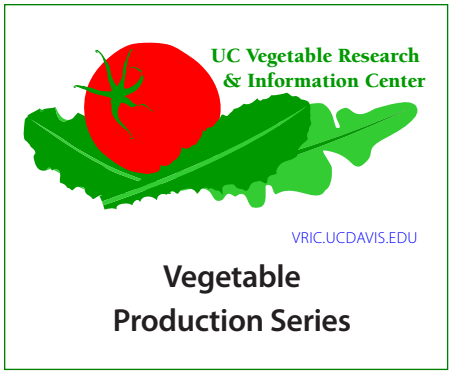

GREEN ONION PRODUCTION IN CALIFORNIA

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PRODUCTION AREAS AND SEASONS

Green onions (*Allium cepa* L.) are produced mainly in Monterey, Riverside, and Ventura Counties, but there is also small-scale production in other parts of the state. Harvest and bunching of this crop is labor intensive, and over the last several years substantial production has moved to Mexico, where the crop is less expensive to produce. Green onions are planted from spring through fall for nearly year-round harvest.

CLIMATIC REQUIREMENTS

Onions are cool-season biennial plants (requiring two seasons to complete the cycle from seed to seed) that are commercially grown as an annual crop. Bulbing and growth are highly sensitive to day length. Each variety has a critical day length at which bulbing is initiated, regardless of size. As days lengthen in the spring and summer, these critical day lengths are reached.

Growth is also dependent on temperature. The minimum for emergence is higher than for most other cool-season vegetables, at 55ºF (12.8ºC) for 70 percent emergence in up to 2 weeks. In addition, early growth rate is slow compared with other cool-season crops. Optimal leaf growth rate occurs at 68º to 77ºF (20º to 25ºC). However, the total plant growth rate depends on the amount of light intercepted. Combinations of factors, including variety, stem size, temperature, and duration of temperature, determine bolting susceptibility. Onions are stimulated to bolt at temperatures of 45º to 50ºF (7.2º to 10ºC).

GREEN ONION ACREAGE AND VALUE

Year	Acreage	Average yield (tons/acre)	Gross value/acre
2009	1,504	16.05	$18,589
2008	1,633	13.04	$13,651
2007	2,045	14.64	$15,143
2006	1,495	13.02	$13,312

Source: County agriculture commissioners' annual report data, Monterey and Riverside Counties.

VARIETIES

Few public onion breeding programs exist in the United States (none in California), but private seed companies are involved in onion variety development. The emphasis of variety development is on hybrid types.

Green onion varieties are generally classified according to day length (short- and long-day types). Long-day white varieties of Sweet Spanish or Southport White Globe are grown as green onions in areas with short days. Short-day varieties bulb too easily to be used for green onion production. Many hybrids have been developed by crossing *Allium cepa* with *A. fistulosum*, the nonbulbing Japanese bunching onion. These hybrids are most commonly grown in spring and summer in the Salinas Valley, and occasionally during winter in the southern desert regions and in Baja California, Mexico. Green onion production in areas with long days or during the summer months is most successful with the use of varieties with Japanese bunching onion parentage. White Sweet Spanish and Southport White Globe types are also sometimes grown in intermediate- and long-day growing regions.

PLANTING

Green onions are planted in dense stands on beds 40 or 80 inches (1 or 2 meters) wide. The crop is seeded in dense plantings with 18 to 20 seed lines on 80-inch beds. Seed is planted approximately 0.5 inch (12.5 mm) deep; this shallow planting requires a soil surface that is well prepared and that is kept moist through germination. Onion seed is susceptible to loss

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of vigor from high temperature and humidity. The minimum level of germination is 85 percent for onion seed accepted and packaged by seed companies in California. Seed size may range from 100,000 to 130,000 seed per pound (220,000 to 286,000 seed/kg). Plantings of green onions require 12 to 18 pounds of seed per acre (13 to 20 kg/ha) or 1.2 to 2.3 million seed/acre (3.0 to 5.7 million seed/ha).

SOILS

Green onions will grow in a wide range of soil types. They grow best in well-drained soils such as sandy loam, loam, and clay loams. Green onions are shallow-rooted and need a friable soil that retains moisture. Sandy soils require frequent irrigation but are less likely to adhere to roots at harvest than are clay soils. Plantings in clay soils are often avoided for early-spring crops due to the extra time needed for the soil to dry after rain. Seed germination and seedling establishment require a seedbed that is uniform, clod-free, firm, and several inches deep. Compared with planting on flat or small ridges, raised beds provide better drainage and an area for salt accumulation away from the root zone.

