

SUSTAINABLE BIOECONOMY

FOR ARID REGIONS



THE THREE SISTERS AND COMPANION PLANTING

OVERVIEW

This lesson introduces students to the concept of companion planting by focusing on the Native American tradition of planting the Three Sisters: corn, beans and squash. Students will design their own Three Sisters garden as part of this lesson.

Matt Swanson and Juan Arias, University of Arizona Cooperative Extension



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THE THREE SISTERS AND COMPANION PLANTING

STUDENT LEARNING OBJECTIVES:

After completing this lesson, students will be able to:

1. Demonstrate understanding of the agricultural and health benefits of planting food crops that support each other in a mutually beneficial relationship.
2. Demonstrate understanding of crop management techniques by creating a plan for their own Three Sisters garden.
3. Identify variations of the Three Sisters garden as well as the presence of many variations of companion planting in Native American's environment-specific agricultural traditions.
4. Identify resources in their community that can help them with gardening projects.

TIME REQUIRED:

50 to 75 minutes

5 min teacher preparation

RESOURCES:

1. The Three Sisters and Companion Planting Lesson Plan
2. The Three Sisters and Companion Planting Presentation
3. The Three Sisters and Companion Planting Worksheet

EQUIPMENT AND SUPPLIES NEEDED:

1. Worksheet and graph paper for all students
2. Device with internet access to play videos embedded into PowerPoint
3. Device with internet access to search Native Seed SEARCH database
 - <https://www.nativeseeds.org/pages/seeds>

THIS LESSON PLAN WOULD WORK WELL AS PART OF:

- Environmental Science curriculum
- Plant biology curriculum
- Chemistry curriculum

THIS LESSON IS ALIGNED TO AFNR, COMMON CORE, FFA AND NGSS STANDARDS.

Expanded standards listed on page 6.



LESSON PLAN:

1. Introduction

In this activity, students will understand the many benefits of carefully planting different types of crops that mutually benefit each other. Students will also plan out their own gardening project based upon what they learn in this lesson.

2. PART 1: What Are the Three Sisters? (20 to 30 minutes)

Begin The Three Sisters and Companion Planting PowerPoint presentation. Advance to slide 2.

Slide 2 (5 minutes): Give students time to complete bellwork. When they are done, elicit student responses. The point of this question is to get students to think about the long history of cultivation in arid lands. Some sample answers follow:

A) **Why are these types of corn different colors and sizes?** *The different colors and sizes are in response to different environmental conditions as well as what the cultivators were aiming for—like a sweeter flavor, for instance.*

B) **Why is corn considered a fundamental, or "staple" crop across the world?** *Corn is a staple crop because it contains a lot of energy per weight, it has a pleasing taste to most people, and it can be added to many other foods as an ingredient.*

Slide 3 (1 minute): Go over the objective with students so they know the purpose of the activity.

Slide 4 (2-3 minutes): Read the brief introduction to students about the Three Sisters agricultural traditions employed by many Native American communities. The emphasis should be on the long tradition of careful observation of agricultural techniques that have led to this remarkable practice. More recent scientific research has also verified many of the benefits of the Three Sisters and other mutual benefit crop plantings that are known as companion planting.

Slide 5 (6 minutes): Emphasize that there are MANY legends surrounding the Three Sisters, and you are reading the beginning to one of them. The Three Sisters video is 5 minutes. At the end of the video, ask students to identify the plants being described in the video.

Slide 6-7 (3-4 minutes): Present the information about the first two sisters. Several different languages are used for the names of These Sisters. Emphasize the long traditions of diverse cultures regarding these crops, particularly Native American cultures.

Slide 8 (3 minutes): A little more detail on the particularly important nitrogen fixing process that beans can complete is included. The answer to the question on the slide is: *Nitrogen makes up about 71% of the air around us but is much less common in soil.* We all depend on the relationship between plants and nitrogen-fixing bacteria.



Slide 9 (2 minutes): Present the information about squash. You may want to emphasize that squash is part of a family (cucurbits) that include melons and gourds, so other cucurbits can be substituted into a Three Sisters garden.

Slide 10-11 (2-3 minutes): Explain the nutritional benefits of a diet with all Three Sisters. Other examples of complete meals are numerous and students might think of traditional holiday meals. Nutritionally, amino acids combined create proteins, which are the building blocks for all of our body structures. As an option, you can show students the My Plate guidelines that outline a balanced diet to emphasize this point further.

Slide 12-13 (3-4 minutes): Explain companion planning, which is often between only two crops, and give the three examples included on slide 12. Emphasize that guayule and guar, like many other plants, are being studied and don't have proven benefits to each other yet.

3. PART 2. Three Sisters Garden Planning Activity (20 to 40 minutes)

Slide 14 (1-2 minutes): Explain the objective for the garden planning. This is a suitable time to hand out Three Sisters and Companion Planting Worksheet and graph paper to each student.

Slide 15-16 (3-7 minutes): Show the list of seeds that are included in the student handout but emphasize that the website has currently available varieties and more choices. You may want to either project the website <https://www.nativeseeds.org/pages/seeds> or ask students to look on separate devices for the seed list if possible. If you would rather use another native/heirloom seed site, there are many regional organizations that can be found with an internet search that can be substituted for the Native Seeds SEARCH site. Make sure that students know the five rules on their handout for this activity. The rules are based upon extensive experience with each plant's optimal growing conditions.

