



Sweet Corn

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Corn as a vegetable

Different groups of people—in Hawai'i and around the world—use various kinds of corn as a vegetable. Most of these types of corn can be grown in Hawai'i's gardens. Many Asians love a corn called “glutinous,” which has a consistency like mochi rice. Many Africans and Latin Americans relish immature “field corn” (“cow corn”) as a vegetable when boiled or roasted. Our locally grown corn sold for cooking for the dinner table is called “sweet corn,” although it is really a type called “supersweet corn.” This publication will focus on the “supersweets” grown by our farmers and gardeners.

Something about corn

Corn is a member of the huge grass family, a sister of sugarcane and sorghum. It was named *Zea mays* by the botanist Carl von Linne (a.k.a. Linnaeus)—the “mays” coming from the Native American name “mais,” which Columbus was the first European to encounter. In the United States we call the crop “corn,” but internationally it is commonly known as “maize.” Unlike rice, sugarcane, sorghum, and wheat, maize is a truly American crop. Yet, it shares at least 98 percent of the genes of those related grasses, which did not evolve in the Americas. All early American civilizations were built on maize as the primary energy food. Many of those civilizations collapsed, a fact that can be attributed to plant diseases that co-evolved with maize and caused its periodic decline. Maize's 10 pairs of chromosomes include two sets of five, and its evolution from rice-like forebears is placed at about the time of the emergence of *Homo sapiens*. Nowadays, corn turns up in at least 20,000 products in your supermarket.

Cultivars

Corn cultivars can be simply classified into two groups: tropical and temperate. Tropical supersweet corns have been bred in Hawai'i. These are of two types: hybrids and open-pollinated varieties (OPVs). The best-known hybrids are ‘Hawaiian Supersweet #10’ and ‘Sweet Sarah’. Well-known OPVs include ‘Hawaiian Supersweet #9’ and ‘Hawaiian Supersweet Silver’. Imaginative growers may wish to try ‘Kalakoa Supersweet’ with its purple husks and cob and yellow kernels that “bleed” like a red beet when boiled. These seeds are sold without a coating of pesticide, as they resist the afflictions that beset temperate corns planted in Hawai'i.

The average U.S. mainland seed company catalog, however, lists only temperate hybrids (and none of those mentioned above). There are about 600 of them, and perhaps a dozen are sold in little packages in Hawai'i's stores. In general, they grow well in Iowa but are disappointing in Hawai'i. Their failure here may be accounted for by our relatively short days (compared to mainland summer days) and a plethora of diseases and pests they don't encounter on the mainland. A few Hawai'i growers have succeeded in growing these temperate hybrids (e.g., ‘Golden Cross Bantam’, ‘Jubilee’, ‘Sure Gold’) in our summer months, with care to use chemically treated seeds and to spray the plants for diseases and insects. A few Hawai'i growers market temperate, genetically modified hybrids that have tolerance of our abundant corn earworms. For the adventurous grower, as an alternative to these temperate corns from the U.S. mainland, tropical hybrids of many types can be obtained for testing from Hawai'i Foundation Seeds; these include whites, yellows, and bicolors (with mixtures of white and yellow kernels).

*Replaces earlier publications of the same title: HGVS-004, 1973, and HGVS-004-rev., 1978.

Soil preparation

The technology of growing sweet corn differs little from that for growing corn for grain or silage. Serious growers are referred to the CTAHR publication *Corn Production in the Tropics—The Hawai'i Experience*. (www.ctahr.hawaii.edu/oc/freepubs/pdf/corn03.pdf; or www.ctahr.hawaii.edu/oc/forsale/cornflifer.pdf).

A tillable soil with pH of 5.5–7.0 is preferable. Modern large-scale growers often prefer low-tillage or no-till management, using herbicides to kill weeds. A healthy crop will require around 150 pounds of nitrogen (N) per acre, 90 pounds of phosphorus (P) as phosphate (P_2O_5), and 90 pounds of potassium (K) as potash (K_2O).

