VEGETABLE RESEARCH AND INFORMATION CENTER

Vegetable Production Series

SWEET CORN PRODUCTION IN CALIFORNIA

Richard Smith, José Aguiar, and Janet Caprile
University of California Cooperative Extension Farm Advisors
San Benito, Riverside, and Contra Costa Counties, respectively

PRODUCTION AREAS AND SEASONS

California has four main production areas for sweet corn (*Zea mays)*: the southern desert valleys (Riverside and Imperial Counties); the south coast (San Diego, Orange, and Santa Barbara Counties); the Central Valley (Contra Costa, San Joaquin, Stanislaus, Merced, Madera, and Fresno Counties); and the central coast (San Benito, Santa Clara, and Alameda Counties). In addition to these areas, most counties produce some sweet corn for direct marketing at roadside stands and farmers' markets.

In the southern desert valleys, planting occurs from January to March and in August for harvest in May through early June and November through early December. In the south coast, planting occurs from February through July for harvest from June through October. In the Central Valley, planting occurs from February through July for harvest in June through October. In the central coast, planting occurs from February through June for harvest in July through October.

SWEET CORN ACREAGE AND VALUE

Year	Acreage	Average yield (*tons/acre*)	Gross value / acre
1995	25,387	7.74	$2,571
1994	19,222	7.55	$2,019
1993	23,119	7.20	$2,194

Source: County Agricultural Commissioner's Annual Report Data (Sacramento: California Department of Food and Agriculture, 1994–1996).

CLIMATIC REQUIREMENTS

Temperatures for optimal germination of sweet corn seed are 65°F (18°C) and above. Optimal temperatures for growth are 60° to 75°F (16° to 24°C), with 50°F (10°C) as a minimum and 95°F (35°C) as a maximum.

VARIETIES

Sweet corn varieties are either yellow (y), white (w), or bicolor. In recent years there have been great changes in the varieties of sweet corn grown in the state. There are three genetic classes of sweet corn: standard endosperm (SU), sugar enhanced (SE), and supersweet (SH_2). The SU types include Jubilee (y), Silver Queen (w), and 2327 (y). These varieties are not as sweet as the SE and SH_2 types and convert sugar to starch more quickly than SH_2 types. The use of SU varieties has declined as the sweeter SE and SH_2 types have received more favor in the market. However, SU types yield well and have vigorous germination and as a result are used mostly in the early part of the planting season when seed is being planted in cold soils. The SE varieties, which include Miracle (y), Bodacious (y), and Sweetie 82 (y), have a higher sugar content than SU varieties. Their rate of conversion of sugar to starch is the same, and they are best if eaten within 1 to 2 days after harvest. They are used extensively in roadside and direct marketing. The SH_2 varieties, which include 3680B (w), Aspen (w), Challenger (y), and Supersweet Jubilee (y), contain twice the sugar content of the SU varieties and the rate of conversion of sugar to starch is slower, extending postharvest quality. These characteristics have given SH_2 varieties widespread acceptance by consumers. These varieties generally have poor germination in cold soils due to smaller, weaker seed. This characteristic reduces their use early in the season, although progress has been made in improving the germination characteristics of the SH_2 varieties.

PLANTING TECHNIQUES

Sweet corn varies from 1,800 to 3,000 seed per pound (4,000–6,600 per kg) for SU types to 3,300 to 4,500 per pound (7,300–9,900 per kg) for SH_2. The number of seed planted per acre ranges from 18,000 to 30,000 (45,000–75,000 per ha). A common desired plant population goal is 19,000 to 20,000 per acre (47,500–50,000 per ha). A wide variety of field configurations is used for planting. Bed widths range from 30 to 66 inches (76–165 cm), with one or two rows of plants per bed; in-row plant spacing ranges from 7 to 10 inches (17.5–25 cm). In the central and south coasts, sweet corn is usually grown in rows 36 to 40 inches (90–100 cm) apart. In the southern deserts, sweet corn is usually grown on beds 36 to 40 inches (90–100 cm) wide oriented east to west and slanted to the south to increase warming and improve germination. In the Central Valley, early sweet corn is produced by planting the seed in a small trough on a bed that is covered with a sheet of clear plastic held taut with soil along the edges. The plastic provides rapid heating

University of California • Division of Agriculture and Natural Resources
Publication 7223

of the soil and improved growth. Elsewhere in the state, bed manipulation or plastics are rarely used.

