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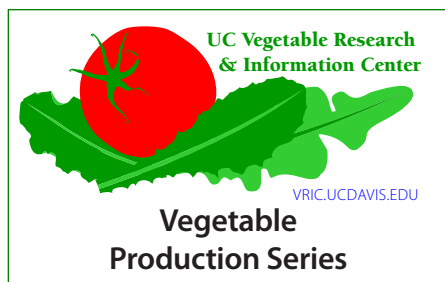
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# OKRA PRODUCTION IN CALIFORNIA

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## PRODUCTION AREAS

California has relatively little acreage in okra (*Abelmoschus esculentus* L.), but it is an important cash crop for small-scale farmers. Imperial County has the most okra production with 184 acres (74 ha), and other counties produce small amounts.

## LAND PREPARATION

Preliminary tillage and planting groundwork operations include chopping prior crop residues, disking, subsoiling, floating, and listing beds. Chopped residues should be disked while there is still some soil moisture to avoid forming large, hard clods on heavier soils. The breakdown rate of crop residues depends on temperature, moisture, soil aeration, ample nitrogen, and the particle size of crop residues. Stubble is disked across the previous crop rows to ensure good aeration of the soil, adequate burial of organic matter, and to aid in the control of pests and diseases.

## VARIETIES AND PLANTING

Most California commercial okra cultivars are green, ribbed, spineless types. Clemson Spineless, the standard open-pollinated variety, has been grown for over 40 years. It is still used because of low seed cost and wide adaptation. Its dark green pods are slightly grooved, and the plants are about 4 feet (1.2 m) tall. Clemson Spineless 80 is an open-pollinated selection from Clemson Spineless with shorter plants and greater uniformity. Annie Oakley F1 is a very

prolific hybrid that produces bright green pods and nearly double the yield of standard varieties. Growers are reluctant to plant it because seed is much more expensive than open-pollinated varieties. Other varieties that have been grown or are under trial include Green Best F1, Penta-Green OP, Annie Oakley II, Emerald, Picacho, Velvet, and Lee.

Planting should begin after the last killing frost. The best time to plant the spring crop in the southern desert valleys is from the first of February to the end of March. The fall crop is planted from mid-June to mid-July. The soil temperature should be at least 60°F (16°C) for adequate germination. Studies show that it takes 17 days for plants to emerge at 68°F (20°C), 13 days at 77°F (25°C), and 7 days at 86°F (30°C).

Rows should be spaced from 26 to 40 inches (0.65 to 1 m) apart, depending on the equipment. Seed should be planted about 1.5 inches (3.7 cm) deep. Most growers plant about 10 pounds (4.5 kg) of seed per acre, but the amount of seed used can be substantially reduced by precision planting. This amount gives an approximate spacing of 5 to 7 seed per foot of row. When the plants reach a height of 3 inches (7.5 cm), they should be thinned to 6 to 9 inches (15 to 22.5 cm) apart. In some states, 4- to 6-week-old okra transplants are used to establish a stand. These plants have 3 to 4 true leaves at transplanting time and are spaced 9 inches apart.

## SOILS

Okra will grow on many soil types, and management should adjust to the soil type. In sandy soils (e.g., the Coachella Valley), fertilize frequently as soluble nutrients leach readily from the crop root zone.

## OKRA ACREAGE AND VALUE

Year	Acres	Average yield (tons/acre)	Gross value/acre
2007	223	3.4	\$3,348
2006	417	4.0	\$3,760
2005	504	5.0	\$4,904

SOURCE: USDA/National Agricultural Statistics Services; California County Agricultural Commissioners' Data, 2005–2007.

## IRRIGATION

The crop may be planted in moist soil (mulch planting) or furrow-irrigated for the initial irrigation. If the soil has adequate moisture at planting, the young seedlings will grow to 3 to 5 inches (7.5 to 12.5 cm) before another irrigation is needed. Excessive irrigation in chilly weather tends to cool the soil and retard plant growth. As the plants mature, the crop should

not be stressed for moisture if maximum yields are to be obtained. At harvest, irrigate alternate furrows (depressions between rows) to provide a dry place to walk during harvest. Subsequent irrigation should be applied to the dry furrow.

## FERTILIZATION

Growers typically apply 100 pounds per acre (112 kg/ha) of 11-52-0 or other ammoniated phosphate fertilizers that contain both phosphorous (P) and nitrogen (N). Dry fertilizer is broadcast flat and listed into the beds. Some growers inject ammoniated phosphate (5-35-0) at 15 gallons per acre (168 l/ha) 4 inches (10 cm) below and 1 inch (2.5 cm) to the side of the seed rows. A preplant application of chicken manure may be substituted for chemical fertilizers. The manure should be broadcast applied 1 week or more prior to listing, then disked into the soil.

Growers sidedress an additional application of 40 to 60 pounds of nitrogen per acre (45 to 67 kg/ha) about 6 weeks after planting. Sources of nitrogen such as dry ammonium nitrate (34-0-0), AN-20 (liquid ammonium nitrate, 20-0-0), dry urea (46-0-0), UAN-32 (liquid urea-ammonium nitrate, 32-0-0), or aqua ammonia (21-0-0) may be used. However, when plants are small direct placement of fertilizer with a tractor-mounted applicator is more efficient than sidedress applications as the fertilizer can be precisely placed in the crop root zone when the plants are small.