Slides 17-18 (5-7 minutes): have students create a scale on their graph paper that would be appropriate for the space they are thinking of. A great option for this activity is to pick a school space where a garden could be planted and have students measure the area with rulers. If this is not possible and students do not have a space in mind, you can give them a generic area, say 10 feet by 20 feet, for them to start their planning.

Slide 19 - 21 (10-25 minutes): Show the map examples to students so they have an idea of what a completed map looks like. Emphasize to students that they can be creative, and the example is meant to give them an idea only. Ask students if the example maps follow all five rules to check for understanding (*they do not*). Give students time to work on the map as you monitor their progress.

Slide 22 Optional Extension: (10 minutes): When maps are done, you may want to post them in a central location and have students comment on each other's maps or pick a winning design if this is a school site project.



4. PART 3. Wrap up (10 to 15 minutes)

Slides 23-24 (3-5 minutes): The leveling up question is meant to get students to think about the properties of each plant and figure out which would be planted first based on what they already know. You can go over the answers with them on slide 24.

A) Which sister would you plant first? Why? *Corn is planted first, so it can grow tall over the other crops.*

B) Which sister would you plant second? Why? *Beans are planted when the corn is a few inches tall so it can climb the corn stalks.*

C) Which sister would you plant last? Why? *Squash is planted last after the beans have emerged from the soil, so the large leaves don't block the growth of the other sisters.*

Slide 25 (5-10 minutes): The two questions here have answers that will vary per student. The objective is to get students to think about the actual act of planting this garden and encouraging them in the process of making it a reality.

Slide 26: This is a link to Native Seed SEARCH community seed grant applications, which can provide hundreds of dollars in seeds to your school or non-profit. If you receive the grant, you can have kids revisit the exit ticket questions to pick seeds for your school community. Some communities also have Seed Libraries, sometimes part of the traditional library system.

DEFINITIONS:

Amino Acid: A molecule present in living things that are the building blocks of protein in your body.

Bioregion: A region defined by characteristics of the natural environment rather than man-made divisions. For example, the Sonoran Desert area is a bioregion, Tucson is a man-made city.

Companion Planting: Growing two or more varieties of plants that help each other.

Diné: Language spoken by the Navajo.

Hopi: Language spoken by the Hopi.

Nitrogen: An element needed as a nutrient by living things but is not present in large amounts in the soil for plants.

Protein: A chain of amino acids combined, forms many of the structures in living things.

Vitamins: Certain chemical substances needed by living things to function normally.



STANDARDS DETAILS:

Common Core – Science and Technical Subjects

CCSS.ELA-Literacy.RST.9-10.7: Translate quantitative or technical information expressed in words in a text into a visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

CCSS.ELA-Literacy.RST.9-10.9: By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

Common Core – Math Practices

MP1: Make sense of problems and persevere in solving them.

MP2: Reason abstractly and quantitatively.

MP5: Use appropriate tools strategically.

MP6: Attend to precision.

NGSS

Disciplinary Core Ideas:

LS1.B: Growth and Development of Organisms

LS2.A: Interdependent Relationships in Ecosystems

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

LS4.D: Biodiversity and Humans

E S S2.D: Weather and Climate

E T S1.B: Developing Possible Solutions

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms

HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

AFNR

CRP.02: Apply appropriate academic and technical skills. Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive.

CRP.02.01. Use strategic thinking to connect and apply academic learning, knowledge and skills to solve problems in the workplace and community.

CRP.02.02. Use strategic thinking to connect and apply technical concepts to solve problems in the workplace and community.

CRP.04: Communicate clearly, effectively, and with reason. Career-ready individuals communicate thoughts, ideas and action plans with clarity, whether using written, verbal and/or visual methods.

CRP.07: Employ valid and reliable research strategies. Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies.

CRP.08: Utilize critical thinking to make sense of problems and persevere in solving them.

CS.06. Analyze the interaction among AFNR systems in the production, processing and management of food, fiber and fuel and the sustainable use of natural resources.



FFA Precept

FFA.PL-A. Action: Assume responsibility and take the necessary steps to achieve the desired results, no matter what the goal or task at hand.

FFA.PL-E. Awareness: Understand personal vision, mission and goals.

FFA.PL-F. Continuous Improvement: Accept responsibility for learning and personal growth.

FFA.PG-J. Mental Growth: Embrace cognitive and intellectual development relative to reasoning, thinking, and coping.

FFA.CS-M. Communication: Effectively interact with others in personal and professional settings.

FFA.CS-N. Decision Making: Analyze a situation and execute an appropriate course of action.

FFA.CS-O. Flexibility/Adaptability: Be flexible in various situations and adapt to change.



AUTHOR BIOGRAPHY

Matt Swanson is a lifelong Arizona resident and an educator with experience teaching science at the middle school and high school levels. He is now working for the Arizona State 4-H office as a curriculum specialist, where he continues to enjoy bringing learning experiences to youth. He received both his undergraduate degree in philosophy and his graduate degree in science education at the University of Arizona.

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