NO PREP

From Teosinte to Corn

Domestication and Selective Breeding

Includes: Student reading, case study, differentiated questions, teacher key

Name: Period: Date:

From Teosinte to Corn: Domestication and Selective Breeding

Wild Grass to Global Staple: How Teosinte Became Maize

Long before canned corn appeared on Thanksgiving tables, a scrubby wild grass called teosinte grew in the river valleys and foothills of Mesoamerica. Teosinte bears small, hard kernels encased in tough husks and shatters at maturity to scatter seeds—perfect for survival, terrible for snacking. Over thousands of years, Indigenous farmers transformed this wild plant into maize (corn) through domestication, a gradual process

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Wild Grass to Global Staple: How Teosinte Became Maize

Long before canned corn appeared on Thanksgiving tables, a scrubby wild grass called teosinte grew in the river valleys and foothills of Mesoamerica. Teosinte bears small, hard kernels encased in tough husks and shatters at maturity to scatter seeds. That trait was perfect for survival in the wild, but terrible for snacking. Over thousands of years, Indigenous farmers transformed this wild plant into maize (corn) through domestication, a gradual process of selecting plants with desirable traits. Early farmers likely saved seeds from ears that were slightly larger, less brittle, or easier to harvest, replanting them season after season. Those tiny preferences added up. The signature markers of domestication syndrome emerged as humans steadily shaped the gene pool: bigger ears, non-shattering seeds, softer seed coats, and reduced branching. This transformation wasn't a single event or location, but a mosaic of experiments, exchanges, and local adaptations. As maize spread, it diversified into landraces: regionally adapted varieties selected for altitude, rainfall, soils, and culinary uses (tortillas, tamales, atole). In that diffusion, technology and cuisine co-evolved: nixtamalization (alkaline cooking with lime) released niacin and improved protein quality, while grinding stones and pottery scaled up maize-based diets. In other words, people didn't just domesticate a plant; they domesticated an entire food system that would feed festivals, markets, and, centuries later, our holiday side dishes.

Genes That Rewrote a Plant: The Biology Behind Bigger Ears

What flipped teosinte's architecture into maize's iconic ear? Selection tweaked many genes, but a few loom large. The teosinte branched1 (tb1) gene alters plant architecture: higher tb1 expression suppresses tillering (side shoots), channeling energy into a central stalk with bigger ears. Changes near tga1 helped convert

teosinte's rock-hard fruitcase into the familiar naked kernel, making maize edible without hammering. Other loci tuned kernel row number, ear length, and sugar–starch balance that distinguishes sweet corn from field corn. None of these genes act alone; they interact with environment factors like sunlight, water, and soil fertility to produce the phenotype you see on the cob. Over time, farmers refined traits through mass selection (saving the best ears), family selection (saving seeds from the best plants and their relatives), and later controlled crossing. The 20th century layered in hybridization, where crossing inbred lines produces heterosis (hybrid vigor): taller plants, higher yields, stronger stalks. For Thanksgiving favorites like sweet corn, breeders selected for sugar-accumulating alleles (e.g., su, se, and sh2) that slow conversion of sugar to starch, keeping kernels tender and sweet. For flint and dent corns used in cornmeal and pie thickeners, selection emphasized starch type and kernel hardness. Whether ancient or modern, the principle stayed constant: variation exists, people select, and populations change.

Indigenous Innovation and the Spread of Maize

As maize traveled north and south from its Mesoamerican cradle, Indigenous farmers were the innovators. In highland valleys, they chose plants that tolerated cool nights; in tropical lowlands, they favored disease tolerance and ear rot resistance. Along river floodplains, they synchronized varieties with flood recession; on the Plains, they emphasized drought resilience and shorter seasons. Each community linked agronomy to culture: kernels slated for hominy needed nixtamalization performance; those for tortillas needed grindability; ceremonial colors such as blue, red, black, and white carried meaning beyond yield. The result is a living library of landraces whose genetic diversity still powers modern breeding. This geographic–cultural spread also shaped trade. Maize moved alongside beans and squash (the "Three Sisters"), creating nitrogen and canopy synergies in fields and protein complementarities on the plate. Storage innovations (cobs hung to dry, clay granaries) stabilized supply through lean seasons. When maize later entered European and global routes, its flexibility made it a staple crop on multiple continents: it could grow in short seasons, at high elevations, and in varied soils, even as cuisines adapted it to local tastes, from polenta to arepas.

From Selection to Strategy: How Modern Breeding Builds Your Cornbread

Today's breeding mixes traditional selection with data-rich tools. Phenotyping (measuring traits in the field) pairs with genotyping (DNA markers) to accelerate choices. Marker-assisted selection helps stack traits—drought tolerance, standability, disease resistance—into a single variety. For quality traits relevant to kitchens—starch structure (amylose vs. amylopectin), kernel hardness, protein balance—breeders still confirm with sensory and processing tests. Meanwhile, preserving landrace diversity in seed banks and farmer fields protects options for the future as climate shifts. Hybrid seed companies generate inbred parent lines and cross them to release F1 hybrids that farmers plant each year for consistent performance. Public programs and Indigenous seed stewards, in turn, keep heritage open-pollinated lines alive for cultural, culinary, and resilience reasons. Your Thanksgiving table may include cornbread from a heirloom flint meal, thickened gravy with corn starch, or sweet corn frozen at peak ripeness—each a different destination reached by centuries of human choices.

