

Kitchen Lesson K7-1

Corn Series

Tortillas!

Nourishment

Students learn the nutritional benefits of the nixtamalization process, taste and compare nixtamalized corn and non-nixtamalized corn and eat freshly made corn tortillas.

Life Skills

Students compare three different methods of grinding corn by hand, learn to prepare masa before using a tortilla press to form fresh tortillas and practice cooking them on a griddle.



Sustainability

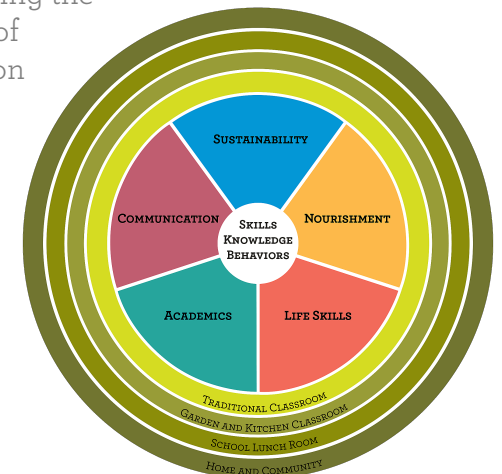
By processing corn in different ways, we can compare methods of food production from contrasting times.

Communication

Students discuss pros and cons of various methods of corn processing, drawing on their personal experience to formulate and defend opinions in a respectful way.

Academics

This lesson fulfills History–Social Science Content Standards for Meso-American and Andean civilizations; studying the roles of people in each society; Common Core State Standards for following a multistep procedure; collaborative discussion; speaking and listening; language; acquiring words and phrases; Health Education Content Standards for identifying nutrients; differentiating between diets that are health-promoting and diets linked to disease; preparing nutritious food; and identifying the impact of nutrition on chronic disease.



The Corn Series: Tortillas! Abstract

Summary

In this 7th grade humanities lesson, students rotate through three stations to explore the process of making corn tortillas from scratch. Students learn about **food production** and **processing** by making tortillas two different ways, using commercially processed **masa** harina or freshly-ground **nixtamalized** dent corn. They taste, compare, and discuss the results. This is the first of five lessons in the Corn Series.

Objectives

After this lesson, students will be able to:

- Understand that corn was a staple crop of the Aztecs and that much of their time was devoted to food processing
- Follow a recipe for **nixtamalizing** corn and identify the 3 outcomes of this process
- Practice a variety of hands-on methods for grinding **nixtamalized** corn and make fresh **masa** for tortillas
- Understand that **masa** harina is a relatively recent invention that has rapidly changed how most tortillas are prepared
- Note the differences between tortillas made from fresh **masa** and from **masa** harina.

Assessments

During this lesson, students will:

- Experience **processing** corn by hand and comparing pros and cons of different methods
- **Nixtamalize** corn and learn that **nixtamalizing** make corn sweeter, more tender and more nutritious (by releasing niacin)
- Experience the time and labor required to produce fresh **masa** for tortillas
- Prepare **masa** harina for tortillas
- Press and cook corn tortillas using fresh **masa**

Communication is strengthened by discussing pros and cons of various methods of corn **processing**, drawing on their personal experience to formulate and defend opinions in a respectful way. **Sustainability** is highlighted by **processing** corn in different ways, so that we can compare methods of corn **processing** throughout history. **Nourishment** is expanded by learning the nutritional benefits of the **nixtamalization** process, tasting and comparing **nixtamalized** corn and non-**nixtamalized** corn and

eating freshly made corn tortillas. *Life Skills* are sharpened as students compare three different methods of grinding corn by hand, learn to prepare **masa** before using a tortilla press to form fresh tortillas and practice cooking them on a griddle.

Academics fulfill History–Social Science Content Standards for comparing and contrasting the geographic, political, economic, religious, and social structures of the Meso-American and Andean civilizations; studying the roles of people in each society; Common Core State Standards in ELA for following a multistep procedure; collaborative discussion; speaking and listening; language; acquiring words and phrases; Health Education Content Standards for identifying nutrients; differentiating between diets that are health-promoting and diets linked to disease; preparing nutritious food; and identifying the impact of nutrition on chronic disease. See **Connections to Academic Standards** below for details.

