AH! A FARMER!
A MAN OF THE EARTH!
GREETINGS... I'M
SENATOR BEDFELLOW.

AH... MY HEART BLEEDS
FOR YOU GOOD FOLKS...
BEEN HARD TIMES,
HASN'T IT?

NOPE. DODIN' DANDY.

WELL GOOD! GOOD!
THIS IS A FINE
BATCH OF CORN
YOU HAVE!

TAINT CORN.
IT'S DOPE.

BEG PARDON?

HERE...
TAKE A FEW
POUNDS HOME
TO THE WIFE.

©Berkeley Breathed.
WHY SHOULD I WORRY ABOUT PEST-RESISTANT GENETICALLY MODIFIED CORN?

ISN'T PEST RESISTANCE A GOOD THING?

DON'T TOUCH ME!

NOT IF YOU ARE THE PEST.
Not only are they edible, you don't even have to sneak up on them!

Early in the domestication of crops.
Sweet Corn

Taxonomy

Monocotyledon
Family: Poaceae (Graminae)
Genus and species: Zea mays L. var. saccharata Sturt.
Related species: field corn, teosinte, sorghum, wheat and other small grains, grasses
Sweet Corn

Origin and Domestication

Corn originated in Mexico

Possibly derived from teosinte (*Zea mexicana*)

Used as early as 5000 BC

Sweet corn is a recent crop, 8th century in Guatemala

Sweet corn results from the *su1* mutation

Many modern varieties derived from India
Teosinte

Teosinte

Modern Corn
Landrace Corn
Sweet Corn

Importance of Corn

General corn information

One of the major grains for human nutrition – one of four most important crops

The major cereal crop used for stock feed

Produced throughout the world

Largest producers are U.S., China, Brazil, Russia, Mexico, Argentina, Romania
Sweet Corn

Importance of Corn

Sweet corn
Production dominated by the U.S. where development of this crop began among the Iroquois (>500,000 A)

Considerable production in Europe

Important source of calories, vitamin A, minerals, lipids, and protein
# Sweet Corn

## Major producing countries (2008)

<table>
<thead>
<tr>
<th>Country</th>
<th>Tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unites States</td>
<td>3,888,080</td>
</tr>
<tr>
<td>Mexico</td>
<td>610,593</td>
</tr>
<tr>
<td>Nigeria</td>
<td>579,000</td>
</tr>
<tr>
<td>France</td>
<td>521,916</td>
</tr>
<tr>
<td>Hungary</td>
<td>514,000</td>
</tr>
<tr>
<td>Peru</td>
<td>332,255</td>
</tr>
<tr>
<td>Indonesia</td>
<td>332,000</td>
</tr>
<tr>
<td>South Africa</td>
<td>310,000</td>
</tr>
<tr>
<td>Thailand</td>
<td>305,000</td>
</tr>
</tbody>
</table>
Sweet Corn

U.S. Fresh Market Sweet Corn 1,000 cwt (2005 - 2009)
Sweet Corn

U.S. Processed Sweet Corn Short Tons (2005 - 2009)
Sweet Corn

Botany

Annual

Monoecious

Male flower a loose terminal panicle

Female flowers on an axillary rachis

Pistillate “silks”
Sweet Corn

Xenia

Pollen-induced changes in kernels of sweetcorn apparent on the harvested ears.

Some of these changes may be intended and beneficial.

These changes are of most concern when they result in a loss of cob or kernel quality by adversely changing kernel color, kernel weight, embryo weight, soluble solids percent, kernel moisture, or cause other undesirable direct and indirect effects.
# Sweet Corn

Xenia

## TABLE 15.3. POLLEN EFFECT (XENIA) ON SWEET CORN KERNEL COLOR

<table>
<thead>
<tr>
<th>Pollen source</th>
<th>Expected genotype kernel color</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow Mixed (W/Y)</td>
<td>White</td>
<td>Some yellow kernels among white</td>
</tr>
<tr>
<td>Yellow</td>
<td>White/yellow</td>
<td>Few yellow kernels among white</td>
</tr>
<tr>
<td>White</td>
<td>Yellow</td>
<td>White and yellow, with more yellow than white kernels</td>
</tr>
<tr>
<td>White</td>
<td>White/yellow</td>
<td>Yellow kernels, no effect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>White and yellow, no effect</td>
</tr>
</tbody>
</table>
Sweet Corn