Because of their weak germination, SH_2 varieties should be planted relatively shallow, ¾ to 1 inch (1.9–2.5 cm) deep on a smooth, flat seedbed, to optimize germination. SH_2 varieties must be isolated from other varieties because cross-pollination with these varieties makes SH_2 kernels starchy and not sweet. SH_2 varieties should be isolated from other corn varieties by a minimum of 330 feet (99 m) or by 2 weeks' difference in pollination time.

There is conflicting information regarding the value of suckering sweet corn plants. Removing tillers has been shown to improve yields, ear size, and earliness in some studies and not in others. The effectiveness of suckering depends on the variety, time of suckering, planting date, and level of fertility.

SOILS

A variety of soil textures are used for sweet corn production. Sandy soils are preferred for early plantings because they warm rapidly in the spring. Heavier soils are productive, provided they are well drained and irrigated with care.

IRRIGATION

Statewide, most sweet corn is furrow-irrigated. However, significant acreage is drip-irrigated, usually with buried systems; the tape is buried 6 to 8 inches (15–20 cm) deep in a permanent bed system. Some growers use drip tape on the surface of the beds. In cool weather, seed can be successfully mulch-planted into preirrigated soil. Under warm, dry conditions irrigation may be required for stand establishment.

The irrigation requirement is determined by potential evapotraspiration (Et_o) and crop growth stage. Total water application typically ranges from 1 to 2 acre-feet (1,233–2,466 cu. m). Summer plantings in the interior valleys require more water than early spring plantings or crops grown on the coast. Irrigation frequency varies with the soil type and irrigation system used. The crop must not be stressed for moisture at any time during the growth cycle to achieve maximum yield. The pollination period is especially sensitive to water stress, which may result in poor kernel formation.

FERTILIZATION

Sweet corn requires about 200 pounds per acre (224 kg / ha) of nitrogen (N) for early spring plantings and 100 pounds per acre (112 kg / ha) of N for later plantings. Growers generally apply 30 to 50 pounds per acre (33.6–56 kg / ha) of N preplant and the remainder as a sidedress when the corn is 12 to 15 inches (30–37.5 cm) tall. If the corn requires additional N after it is too big to sidedress, 10 to 20 pounds per acre (11.2–22.4 kg / ha) can be water-run. In drip irrigation, 10 to 15 pounds per acre (11.2–16.8 kg / ha) of N per week is injected with the irrigation water during the main part of the growing season for a total of 80 to 120 pounds per acre (90–134 kg / ha) of N over the season. Total N in the leaf tissue opposite the first ear should be 2.0 percent at silking; nitrate-nitrogen in the fresh sap of the basal 6 inches (15 cm) of stalk should be 700 ppm over the course of the season.

Phosphorous (P) applications of 40 to 50 pounds per acre (44.8–56 kg / ha) preplant are usually sufficient. Most California soils contain enough of the other nutrients (potassium, magnesium, etc.) that these seldom need to be supplied in fertilizers. Zinc and iron deficiencies have been found in several production areas of the state. This deficiency can affect quality and yield.

POLLINATION

Good pollination is necessary for proper ear development. The pollen falls from the tassels and is carried by wind or gravity to the silks. Fertilized silks stop growing and begin to dry. Hot weather above 90°F (32°C), dry winds, or dry soil can cause pollination irregularities in which the kernels may not develop evenly on the ear.

INTEGRATED PEST MANAGEMENT

Integrated pest management (IPM) information is continually being developed for weed, insect, and disease problems in California sweet corn. Cultural control methods such as mechanical cultivation, field sanitation, good drainage, and irrigation management to avoid excessively wet soils are important components of IPM that help minimize the use of chemical controls. Herbicides, insecticides, and fungicides should always be used in compliance with label instructions. Contact the UC Davis IPM World Wide Web site at http://www.ipm.ucdavis.edu or see *UC IPM Pest Management Guidelines*, DANR Communication Services Publication 3339.

Weed management. A number of cultural, mechanical, and chemical measures can be taken to control weeds in sweet corn. Preirrigation and subsequent cultivation are useful, as is cultivation after stand establishment. After the crop has emerged, piling soil at the base of the corn plants can bury young weeds; as the crop grows, subsequent weed growth is inhibited by shading. In addition, a number of effective registered herbicides are available.