For a 100 sq ft corn patch, these amounts correspond to about 6 oz N, 4 oz P_2O_5 , and 4 oz K_2O . An application before planting of a “balanced” formulation such as (N- P_2O_5 - K_2O) 16-16-16 is recommended. To apply 6 oz of N, you would apply about 2 $\frac{1}{3}$ pounds of triple-16. Additional nitrogen should be provided as a side-dressing of urea or ammonium sulfate when the plants are 1 month old.

Planting and watering

Corn seeds should be planted singly and covered by 1–2 inches of soil. Typical corn plant spacing allows about 2 sq ft per plant, or roughly 50 plants in a 100 sq ft corn patch. Normal machine-planted spacing is 30 inches between rows, and a density of 25,000 plants per acre is achieved by spacing seeds about 6 $\frac{1}{2}$ inches apart in the rows. Once planted, seeds should be watered immediately, and the seedlings should emerge within a week and be knee-high in a month. Corn must be watered weekly to avoid wilting (moisture stress). Demand for water increases as the plants grow, maximizing during and after flowering. Irrigation needs vary greatly by season, region, and elevation in Hawai'i. Large sweet corn fields require about 400,000 gallons of water per acre, equal to 15 acre-inches for the crop. Small gardens need 1–2 inches per week for the first 6 weeks and 2–3 inches per week for the last 6 weeks.

Weed management

Weeds are the bane of existence to Hawai'i's farmers; they can rapidly suck up any fertilizer you provide to sweet corn. While the hoe may be adequate for home gardeners, several herbicides must be in the arsenal of the larger-area farmer. Roundup® and Liberty® are broad-spectrum herbicides convenient for preplant field clearing, while a mixture of atrazine and Lasso® is preferred

as a pre-emergence herbicide. Sedges (purple and yellow nutsedge, white and green kyllingias) may require special treatment, and for these weeds the herbicide Sedge-Hammer® (formerly called Manage) is recommended. Temperate hybrids are available with the transgene for resistance to Liberty, but these corns are poorly adapted to our conditions.

Wind

Hawai'i's trade winds are a blessing to tourists but can be a curse to corn fields. Corn is pollinated by wind, and windward rows in a large field often produce ears with missing seeds. The home gardener with adequate space wisely mimics the seasoned sweet corn producer, planting every week to spread the harvest season. But the male pollen grains can be blown away from a small home garden planting, leaving the females unfertilized, so rows should be planted taking the wind direction into account. Planting rows parallel to the wind direction will ensure that most plants along the row will receive pollen. Another common garden strategy is to plant corn in a circle three feet in diameter, with plants “on the hour.” Larger field plantings may need protection of windbreaks. A convenient border is the giant, male-sterile, purple field corn sold by Hawaii Foundation Seeds.

Birds, rats, pigs, etc.

Sweet corn may be “America's No. 1 favorite vegetable,” but it is also a favorite of many animals. Fortunately, Hawai'i's growers needn't worry about the raccoons, monkeys, jackals, wild dogs, kangaroos, or alligators that attack maize fields in other places. But birds, rats, mice, pigs, and humans can be equally problematic. Many of Hawai'i's birds, including Brazilian cardinals, pigeons, and pheasants, can cause damage at planting time. Smaller birds may feed on the tassels. As plants reach harvest stage, many birds and mice or rats will get into the open husks of temperate hybrids. These injuries can allow entry of insects, such as the pineapple beetle, and fungal rots. Tropical hybrids have many husks that help minimize these problems.