Key Information: Quick Guide: Teosinte vs. Maize (Domestication Snapshot)

Feature	Teosinte (Wild)	Maize (Domesticated)	Why It Matters
Seed protection	Hard fruitcase; enclosed kernels	Naked kernels with exposed pericarp	Easier to eat and process
Seed dispersal	Shattering; seeds scatter at maturity	Non-shattering; seeds stay on ear	Allows harvest and storage
Plant architecture	Many branches/tillers	Fewer branches; larger central ear	Energy focused into harvestable ear
Ear size/rows	Tiny, few kernels	Large ears, multiple rows	Higher yield per plant

Feature	Teosinte (Wild)	Maize (Domesticated)	Why It Matters
Culinary use	Limited without processing	Broad uses: nixtamal, meal, sweet corn	Dietary diversity and nutrition

Case Study Excerpt — From River Valley Seeds to Thanksgiving Cornbread: An Archaeobotany Story

In a dry river valley site, archaeologists sift through ancient middens—layers of household trash that survive as time capsules. Under a collapsed wall, they find charred plant remains: tiny cobs no longer than a thumb, each with only a handful of kernel impressions. The team's archaeobotanist, Dr. Álvarez, samples dozens of fragments for radiocarbon dating and examines them under a microscope. Compared to local teosinte, these cobs show clues of change: non-shattering attachment scars, more kernel rows, and reduced branching nodes on associated plant bits. The dates cluster around a period when nearby settlements expanded terraces and irrigation ditches, hinting that people were stabilizing water supply while stabilizing a grain, too. Back in the lab, a collaborator extracts ancient starch granules from stone grinding tools. The granules' size distribution matches modern maize landraces, not teosinte. Lipid residues suggest nixtamalization; alkaline markers point to cooked maize doughs. The story coalesces: families weren't merely gathering wild seeds; they were replanting selected ears, storing them in clay bins, and cooking with techniques that improved nutrition. To link past to present, the team runs a common-garden experiment with seeds from modern landraces that resemble those ancient cobs. Grown side by side under similar water and soil, some plants thrive in cooler nights and thin air, others in hot, floodplain conditions. The results show how local selection produced regionally tuned maize long before modern labs. When the class bakes cornbread from a stone-ground flint meal and compares it to a pan made with commercial cornmeal, they can taste texture differences that trace back to kernel hardness and starch structure—living echoes of choices made in fields thousands of years ago.

1. Which specific trait changes in the case study signal a shift from teosinte toward domesticated maize, and why would ancient farmers have favored them?

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2. How does the common-garden experiment help distinguish genetic differences among landraces from environmental effects?

Multiple Choice

1. The gene most associated with reduced branching and a larger central ear in maize is:

    a) Rht (reduced height) gene

    b) phyB (phytochrome B)

    c) tb1 (teosinte branched1)

    d) sh2 (shrunken2)

2. A practical hallmark of domestication syndrome in grains like maize is:

    a) Non-shattering seeds that stay attached for harvest

    b) Increased seed shattering at maturity

    c) Fewer kernel rows and smaller ears

    d) Thicker seed coats that resist grinding and milling

3. Heterosis (hybrid vigor) in maize breeding primarily means:

    a) Hybrids are genetically identical to their parent plants

    b) Hybrids always taste sweeter than inbreds

    c) F1 hybrids outperform parents in yield or robustness

    d) Hybrids require no fertilizer or irrigation

Matching

Write the letter of the correct definition on the line next to each term.

Term	Definition
1. ___ Teosinte	A) Process of alkaline cooking that unlocks niacin and improves dough
2. ___ Domestication syndrome	B) Wild progenitor of maize with small, hard kernels
3. ___ Landrace	C) Gene affecting plant architecture and tillering
4. ___ tb1	D) Suite of traits like non-shattering, larger seeds, reduced branching
5. ___ Nixtamalization	E) Regionally adapted variety maintained by farmers

Fill-in-the-Blank

1. Selection for _____ (seeds that do not fall off the ear at maturity) makes harvest and storage far easier.

2. Crossing two inbred lines to produce an F1 hybrid often yields _____, or hybrid vigor.

3. Maize varieties locally adapted by communities over generations are called _____.

Short Answer

Answer each question in 2-4 complete sentences.

1. Give one reason communities might preserve landraces even when commercial hybrids are available.

2. Explain how nixtamalization changes the nutritional and culinary properties of maize.

3. A breeder wants sweeter kernels that stay sweet after harvest. Which trait or allele types should they select for, and why?