



School Garden Curriculum

STEM + Ecology Integration



Grades K–5 • 8 Units • 40 Lessons
Standards-Aligned • Garden-Based Learning

Plant Life Cycles • Soil Science • Composting • Food Systems
Seed Dispersal • Pollination • Seasonal Harvest • Garden Ecosystems

Works With or Without an Actual Garden

by UM Printables

Table of Contents

Introduction & How to Use This Resource

Unit 1: Plant Life Cycles — From Seed to Harvest

Lessons 1–5: Seed exploration, germination, growth stages, flowering, seed saving

Unit 2: Soil Science — The Living Earth Beneath Us

Lessons 1–5: Soil components, texture, organisms, nutrients, conservation

Unit 3: Composting — Nature’s Recycling System

Lessons 1–5: Decomposition, ingredients, building a bin, observations, applications

Unit 4: Food Systems — From Garden to Table

Lessons 1–5: Food sources, farm to table, nutrition, cultural foods, preservation

Unit 5: Seed Dispersal — Traveling Seeds

Lessons 1–5: Dispersal methods, wind/animal/water/mechanical, design challenge, mapping

Unit 6: Pollination — Nature’s Matchmakers

Lessons 1–5: Flower anatomy, pollinator types, process, pollinator gardens, citizen science

Unit 7: Seasonal Harvest — Following Nature’s Calendar

Lessons 1–5: Seasonal cycles, spring planting, summer growth, fall harvest, winter planning

Unit 8: Garden Ecosystems — A Community of Life

Lessons 1–5: Ecosystems basics, food chains, symbiosis, biodiversity, stewardship

Garden Observation Journal — Student Pages

Data Collection Sheets

Plant Diagram Labeling Activities

STEM Connection Notes

Harvest Math Activities

Introduction

How to Use This Resource

Welcome to the **School Garden Curriculum: STEM + Ecology Integration** — a comprehensive, standards-aligned resource designed to connect students in Grades K–5 with the natural world through hands-on garden-based learning. This curriculum bridges science, technology, engineering, mathematics, and English language arts through the living laboratory of a school garden.

Whether you have a sprawling garden plot, a few container pots on a windowsill, or no garden at all — this resource works for you. Every lesson includes adaptations for classrooms without outdoor garden access, using everyday materials and indoor-friendly activities.

What's Inside This Resource

- **8 comprehensive unit guides** (5 lessons each = 40 total lessons)
- **Garden Observation Journal** — ready-to-use student pages
- **Data Collection Sheets** for authentic scientific observation
- **Plant Diagram Labeling Activities**
- **STEM Connection Notes** for cross-curricular integration
- **Harvest Math Activities** for real-world problem solving
- **Differentiation strategies** for K–2 and 3–5
- **NGSS, CCSS-Math, and CCSS-ELA** standards alignment

Curriculum Overview

This curriculum is organized into 8 sequential units that follow the natural cycle of a garden — from understanding plant life cycles and the soil that sustains them, through the processes of composting and pollination that support growth, to the harvest and broader ecosystem connections. Each unit builds on previous knowledge while remaining accessible enough to be taught independently based on your classroom needs and seasonal timing.

Unit	Title	Core Focus	Primary NGSS
1	Plant Life Cycles	From seed to seed	1-LS1-1, 3-LS1-1
2	Soil Science	The living earth	2-ESS2-1, 4-ESS2-1
3	Composting	Nature's recycling	5-LS2-1, K-ESS3-3
4	Food Systems	Garden to table	3-5-ETS1-1, K-ESS3-1
5	Seed Dispersal	How seeds travel	2-LS2-2, 4-LS1-1
6	Pollination	Nature's matchmakers	2-LS2-2, 3-LS2-1
7	Seasonal Harvest	Nature's calendar	K-ESS2-1, 1-LS1-2
8	Garden Ecosystems	Community of life	5-LS2-1, 3-LS4-3

Lesson Structure

Each of the 40 lessons follows a consistent, teacher-friendly format designed for easy implementation:

- **Objective** — Clear, measurable learning target aligned to standards
- **Materials** — Complete list of supplies needed (with no-garden alternatives noted)
- **Procedure** — Step-by-step instructions with suggested timing
- **STEM Connection** — Explicit link to science, technology, engineering, or math

- **ELA Connection** — Reading, writing, speaking, or listening integration
- **Assessment** — Formative assessment strategies and exit ticket ideas
- **Differentiation** — Specific adaptations for K–2 and 3–5 learners

No Garden? No Problem!