Onions are sensitive to salinity, primarily at the stages of germination and emergence. Once plants are established, higher levels of salinity are tolerated. Yield reductions may occur in soils with an electrical conductivity greater than 1.2 dS/m (mmho/cm) or that are irrigated with water with an electrical conductivity greater than 0.8 dS/m. A 50 percent yield reduction may occur at soil electrical conductivity levels of 4 to 5 dS/m. Onions are sensitive to boron in concentrations greater than 0.5 mg/L in irrigation water.

IRRIGATION

Overhead sprinklers are typically used for green onion production. Onion seed must not dry out during germination, and the soil surface should not be allowed to crust during seedling emergence, which may last 10 to 20 days following the initial irrigation. After emergence, irrigation with overhead sprinklers is continued until harvest. Drip irrigation is uncommon in green onion production because of the close spacing of rows.

Green onions require frequent and uniform irrigation. Because 90 percent of the roots are in the upper 8 inches (20 cm) of the soil, little water is extracted from the soil at a depth of more than 18 inches (46 cm). Moisture is required near the surface of the soil to stimulate new root growth because onion roots are mostly nonbranching, and all roots originate at the stem, or basal plate, of the plant. Mild water stress can reduce yield or cause uneven growth patterns in the field.

The amount and frequency of irrigation depends on the soil type, weather conditions, and development stage of the crop. After emergence when plants are small, water needs are low, so the irrigation interval with overhead sprinklers may range from 7 to 10 days. As plants increase in size, water use increases, and irrigations may become more frequent or longer to maintain uniform soil moisture in the beds. A green onion crop typically uses 10 to 15 inches (25 to 38 cm) of water to meet evapotranspiration requirements. Most growers apply 12 to 20 inches (36 to 51 cm) to achieve maximum yields. Water is cutoff 3 to 5 days before harvest, depending on the soil type. Supplemental irrigation may be needed to maintain the remaining crop during harvest, which may last 5 to 7 days.

The combination of soil moisture monitoring and weather-based irrigation scheduling can be used to determine the water needs of green onions. For optimal plant growth on most soil types, irrigate to maintain the soil water tension less than 30 cbars (kPa) in the upper 8 inches (20 cm) of the soil. Water use is highest when the crop reaches full canopy cover. The water extraction of onions can be estimated using reference evapotranspiration data adjusted with a crop coefficient that is closely related to the percentage of ground covered by the leaf canopy. At a maximum canopy cover of 85 percent, the crop coefficient is nearly 1.0. Because evaporation represents a majority of the water loss during the early stages of growth, a crop coefficient between 0.3 and 0.5 should be used for overhead sprinklers, depending on the irrigation frequency, until the leaves shade more than 30 percent of the ground. Maximum yields are reached with applied water from 100 to 150 percent of crop ET. The California Irrigation Management Information System (CIMIS), coordinated by the California Department of Water Resources, provides daily estimates of reference evapotranspiration for most production regions of California at their Web site, http://wwwcimis.water.ca.gov.

FERTILIZATION

Because onions are shallow rooted and often planted in cool soils, they are responsive to fertilization. Soil analyses are the best indicators for phosphorus (P), potassium (K), and micronutrient needs. Soils with bicarbonate extractable phosphorus less than 10 ppm may require up to 200 pounds of P_2O_5 per acre (224 kg/ha), but soils with phosphorus levels greater than 30 ppm may need as little as 50 pounds of P_2O_5 per acre (56 kg/ha). With adequate preplant application, in-season phosphorus application is seldom warranted. Soils with less than 100 ppm ammonium acetate—extractable potassium may require up to 150

pounds of K_2O per acre (168 kg/ha) to ensure adequate potassium supply. However, soils in with more than 150 ppm ammonium acetate–exchangeable potassium are unlikely to respond to potassium fertilization. Most California soils have adequate availability of all micronutrients; where micronutrient deficiency occurs, zinc is often the most limiting nutrient.