Edible Schoolyard curriculum emphasizes developing community and personal stewardship; **teamwork**; making **positive contributions**; **communicating** relevant questions; recognizing the **right tool** for a job; **solving problems**; making **decisions**; using **rituals** and **routines**; creating **unity**; noticing **beauty**; developing **confidence**; understanding **seasonality**; being mindful of **bio-diversity**; understanding the versatility of **ingredients**, and realizing that certain ingredients are available in particular seasons; approaching lessons with **intention** by thinking through how the recipe relates to the kitchen, garden, and wider environment as a whole; **fully engaging their senses** and using descriptive vocabulary to discuss observations, situations, events, moods, and other subjects including and beyond food; and making connections between the diets of **historic cultures** and foods we eat today. See **Connections to Edible Schoolyard Standards** below for details.

This lesson follows the BEETLES Project’s *Learning Cycle* (Invitation-> Exploration -> Concept Invention -> Application -> Reflection) and uses their *Discussion Routines* (Think-Pair-Share, Whip-Around). All are highlighted in *Green** with an asterisk for easy identification. See the documents BEETLES_Discussion_Routines.pdf and BEETLES_Learning_Cycle.pdf included in **Resources** below for more information. Games and activities from other sources are also identified in *Green*, without an asterisk.

Connections to Academic Standards

History–Social Science Content Standards for California Public Schools, Grade 7

- 7.7 Students compare and contrast the geographic, political, economic, religious, and social structures of the Meso-American and Andean civilizations.
 - 7.7.2 Study the roles of people in each society, including class structures, family life, war- fare, religious beliefs and practices, and slavery.

Common Core State Standards, English Language Arts and Literacy, Grade 7

- RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- SL.7.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 7 topics, texts, and issues*, building on others' ideas and expressing their own clearly.
 - SL.7.1.b Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed.
 - SL.7.1.c Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.
 - SL.7.1.d Acknowledge new information expressed by others and, when warranted, modify their own views.
- SL.7.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.
- SL.7.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grade 7 Language standards 1 and 3 on page 53 for specific expectations.)
- L.7.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
 - L.7.1.a Explain the function of phrases and clauses in general and their function in specific sentences.
 - L.7.1.b Choose among simple, compound, complex, and compound-complex sentences to signal differing relationships among ideas.
 - L.7.1.c Place phrases and clauses within a sentence, recognizing and correcting misplaced and dangling modifiers.*
- L.7.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.
 - L.7.3.a Choose language that expresses ideas precisely and concisely, recognizing and eliminating wordiness and redundancy.*
- L.7.6 Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Health Education Content Standards for California Public Schools, Grades 7&8,

- 1.2.N Identify nutrients and their relationships to health.
- 1.4.N Describe how to keep food safe through proper food purchasing, preparation, and storage practices.
- 1.5.N Differentiate between diets that are health-promoting and diets linked to disease.
- 1.8.N Identify ways to prepare food that are consistent with current research-based guidelines for a nutritionally balanced diet.

- 1.10.N Identify the impact of nutrition on chronic disease.

Connections to *Edible Schoolyard* Standards

Edible Schoolyard 3.0

In the Edible Schoolyard Program

- 1.1.0: Students work with each other and teachers to develop community and personal stewardship, along with skills that will help them navigate different situations throughout their lives.
- Tools 1.1.1: Engage in structured groups to complete tasks and practice teamwork.
- Tools 1.1.2: Make positive contributions to small group discussions.
- Tools 1.1.3: Communicate relevant questions to classmates; build language and listening skills by practicing self-control, self-awareness, and noticing our impact on others.
- Tools 1.1.4: Recognize the right tool for a job and clearly articulate reasons for choosing it.
- Techniques 1.2.5: Solve problems by clearly identifying the challenge, posing questions, visualizing the end goal and identifying multiple solutions.
- Techniques 1.2.6: routinely make **decisions**, and demonstrate increased self-awareness, confidence, empathy, and ability to respectfully challenge and debate others.
- Techniques 1.2.7: Follow a set of rituals and routines that help work go smoothly and develop into lifelong habits.
- Concepts 1.3.8: Create an atmosphere of cooperation and unity. We elevate the class experience for all by offering and receiving encouragement, and welcoming the ideas and contributions of others.
- Concepts 1.3.9: Notice and appreciate beauty. We take ownership in pleasing and awakening our senses to communicate care and value, because beauty can deliver a message of optimism and expectation without saying a word.
- Concepts 1.3.10: Develop confidence by creating a supportive and stimulating middle school environment in which they can seek and test boundaries, begin to formulate value systems, and define their interests and talents. The kitchen and garden offer opportunities for students to explore their strengths while building skills for life.
- Concepts 1.3.11: Understand seasonality by recognizing and enjoying foods at their peak of flavor and ripeness. Students know that locally sourced foods are good choices because they provide optimum freshness, support the local economy, and help offset global warming.
- Concepts 1.3.12: Are mindful of bio-diversity as it pertains to the ecology of the garden, the development of food throughout history, and within our own faculty and student body. We explore the garden as an ecosystem and understand that embracing and preserving diversity builds a strong, healthy, and resilient planet.