Disease identification and management. Several diseases affect sweet corn. Smut (*Ustilago maydis*), the most common, causes large, fleshy swellings on the stems, ears, or tassels. This problem is most common in the warm production areas; resistant varieties are available. Several fungi including *Fusarium moniliforme* and yeasts may develop on ears in the field, usually in worm-damaged ears. Root rot caused by *Pythium* spp. occurs sporadically in late-maturing fields. Sugar cane mosaic virus (SCMV) is a serious pest in some areas of California,

especially near fields, ditch banks, etc., that are infested with johnsongrass (*Sorghum halepense*). The disease causes an interveinal mottling and can significantly reduce yields. Many varieties possess good tolerance to SCMV.

Insect and mite identification and control. Several insects can cause serious production problems in sweet corn. Seedcorn maggots (*Delia platura*) and wireworms (*Limonius* spp.) feed on germinating seed; however, planting into clean fields free of fresh plant residues reduces the chance of a problem. Insecticides applied with the seed at planting can help control these pests. Darkling beetles (*Blapstinus* spp.) occasionally attack and girdle young seedlings. Flea beetles (*Epitrix* spp.) attack seedlings and larger plants. They gouge small holes in the leaves and can cause the leaves to die back to the stalk. Cutworms and armyworms often cause serious problems with established stands and at other stages of production. Black cutworm (*Agrotis ipsilon*) and variegated cutworm (*Peridroma saucia*) hide in the soil during the day and cut off the plants or bore upwards inside the stalks from ground level. Armyworms can migrate from other fields and attack the plant at any level. Beet armyworm (*Spodoptera exigua*) prefers small plants, often doing considerable webbing of the foliage. Fall armyworm (*Spodoptera frugiperda*) attacks all stages of the corn plant and all plant parts, even the ears. The larvae of the western spotted cucumber beetle (*Diabrotica undecimpunctata*) can cause severe damage on sweet corn by tunneling into the roots and causing stunting and lodging of the plants. Soil-applied insecticides can help against this pest. The apple grain aphid (*Rhopalosiphum fitchii*) and the corn leaf aphid (*Rhopalosiphum maidis*) can become abundant enough on corn to make the foliage and ears sticky with honeydew; a black sooty mold then develops on the ears and makes them unsightly. Control of these aphids is rarely needed. The two-spotted spider mite (*Tetranychus urticae*) and other mites occasionally cause severe damage to sweet corn. They cover the plants with a fine silk webbing and their feeding causes the leaves to turn yellow and then brown. Their feeding may reduce yield but usually they cause only cosmetic damage to the ears.

The most significant insect pest of sweet corn is the corn earworm (*Heliothis zea*). Although this pest is most severe late in the season, some damage can occur earlier in the season as well. The night-flying moth lays its eggs on the silks of the ear. The young worms emerge and work their way down the silks into the ear where they begin to feed. Insecticide applications are made to control the pest during the silking stage. During periods of high populations, applications may be necessary every 2 to 3 days when corn is susceptible.

HARVESTING AND HANDLING

Sweet corn is ready to pick when each seed on the cob is filled and mature. Although mechanical pickers exist, most sweet corn in California is picked by hand. Hand-picked sweet corn is subject to less damage, although improvements in mechanical pickers have decreased damage to the ears. Corn picked for direct marketing is usually picked into bins. Corn picked for shipping is picked onto a packing trailer and packed into 50-pound (22.7-kg), 48-count, waxed cardboard boxes. Fields grown for shipping are usually picked for market once, but the fields may be subsequently gleaned for sales of "number 2" (second picking) ears in direct marketing.

Corn yields vary widely depending upon the stand, growing conditions, weather, and marketing channels. In general, a yield of 350 to 500 48-count boxes per acre (875–1,250 per ha) would be considered good.

POSTHARVEST HANDLING

Sweet corn should be cooled as quickly as possible after picking to maintain quality and sweetness. By lowering the temperature, the conversion of sugar to starch is considerably slowed but not stopped. The loss of sugar is about 4 times as rapid at 50°F (10°C) than at 32°F (0°C). Sweet corn picked for shipping is hydrocooled and the boxes are injected with liquid ice. In the Coachella Valley sweet corn is generally harvested at night when the ears are cool. The quality of sweet corn picked for direct marketing can also benefit by picking early in the day when the ears are cool and keeping them out of the sun and as cool as possible before selling them.

MARKETING

Sweet corn is actively marketed in direct-marketing channels such as farmers' markets, roadside stands, and direct to retail. In addition, much of the production in California is shipped to large metropolitan markets within the state as well as to terminal markets and wholesale receivers in the United States and Canada.

75-pr-2/97-SB

ISBN 978-1-60107-015-9