Soil nitrate levels and cropping history are the best indicators for nitrogen (N) needs. Typically, no more than one-third of the nitrogen should be applied at planting, one-third at early-season (2 to 3 leaf stage), and one-third at midseason. Total supplemental nitrogen needs may vary from 100 to 200 pounds of nitrogen per acre (112 to 224 kg/ha). Marketability requires that leaves be dark green and without yellowed or necrotic leaf tips.

INTEGRATED PEST MANAGEMENT

UC IPM Pest Management Guidelines for onions have been updated (including photographs) and are available for weed, insect, disease, and nematode pests; see the UC IPM Web site, http://www.ipm.ucdavis.edu. Sanitation, crop rotation, resistant varieties, and frequent monitoring are essential for prevention and control of the numerous pests afflicting onions.

Weed management. Onions compete poorly with weeds because they initially grow slowly, and the crop canopy does not provide complete ground cover. Dense plantings of green onions do not allow for effective use of cultivation. Weed control in conventionally produced green onions consists of the use of a preemergence herbicide followed by a postemergence herbicide. Topical applications of liquid fertilizers at the second true leaf stage can kill many broadleaf weeds. Organic producers rely on cultural practices such as rotating into fields with low weed pressure as well as using preirrigation followed by shallow cultivation to kill an initial flush of weeds. Under both production systems, hand weeding is typically required to control weeds later in the growth cycle. However, the cost of hand weeding can vary widely depending on the effectiveness of early season weed control efforts.

Insect identification and management. Thrips (western flower and onion) and maggots (seed corn and onion) are the most frequent serious insect problems in onions, but bulb mites, leafminers, and armyworms are occasionally serious pests.

Bulb mite is most damaging when plant growth is slowed by cool, wet weather. The mites cut off the radical of germinating seed before the plant becomes established or penetrate the outer layer of tissue and allow rot-causing organisms enter the bulbs. Decaying cole crops or other crop residues cause a rapid buildup of mites. The best management option is to allow the organic matter to decompose completely, which causes the mite population to crash.

Maggots, similar to bulb mites, are favored by cool, moist soils with high levels of nondecomposed organic matter. Seed corn maggot larvae attack germinating seedlings, feeding on the developing roots and epicotyl. Onion maggots also damage seedlings but continue feeding on the expanding bulb. Allow complete decomposition of organic matter prior to planting or transplanting; if this is not possible, a soil applied insecticide may be used.

Thrips can reduce yield through unacceptable cosmetic damage to the leaves. Sprinkler irrigation can help reduce thrips numbers, but for high populations foliar insecticide applications are required to prevent injury.

Disease identification and management. Pink root *(Phoma terrestris),* white rot *(Sclerotium cepivorum)* and Fusarium basal rot *(F. oxysporum* f. sp. *cepae)* are the most common and important diseases in green onions. Bacterial rots (*Pseudomonas* and *Erwinia* spp.), downy mildew *(Peronospora destructor),* purple blotch *(Stemphylium vesicarium, Alternaria porri)*, black mold *(Aspergillus niger),* neck rot *(Botrytis allii)*, blue mold *(Penicillium hirsutum)*, and smut *(Urocystis cepulae)* are occasionally observed.

Nematode identification and management. Stem and bulb nematode *(Ditylenchus dipsaci)* and root-knot nematodes (*Meloidogyne* spp.) can be problems in California onion production, but these do not occur frequently.

HARVESTING AND HANDLING

Fresh green onions require hand-harvesting. The most common system used involves undercutting the onions, pulling them immediately, gathering them by hand into bunches of five to seven plants tied together with rubber bands, and placing them into 20-pound cartons. Other containers used include 11-, 13-, and 28-pound cartons; these containers are usually for export or are used for imported green onions.

POSTHARVEST HANDLING AND STORAGE

Green onions are highly perishable. Shelf life is only 7 to 10 days. To minimize loss, green onions are stored at 32ºF (0ºC) and 95 to 100 percent relative humidity. If green onions are improperly stored, the leaves will yellow and decay. To keep the moisture content high, top ice can be used, or the onions can be covered with plastic film.

MARKETING

California leads the United States in green onion production. Shipments are made from California year-round, but supplies peak from July to October. The winter and spring supply of green onions is dominated by imports from Mexico, whose production schedule is very similar to that in the southern California desert regions. South Carolina and Ohio are other states with sizeable production of domestically grown green onions.

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