In the Kitchen Classroom, 7th grade

- Techniques 2.2.4: Understand the versatility of **ingredients**, and realize that certain ingredients are available in particular seasons.
- Concepts 2.3.8: Approach lessons with **intention** by thinking through how the recipe relates to the kitchen, garden, and wider environment as a whole.
- Concepts **2.3.10**: Fully **engage their senses** and use descriptive vocabulary to discuss observations, situations, events, moods, and other subjects including and beyond food.
- Concepts 2.3.11: Make connections between the diets of **historic cultures** and foods we eat today.

The Corn Series: Tortillas! Lesson

Materials

For the Nixtamalizing Station

- **Nixtamalizing** Directions
- “**Nixtamalization**” written on a strip of paper

For the Masa Harina Station

- Various types of corn

Ingredients

For the Nixtamalizing Station

- 3 Cups **nixtamalized** corn for grinding
- 1 Package cal (calcium oxide or slaked lime)
- 1 Cup dried dent corn for **nixtamalizing**
- Water

For the Masa Harina Station

- 3 Cups **masa** harina
- Freshly-ground **nixtamalized** dent corn
- Water
- Salt
- Fresh sweet corn on the cob
- Whole **nixtamalized** dent corn
- Dried popcorn
- Dried flint corn

For the Tortilla Station

- Freshly-mixed **masa** from **masa** harina
- Freshly-mixed **masa** from **nixtamalized** dent corn

- Butter
- Salt

Tools

For the Nixtamalizing Station

- Heavy-bottomed pot
- One-cup measuring cup
- Measuring spoons
- Colander
- Wooden spoon
- 1 or 2 **Mortar and pestles**
- 1 Metate y mano
- 1 Molino or hand-grinder
- Several small bowls for holding whole corn kernels and ground **masa**
- Plastic scraper

For the Masa Harina Station

- 2 Large mixing bowls
- 1 One-cup measuring cup
- 1 Measuring beaker for water
- Chef's knife
- Cutting board
- Platter
- Spoon
- Little bowls for corn tasting

For the Tortilla Station

- Tortilla presses
- Platters
- Spatulas
- Tea towels
- Napkins

- Cups
- Water pitcher
- Plate for butter

Equipment

For the Nixtamalizing Station

- Stove

For the Tortilla Station

- Electric griddle

Timeline Overview

Total Duration: 90 minutes

1. *Invitation** (5 minutes)
2. *Concept Invention** (15 minutes)
3. *Application** (20 minutes)
4. *Application** (20 minutes)
5. *Application** (20 minutes)
6. *Clean Up* (5 minutes)
7. *Reflection** (5 minutes)

Before you Begin

- Collect all the tools and ingredients, and distribute them to the stations
- Preheat the griddle at the Tortilla Station
- Boil a pot full of water for **nixtamalizing** corn at **Nixtamalization** Station
- Mix a batch of **masa** for the first group at Tortilla Station to press into tortillas
- Grind a batch of **nixtamalized** corn for the first group at the **Masa Harina** Station to make into balls
- Assemble the corn altar (to remain for the duration of the week-long series)

Procedures

Welcome

1. *Invitation**: (5 minutes)

- a. Welcome students to the kitchen and introduce the theme for the week: corn!
- b. We will talk about changes in production and **processing** over time, and how these changes connect to health, environment, lifestyle, and our relationships to food.

At the Chef Meeting

2. *Concept Invention**: (15 minutes)

Students learn about **processing** corn for tortillas and the three sisters.

