Chapter 7 - New World Grains

The New World has provided only one major domesticated cereal, corn (Zea mays).

Corn has the advantage of:

Corn paired with beans formed the basis of all the major New World civilizations (the Maya, Aztec and Inca).

Modern corn is morphologically different from wild grasses:

- a few large stalks or culms
- each culm is terminated by a tassel of male flowers
- female flowers are tightly packed together and form an "ear"
- the "ear" of domesticated corn is very large
Morphology of the Corn Plant

Modern corn is a direct result of human selection from an annual species of Mexican teosinte.

Teosinte (Zea mays subsp. parviglumis) is the closest wild relative of cultivated corn, Zea mays subsp. mays.

Corn was initially domesticated in southern Mexico.

Phytoliths found in Mexico show that corn was cultivated almost 9000 years ago.

Direct evidence of domestication consists of small charred ears from dry pre-Columbian cave deposits near Tehuacan, east of Mexico City (4700 years old).

By Columbus’s arrival in 1492, there were 3000 (YES! 3000!) locally selected varieties (land races) grown from Canada to South America.
Under the influence of continued human selection, corn acquired several features that reflect the dependency on humans.

- selection for absence of dormancy which allowed 100% germination of seeds annually
- enclosure of the female inflorescence or “ear” in layers of leaves or “shucks”

As corn spread into North and South America, other changes to the plant occurred.

In Mexico, two lines of selection led to kernels that protruded from the cupule.
The selection of these traits led to:

Another mutation was the loss of sensitivity to photoperiod which allowed the spread of corn into temperate regions.

Thousands of corn cultivars exist.

Pod, dent, flint, pop, flour and sweet corn are the six main historical types of corn.

European settlers in the U.S. grew flint and dent corn, but in 1812 two varieties were crossed.

This hybrid is the ancestor of modern Corn Belt dent corn.

Multiple hybridizations and selection in the 1930’s led to sweet eating corn and high-yield field corn.

Columbus took corn back to Europe, but it was less popular in Europe.

Europeans believed that ground corn had limited use in comparison to other grains.
Native Americans used a process called nixtamalization to:

**Nixtamalization** is treating corn kernels with slaked lime (calcium hydroxide).

Corn does not have the same nutritional value as many other whole grains.

Corn is deficient in tryptophan and lysine, and relatively low in protein.

A diet high in untreated corn can lead to a niacin and tryptophan deficiency and the disease pellagra.

Pellagra is characterized by the three D’s (dermitis, diarrhea and dementia).

The health problem of pellagra was addressed in 1914 when yeast was added to the diet.

Native Americans did not suffer from pellagra because the nixtamalization made the niacin in corn more available.
Wild rice, *Zizania palustris*, is a New World species used as a source of grain by Native Americans.

The inflorescences of wild rice shatter.

The grain was traditionally collected by beating mature inflorescences while they were held over the canoes.

The grain was roasted, poured into deerskin-lined pits and trampled to remove the husks.

Wild rice cultivation in the U.S. began in 1959.

In the 1970’s, plant breeders selected a non-shattering strain that improved yield from 100 to 700 pounds.
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Amaranth and quinoa are not members of the grass family.

Species of amaranth (*Amaranthus*; Amaranthaceae) were cultivated by native peoples of Mexico, Guatemala and Peru.

The seeds are high in protein, (30% higher than rice), with the essential amino acid lysine.

It has been suggested that amaranth made up 80% of the caloric intake of Aztecs in Mexico before the Spanish conquest.

Amaranth seeds also contain saponins, oxalates and phenols that must be removed before consumption.

Aztecs also used amaranth for religious ceremonies.

The Spanish forbade the cultivation of the crop which led to the disappearance this important food source in Mexico for several hundred years.

Another member of the Amaranthaceae is quinoa, *Chenopodium quinoa*.

Native people in the New World domesticated three species of *Chenopodium*.

Only the South American species *Chenopodium quinoa* is still cultivated.
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Evidence of use of wild quinoa dates to more than 7000 ybp.

Fossil fruits were uncovered on the southern edge of Lake Titicaca in Bolivia and showed domestication at least 4000 ybp.

The distinctive appearance and texture of wild quinoa are because the embryo in the seed surrounds the endosperm.
Study outline-Chapter 7-New World Grains

Name the only major domesticated cereal from the New World.

What are the main advantages of corn?

What food pairings formed the basis of all the major New World civilizations?

How is modern corn morphologically different from wild grasses?

What is the closest wild relative of cultivated corn?

What are the main differences between teosinte and modern corn?

Where was corn initially domesticated? What types of archaeological evidence is linked to the domestication of corn?

Under the influence of continued human selection, corn acquired which features?

The selection of which 2 traits produced the flint corns and gourd-seed, shoe-peg and dent corns? What were the regions of domestication for the flint corn, and the gourd-seed, shoe-peg and dent corns, respectively?

Which mutation allowed the spread of corn into temperate regions?

What is nixtamalization?

What were the benefits of nixtamalization?

What is pellagra?

Why was pellagra uncommon in Native American populations?

What are the 4 New World grains?

Wild rice (Zizania palustris)
Know origin/history and information about cultivation/domestication and uses.

Amaranth (Amaranthus spp.)
Know origin/history and information about cultivation/domestication and uses.

Quinoa (Chenopodium quinoa)
Know origin/history and information about cultivation/domestication and uses.