Earworms

Of the many insects that find corn tasty, the corn earworm (*Helicoverpa zea*) is the worst. This insect has many host plants, but it gets its common name for its love of corn. The moth flies in the evening and lays eggs on the plant, sensing the heat around the growing ear. Eggs

on the ear hatch overnight, and the worms quickly eat their way down. Fortunately, they are cannibals and feed heavily on each other. Hawai'i's sweet corn hybrids have many tight husks above the ear tip that usually lead to just a single fat worm arriving at the ear too full and too late to eat kernels. Spraying is possible but not recommended unless you grow temperate hybrids. The corn leaf aphid also has many hosts and actually prefers corn's tassels to its leaves. It has many predators and parasites here, and to protect the predators, we find it best never to spray insecticides on Hawai'i's corn hybrids. Our omnipresent rose beetle enjoys chewing holes in corn leaves, but this doesn't reduce yields. Thankfully, few of the many other insects (borers, mites, thrips, etc.) known on corn elsewhere are problematic on Hawai'i's supersweets, although our seed producers commonly spray pesticides anyway.

Rotting fungi

Hawai'i's soils teem with fungi and bacteria, of which the worst for corn is *Fusarium verticillioides*. This rot can kill the seedling, weaken the stalk, destroy the developing ear, and turn young kernels to mush. Thankfully, Hawai'i's hybrids have been bred to be highly resistant to this disease. Any other type of seed must be treated with fungicide.

Other diseases

Hawaii's worst corn disease is the dwarfing virus called maize mosaic virus. Transmitted by a leafhopper, this virus can simply destroy the plant. No temperate sweet corn is resistant. All Hawaiian sweet corns are resistant. Hawai'i's producers of temperate corn seeds must treat their crops almost twice weekly with insecticides to control this pest.

Southern rust disease is also common, and only the rare temperate hybrid has resistance similar to that of the Hawaiian sweet corns. A common disease in cool highlands is turcicum blight, which can greatly reduce corn yield. Sprays do exist for such diseases. The grower of Hawaiian hybrids need not be concerned about these and other less common ailments that include brown spot, bacterial leaf blight, maize dwarf mosaic virus, common rust, stalk rot, and aflatoxin-inducing ear rot.

Growth rate and size

Corn's rate of growth depends on the temperature and thus varies from month to month and from lowland to

highland in Hawai'i. Flowering, with the emergence of silks, will occur between 50 and 65 days after planting in the lowlands, with harvest 16 or so days later. In the highlands, these figures increase to harvest dates between 95 and 110 days after planting. Most temperate hybrids are earlier to harvest. Tropical hybrids are bred to grow around 6 feet tall, with the ears at 2½ feet, making for convenience in hand harvesting. They grow with a single stalk and do not have the tillers commonly found on temperate hybrids.

Harvest

Sweet corn should not be ignored when ripe nor bothered before it is. The careful gardener wisely records the date at which half the plants show the silks emerging from the baby ears. If you are so inclined, harvest and eat the baby ears at this stage—they are excellent in stir-fry. Under warm summer conditions, the ears will be ripe about 18 days later, at which stage the tip of the ear will feel well-filled and the emerging silks should have turned tan or brown. Peel back an ear or two and check, or simply eat one or two—Hawaii's supersweets are delicious uncooked. Up in the cool conditions above 2000 ft, the plants grow much more slowly.

Seed availability, and many kinds of corn

Varieties noted here are called "supersweets," having genes like *brittle-1* or *shrunkn-2* and high sugar contents, with an unusual crispness. This crisp texture is retained upon cooking. They appear as freeze-dried kernels in many noodle boxes. Historic American vegetable corns like 'Golden Bantam' and 'Country Gentleman' are "sweet corns" with the gene *sugary-1*; they are chewy but not crisp. Asians love "glutinous corns" with the gene *waxy-1*, and frozen ears of this type can be purchased in Hawai'i markets. Like mochi rice, these corns are chewy, starchy, and high in energy. Any common field corn can be used to make delicious fritters when harvested immature (18 days after pollination). Experimental varieties or hybrids of all of these types may be obtained from Hawai'i Foundation Seeds (via CTAHR's Department of Tropical Plant and Soil Sciences, www.ctahr.hawaii.edu/ctahr2001/TPSS/research_extension/main.html). The more popular types are available from CTAHR's Agricultural Diagnostic Service Center's seed program (www.ctahr.hawaii.edu/seed).