- a. Define “production” and “**processing**.”
 - i. Have students give examples of ways in which they have participated in each during their classes at the Edbile Schoolyard.
- b. Facilitate a student brainstorm of ways corn may be processed that answer these questions:
 - i. Will the products of corn **processing** always be edible?
 - ii. What are examples of non-edible corn products?
- c. During this week-long investigation of corn, we’ll also be talking about the Three Sisters.
 - i. Ask if students have heard of the Three Sisters before?
 - ii. Who are they? (Corn, squash and beans.
 - iii. They are all native to the Americas, and they were traditionally grown and eaten together.)
- d. In addition to working with corn, we’ll also be cooking a lot with the other two sisters this week.
- e. Today, we’re just going to focus on the tallest of the three sisters: corn.
 - i. Explain to students that **masa** is the dough used to make corn tortillas and that today they will prepare it two ways using corn prepared with different technologies.
 - ii. Explain that students will rotate through the following three stations for today’s lesson:
 - 1) **The Nixtamalizing Station** where students will experience two ancient processes that are still necessary today, investigate different tools for one of them and prepare **masa** from freshly ground corn.
 - 2) **The Masa Harina Station** where they will use a modern tortilla making technology that is more convenient, and taste four different types of corn.
 - 3) **The Tortilla Station**, where they will cook both types of **masa** into tortillas and eat them.
- f. Organize students into three groups, ask them to wash their hands and go to their station.
 - i. Have groups of students rotate between the three stations listed below in 20-25 minute sessions.
 - ii. The stations are at the usual table cooking stations.
 - iii. Students will spend 5-10 minutes of their time at the last station cleaning up.

At the Nixtamalizing Station

3. *Application**: (20 minutes)

- a. Welcome the group and ask them when was the last time (before this lesson) that they ate corn? What form was it in?
- b. Identify corn as a staple crop for the Aztecs and have students define “staple crop”.
- c. Discuss the time and energy the Aztecs devoted to growing and **processing** corn, the way it impacted their relationship to corn and why it held such an important place in their lives.
- d. Explain that the Aztecs developed a method of **processing** corn called **nixtamalizing**, which served 3 purposes:
 - i. It made the corn sweeter.
 - ii. It made the corn tender.
 - iii. It made the corn more nutritious.
- e. This process requires an alkaline solution, which loosens the hulls from the kernels, softens the corn, changes the flavor, and releases niacin (vitamin B3).
 - i. Mixing hardwood ashes or slaked lime (lime stone powder) with water made the alkaline solution.
 - ii. The dried corn was boiled briefly in the alkaline solution and left to soak in it overnight.
 - iii. The next morning the hulls were removed and it was ground to make **masa**.
- f. Invite students to break into pairs or trios and have one pair work at the cooking station, following directions to **nixtamalize** 1 cup of dried dent corn.
- g. Have other pairs take turns grinding the already **nixtamalized** corn with the **mortar and pestle**, metate y mano and the Molino or hand grinder.
- h. Invite students to observe and smell the **nixtamalized** corn being prepared by their group, noting the aroma produced by **nixtamalizing**.
- i. Have students discuss and compare merits of various grinding methods, noting that advantages and disadvantages vary depending on how much **masa** is needed.
 - i. Which process is easiest or most difficult? Why?
 - ii. Which process gives you the most control over the final product? Why?
 - iii. Which process could you engage in for hours at a time? Why?
 - iv. Which process requires the most or least resources? Why?
 - v. Discuss what is involved in cleaning each of the grinders and why some methods are more **efficient** than others.
- j. Have student take the fresh **masa** they made to the next station where they will portion and press it.

At the Masa Harina Station:

4. *Application**: (20 minutes)

- a. Welcome the group and ask students to share one of their favorite ways to eat corn.
- b. Identify **masa** as the dough made of ground **nixtamalized** corn from which tortillas are made.
- c. Ask if any of the students know what *seca* means in Spanish.
 - i. Share that **masa** *seca* or **maseca** is simply dried **masa** ground into a fine flour (also called **masa** harina).
- d. Ask the students if they think it is a necessary step to dry the **masa** and grind it into flour before making it into tortillas.
 - i. Share that it is not a necessary step and is done for convenience.
 - ii. **Maseca** is a very recent innovation in the timeframe of tortillas and many people now eat tortillas made from **maseca**.
 - iii. Some people prefer the flavor and texture of tortillas made from freshly ground corn instead of **masa** harina, but they are becoming harder to find as more people switch to **maseca**.
- e. Invite the students to prepare a batch of **masa** from **maseca** and finish their batch of fresh **masa** from the **Nixtamalization Station**, then compare the two.
- f. Have one half of the group work on preparing **masa** from **maseca**, following the instructions on the bag.
- g. Have the other half of the students mix a small amount of water into the freshly ground corn and add a pinch of salt.
- h. Invite the students to feel each bowl of **masa** and notice the differences in texture.
- i. Ask them to consider how the textures of the **masas** are affected by the processes used.
- j. Have the students portion all of the **masa** and prepare it into balls so that it is ready to press at the next station.
- k. Invite students to taste examples of the 4 main types of corn: popcorn, dent corn, flint corn and sweet corn.