Types of corn

Dent – field corn, most widely grown type, used for dry cereal food and industrial purposes

Flint

Popcorn

Flour

Sweet

Waxy
Sweet Corn

Types of corn

Dent

Flint – field corn, smooth hard kernels with little soft starch, grown in Europe and SA

Popcorn

Flour

Sweet

Waxy
Sweet Corn

Types of corn

Dent

Flint

Popcorn – field corn, smooth hard kernels with little soft starch, grown in Europe and SA

Flour

Sweet

Waxy
Sweet Corn

Types of corn

Dent

Flint

Popcorn

Flour – large kernels with soft starch, native use

Sweet

Waxy
Sweet Corn

Types of corn

Dent

Flint

Popcorn

Flour

Sweet – low in starch, high in sugars

Waxy
Sweet Corn

Types of corn

Dent

Flint

Popcorn

Flour

Sweet

Waxy – kernels lack amylose, used for starch
Sweet Corn

Corn Characterization and Genetics

Sweet corn differs from field corn by 1 or more genes

- $su1$ (sugary) allele on chromosome 4
  increases WSP, phytoglycogen

- $se$ (sugary enhancer) allele on chromosome 4
  enhances sugar level in comb with $su$

- $sh2$ (shrunken 2) allele on chromosome 3
  blocks starch synthesis (4-8x sugars)
Sweet Corn

ATP + α-D-glucose-1-phosphate

ADP-glucose

pyrophosphorylase

Δ

sh2

ADP-glucose + pyrophosphate

starch synthetase

(glucose)n

ADP + (glucose)n+1

Mode of action – sh2 gene in corn
Sweet Corn

Secondary effects of the \textit{sh2} gene

- Tough pericarp
- Minimal starch reserves
- Very shrunken, mummified seed
- Slow and weak emergence following planting
- More susceptible to seedling diseases
Sweet Corn

Corn Characterization and Genetics

Endosperm is the nutritious part of the kernel

Endosperm originates from pollination event

Endosperm has genotype of pollinator and egg producer

Sweet corn must be isolated during production
### Table 15.2. Kernel Characteristics as Affected by Pollen and Kernel Genotype Interactions

<table>
<thead>
<tr>
<th>Kernel genotype</th>
<th>Pollen genotype</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$Su1$</td>
</tr>
<tr>
<td>Grain corn</td>
<td>Starchy</td>
</tr>
<tr>
<td>$Su1$ Grain corn</td>
<td></td>
</tr>
<tr>
<td>$su1$ Sweet corn</td>
<td>Starchy</td>
</tr>
<tr>
<td>$se1$ Sweet corn</td>
<td>Starchy</td>
</tr>
<tr>
<td>$sh2$ Sweet corn</td>
<td>Starchy</td>
</tr>
</tbody>
</table>
Sticky Corn

Also known as “waxy maize”

Found in China in 1909

Led to confusion regarding corn center of origin

Due to a single recessive mutation

Kernels produce only amylopectin, no amylose

Important source of industrial starch during WWII
Sticky Corn

Importance and use

Common usage in Asia, Philippines, parts of SA

Cooked and used much the same way as sweet corn (boiled, steamed, or baked on the cob)

Has a very adhesive, sticky texture, less sweet

Grown agronomically for specialty starch production
Sweet Corn

Climate and soils

Warm season, tender crop

Can withstand only light frost at emergence

Requires 55 degrees for germination

Tolerates most soil types

Requires season-long water availability
Sweet Corn

Seed Production

Requires:

- Interplanting of inbred parents
- Topping female parental line
- Isolation from other corn plants (1/8 mi)
Sweet Corn

Stand Establishment

Isolate classes of sweet corn 600 ft from other types

or

Isolate by pollination time – 300 heat units

Planting date scheduled using 3 methods

Days to harvest

Heat units

Plant growth
Sweet Corn

Modern-Intensive Production

Mostly employed for processing corn, some fresh

Exclusive use of hybrid varieties

Production entirely automated except for harvest of fresh corn
Sweet Corn

Modern-Intensive Production

High inputs:

- Irrigation water
- Fertilizers – high use of N
- Insecticides – control of European corn borer, corn earworm, wireworm
Sweet Corn

Market Garden Production

Production of corn for local fresh markets

Exclusive use of hybrid varieties in developed countries

Land race and open-pollinated varieties common in undeveloped countries

Strong ethnic preferences in local markets
Sweet Corn

Subsistence Production

Practiced worldwide, including modern countries

Production for grain and vegetable use

Exclusive use of land race and open-pollinated varieties

Production with little or no automation except possibly ground preparation
Sweet Corn

Subsistence Production

Beginning to employ GMO insect resistance

Commonly used in intercropping systems provides support for vertical systems

Habitat management strategies (trap crops, intercrops, refuges) important for controlling insects, parasitic striga weed

Water management a serious issue
Sweet Corn
Sweet Corn
Sweet Corn

Harvest

Harvest indices
- Dried silks
- Tight husk appearance
- Kernels nearing full color, firm

Processing indices
- % solids, % alcohol insoluble solids, % WSP, pericarp test, trimetric test (moisture, pericarp, size)
Sweet Corn

Prediction of Harvest Date

Three methods used:

1. Physiological development
2. Published “Days to harvest”
3. Corn heat units
Sweet Corn

Handling and Storage

Hydrocooled or room cooled to <50 degrees
Handled and shipped at 32 degrees, 90-95% RH
Rapid conversion of sugars to starch
Storage, shipping, shelf life – 6-8 days
FIGURE 9  Sucrose depletion in sweet corn at four temperatures.
Cactus (Opuntia)

Taxonomy, origin, and domestication

Dicotyledon
Family: Cactaceae

Two genera are important: *Opuntia*, *Nopalea*

Center of origin – probably Mexico

Columbus introduced them into Spain

Spread to Mediterranean and North Africa
Cactus (Opuntia)

Use and production

Gathered, wild-cultured or produced on small farms

Edible portions are the cladodes (pads) and the tuna (fruit)

Cladodes eaten fresh or boiled

Tuna eaten fresh, boiled, made into syrups or jams
Cactus (Opuntia)
Cactus (Opuntia)

Management techniques

Vegetatively propagated using mature cladodes

Some irrigation is used to increase growth rate

Some fertilizer required
  Nitrogen only for cladode production

Harvested by hand, careful cutting at articulation

Can be stored for 3 weeks at 60 degrees if waxed
Cactus (Opuntia)
Bamboo
Bamboo

Origin and domestication

Center of origin in China

Of ancient use for food, timber, paper, other

Most important genera for food:

Phyllostachys, Bambusa, Dendrocalamus

Bamboo forests in China, Malaysia, Indonesia
Bamboo

Gib’s Picks for Edible Shoots:

- **Bambusa oldhamii** - GIANT TIMBER BAMBOO
- **Phyllostachys dulcis** - SWEET SHOOT BAMBOO
- **Phyllostachys heterocycla pubescens** - MOSO BAMBOO, MOSO-CHIKU
- **Phyllostachys nidularia** - BIG NODE BAMBOO
- **Phyllostachys nuda** - NUDE SHEATH BAMBOO
- **Phyllostachys rubromarginata** - RED MARGIN BAMBOO
Bamboo

Use and production

Edible portion is emerging shoots

Occasionally, seed is used as a grain

Consumed boiled, to remove acridity

Have a crisp, mild flavor after boiling

2,000,000 tons eaten each year
Bamboo
Bamboo

Management techniques

Gathered from the wild and cultured in small market-garden productions systems

Propagation by rhizome divisions or seed

Loose mulch placed over rhizomes

New shoots maintained in the dark
Bamboo

Harvest and Storage

Harvested by cutting just above the rhizome

Shoots harvested continually for 2-3 weeks

Last shoots are allowed to grow and mature

All growth removed at seasons end

Smoke drying is used to preserve shoots