## INTEGRATED PEST MANAGEMENT

**Weed management.** Early-season cultivation for weed control should be shallow so as not to injure young okra roots. A preplant herbicide should be worked into the soil. Which herbicide to use depends on which weeds predominate. Consult your UCCE Farm Advisor or licensed pest control adviser for advice as registered herbicides change often. Select fields free of nutsedge for optimal yields.

**Insect identification and control.** Cutworms (*Agrotis subterranean* (Fabricius) and *Perodroma saucia* (Hübner)), crickets (*Gryllus* spp.), and earwigs (*Forficula auricularia* Linnaeus) attack okra during stand establishment and may clip-off seedlings. During the growing season, silverleaf whitefly (*Bemisia tabaci* (Gennadius) biotype B) and cotton aphids (*Aphis gossypii* Glover) can be present in damaging numbers, causing direct injury from feeding, and honeydew may support the growth of sooty molds, reducing photosynthesis. Honeydew from aphids and whiteflies can also contaminate fruit, rendering it unmarketable. Near harvest, tobacco budworm (*Heliothis virescens* (Fabricius)), corn earworms (*Helicoverpa zea* (Boddie)), silverleaf whitefly, beet armyworm (*Spodoptera exigua* (Hübner)), cabbage looper (*Trichoplusia ni* (Hübner)), lygus bugs (*Lygus hesperus*), and stinkbugs, including Conspense stink bug

(*Euschistus conspersus*); Say stink bug (*Chlorochroa sayi*); and western brown stink bug (*Euschistus impictiventris*) can attack the crop. Consult your local UCCE Farm Advisor or a licensed pest control adviser for information on specific pest problems. Chemicals that may be legally used to control these pests change frequently. Check the label of the material for current registration information before treating a field.

**Disease identification and management.** Damping off, caused by soilborne fungi (*Pythium* and *Rhizoctonia* spp.), may be controlled by a fungicidal seed treatment. Make sure all plant residue from previous crops is decomposed as residues increase the incidence of damping off. *Fusarium* wilt (*Fusarium oxysporum* f. sp. *vasinfectum*) is a fungal disease that destroys okra. The water-transporting cells in the plant become clogged with fungi, and the plants droop and wilt. Crop rotation is the best control. To avoid this disease, do not plant okra, eggplant, or tomatoes in the same field more than once every 4 years.

**Other pests.** Okra is very susceptible to root knot nematodes (*Meloidogyne* spp.), which reduce crop yields and cause secondary infection by fungi in the roots. Avoid soils continually cropped with okra because they may be infested with root knot nematodes.

## HARVEST AND HANDLING

The immature pod (the edible part of the okra plant) is harvested when still tender. Harvesting is normally done by hand every 2 to 3 days, or more often under very warm conditions. The crop is ready for harvest about 4 to 6 days after flowering, when the pods reach 3 to 5 inches (7.5 to 12.5 cm) long. The first pods may be ready to harvest 2 months after planting. The crop will continue to bear for several months under ideal conditions, especially when overmature pods are removed on a regular basis. Overmature pods are more fibrous and lower in quality and value.

Okra that is 3 inches (7.5 cm) long or smaller is marketed as Extra Fancy; okra that is longer than 3 inches is sold as Fancy. Harvested okra is packed in 20-pound (9- kg) waxed cartons or wooden flats. The pods must be handled with care as they are subject to bruising. The bruises will turn black a few hours after rough handling. Harvesters should wear soft cotton gloves to help prevent pod damage. Okra should never be stored in large bins or hampers for any length of time. Because okra has a high respiration rate, the pods will bleach due to lack of proper ventilation and excess heating.

## POSTHARVEST HANDLING

Okra, a very delicate vegetable, should be marketed immediately after harvesting. It should be stored at 45°F (7°C) and a relative humidity of 90 to 95 percent. At this temperature and humidity, shelf life is 7 to 10

days. At higher temperatures, the pods yellow, toughen, and start to decay. As little as 3 percent moisture loss causes okra to wilt.

Okra may be spray washed or placed in a large water tank for cleaning. Wash water may be chlorinated to 75 to 100 ppm of free chlorine. Excess water should be removed after packing. Never use top ice on okra cartons or baskets: the ice will cause water spots on the pods after 2 to 3 days. Okra is subject to chilling injury below 45°F (7°C). Damage will consist of surface pitting, pod discoloration, and excessive decay.

In general, okra has the same storage requirements as green beans, cucumber, eggplant, peppers, and squash. These products may be stored together without deleterious effect. Okra should not be stored with melons, bananas, apples, or other produce that give off ethylene gas.

## MARKETING

Leading okra-producing states are Texas, Georgia, California, and Florida. Supplies peak in June, July, and August. California ships okra from June through October. Mexico exports okra year-round,

but exports to the United States are highest from June to September.

## COSTS OF PRODUCTION

The costs of okra production vary with location. Costs for water, land lease, and production inputs (fertilizer, pesticide, etc.) depend on weather, soil, and other factors. Generally, Okra production is particularly labor intensive in harvest and requires certain skills for harvesting. Costs include about 8 percent in cultural operating costs, 88 percent in harvest, and about 3% in fixed overhead costs. For more information on sample costs for okra production in Riverside County, see the publication *Production Practices and Sample Costs to Produce Okra: Furrow Irrigated, Coachella Valley, Riverside County (1995–96)*, at the UC Davis Agricultural and Resource Economics Web site, <http://coststudies.ucdavis.edu/files/okra96.pdf>. Though the sample cost is old, it provides a general perspective of the breakdown of costs and the typical production practices for Riverside County. Current costs can be approximated by multiplying the costs given in the publication by about 2 percent per year.

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