At the Tortilla Station

5. *Application**: (20 minutes)

- a. Welcome the group and ask students to share their favorite taco or burrito filling.
- b. Demonstrate pressing and cooking a tortilla.
 - i. Press a corn tortilla and place it on the hot griddle to cook.
 - ii. The tortillas will be ready to flip when the edges curl up, it is important not to try to flip them before.
 - iii. Encourage students to use all their senses while working and to notice how the freshly-**nixtamalized masa** differs from the **masa** harina during pressing, cooking, and eating.
- c. Have students press and cook tortillas.

- i. Give each student a chance to eat two hot off the griddle with butter and salt.
- ii. Remaining tortillas will be passed out at the end of class.
 - 1) Challenge students to try to press a square tortilla. Why is this difficult?
 - 2) Ask if they can think of any ways to make tortillas at home without a tortilla press.
 - 3) Ask students how they think people might have made tortillas in Aztec times?
 - 4) Ask how they can tell when the tortillas are ready to be flipped?
 - 5) How can they tell when the tortillas are done?
 - 6) Ask do the two types of **masa** cook differently? How? Why do they think that is?
 - 7) Ask students why they think the edges of the tortillas curl up as they cook.
- d. Ask students to reflect on what they observed about how the two different types of **masa** cooked and tasted.

6. Clean Up (5 minutes)

Ask all students to finish their station activity and clean up.

At the Closing Circle

7. *Reflection**: (5 minutes)

- a. Ask students to describe the activities at each of the three stations.
- b. Is it necessary to complete all three activities in order to make a corn tortilla?
- c. Have students describe each of the steps in the two distinct processes for making tortilla dough from scratch, differentiating between using dried dent corn or commercially processed **masa** harina.

Vocabulary

Food production

Food processing

Nixtamalization

Efficient

Masa

Maseca

Mortar and pestle

Molcajete

Contributors

All lessons at the Edible Schoolyard Berkeley are developed in collaboration with the teachers and staff of the Edible Schoolyard and Martin Luther King Jr. Middle School.

Learning Cycle and Think-Pair-Share discussion routine © The Regents of the University of California. All materials created by BEETLESTM at The Lawrence Hall of Science.

Resources

Nixtamalization_Directions.pdf

BEETLES_Learning_Cycle.pdf (See lesson G6-0)

BEETLES_Discussion_Routines.pdf (See lesson G6-1)

Nixtamalized Corn

Ingredients

2 pounds clean, dried dent-corn kernels (also known as field corn or flour corn)
1/4 cup pickling lime (food-grade calcium hydroxide, also called slaked lime)
3 quarts water

Procedures

1. Rinse the corn in a colander and set aside.
2. In a large, stainless steel (nonreactive) pot, dissolve the lime in the water.
 - a. Immediately wash off any lime that gets on your hands.
 - b. Add the corn and discard any floating kernels.
3. Bring to a boil over high heat.
4. Reduce the heat to low, and cook uncovered for 15 minutes.
5. Turn off the heat, cool the pot and let it sit, uncovered, for 4 hours at room temperature or overnight in the refrigerator.
6. Pour the corn into a colander in the sink.
7. With the cold water running, rub the kernels between your hands to rub away the softened hulls (they will have a gelatinous texture).
8. Rinse thoroughly (some old recipes say to wash between 4 and 11 times).
9. Drain well.
10. Use the whole, moist kernels in soups or stews.
11. Or, grind them through a food mill able to handle moist kernels to make masa, to which you can add enough water to make a slightly sticky dough for making tamales or make tortillas using a tortilla press.
12. Promptly refrigerate any unused masa, and use it within 3 days.

Source: Mother Earth News. "Make Masa: Nixtamalized Corn." April/May 2004.
<http://www.motherearthnews.com/real-food/make-masa-nixtamalized-corn-zmaz04amzsel.aspx>