Every lesson includes a 'Classroom Alternative' option. You can use: container gardens on windowsills, indoor grow lights with seed trays, virtual garden tours and videos, store-bought produce and soil samples, seed packets for observation, or community garden field trips. The learning outcomes remain identical regardless of garden access.

Grade Band Differentiation

This resource is designed for use across the K–5 grade span. Each lesson includes specific differentiation notes to help you adapt content, process, and product for younger and older learners:

Aspect	Grades K–2	Grades 3–5
Vocabulary	Picture-supported, simplified terms	Academic vocabulary with definitions
Data Collection	Tally marks, simple counts, drawings	Measurements, graphs, written analysis
Writing	Sentence starters, labeled drawings	Paragraph responses, compare/contrast
Math Integration	Counting, basic addition, patterns	Multiplication, fractions, data analysis
Independence	Teacher-guided, collaborative groups	Student-directed inquiry, research

Standards Alignment

This curriculum is aligned with the **Next Generation Science Standards (NGSS)**, **Common Core State Standards for Mathematics (CCSS-Math)**, and **Common Core State Standards for English Language Arts (CCSS-ELA)**. Specific standards are cited in each unit and lesson. The curriculum supports the following NGSS science and engineering practices: Asking Questions and Defining Problems, Planning and Carrying Out Investigations, Analyzing and Interpreting Data, Constructing Explanations and Designing Solutions, Engaging in Argument from Evidence, and Obtaining, Evaluating, and Communicating Information.

Suggested Pacing Guide

While this curriculum can be used in any order, the following pacing aligns with a typical school year and seasonal garden cycle in the Northern Hemisphere:

Timeframe	Unit	Rationale
Sep – Oct	Unit 1: Plant Life Cycles	Begin with seeds at harvest time; collect and save seeds
Oct – Nov	Unit 2: Soil Science	Test and amend soil before winter; indoor soil labs
Nov – Dec	Unit 3: Composting	Start compost bins with fall leaves; observe decomposition
Jan – Feb	Unit 4: Food Systems	Indoor-friendly; study food sources during winter
Feb – Mar	Unit 5: Seed Dispersal	Design seed models; prepare for spring planting
Mar – Apr	Unit 6: Pollination	Pollinators emerge in spring; plant pollinator gardens

Apr – May	Unit 7: Seasonal Harvest	Spring harvest of cool-season crops; summer planning
May – Jun	Unit 8: Garden Ecosystems	Garden is fully alive; observe complete ecosystem

Tips for Success

- **Start small.** Even a single container garden provides meaningful learning experiences. Expand as confidence grows.
- **Involve students in planning.** Ownership increases engagement. Let students help choose what to plant and where.
- **Keep a class garden journal.** Document progress with photos, drawings, and written reflections throughout the year.
- **Connect to the cafeteria.** Partner with school nutrition staff to feature garden produce in meals when possible.
- **Embrace failure as learning.** Plants die, pests visit, weather damages crops — these are all authentic science investigations.
- **Use community resources.** Local master gardeners, farmers, and nursery staff are often willing guest speakers.
- **Integrate across subjects daily.** A five-minute garden observation can launch a writing prompt, math problem, or science discussion.

UNIT 1

Plant Life Cycles

From Seed to Harvest

Duration: 5 lessons | 2–3 weeks

Essential Questions

- How does a plant change from a seed to a seed-producing adult?
- What do plants need to survive and grow?
- How are the life cycles of different plants similar and different?

NGSS Standards

- K-LS1-1: Use observations to describe patterns of what plants need to survive.
- 1-LS3-1: Make observations to construct an evidence-based account that young plants resemble their parents.
- 2-LS2-1: Plan and conduct an investigation to determine if plants need sunlight and water to grow.
- 3-LS1-1: Develop models to describe that organisms have unique and diverse life cycles but all have birth, growth, reproduction, and death.

CCSS-Math Standards

- K.CC.C: Count to tell the number of objects.
- 1.MD.A.2: Express the length of an object as a whole number of length units.
- 3.MD.B.3: Draw a scaled picture graph to represent a data set.

CCSS-ELA Standards

- W.K-2.2: Write informative/explanatory texts.
- SL.3-5.1: Engage effectively in a range of collaborative discussions.
- RI.4.3: Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text.

Lesson 1: The Magic of Seeds

Objective: Students will observe, compare, and classify a variety of seeds, identifying the seed coat and embryo inside.

Materials:

- Assorted large seeds (lima beans, sunflower, corn, peas)
- Magnifying glasses
- Pre-soaked lima beans (soaked in water overnight)
- Paper towels
- Seed Sorting Data Sheet (from student pages)

Procedure:

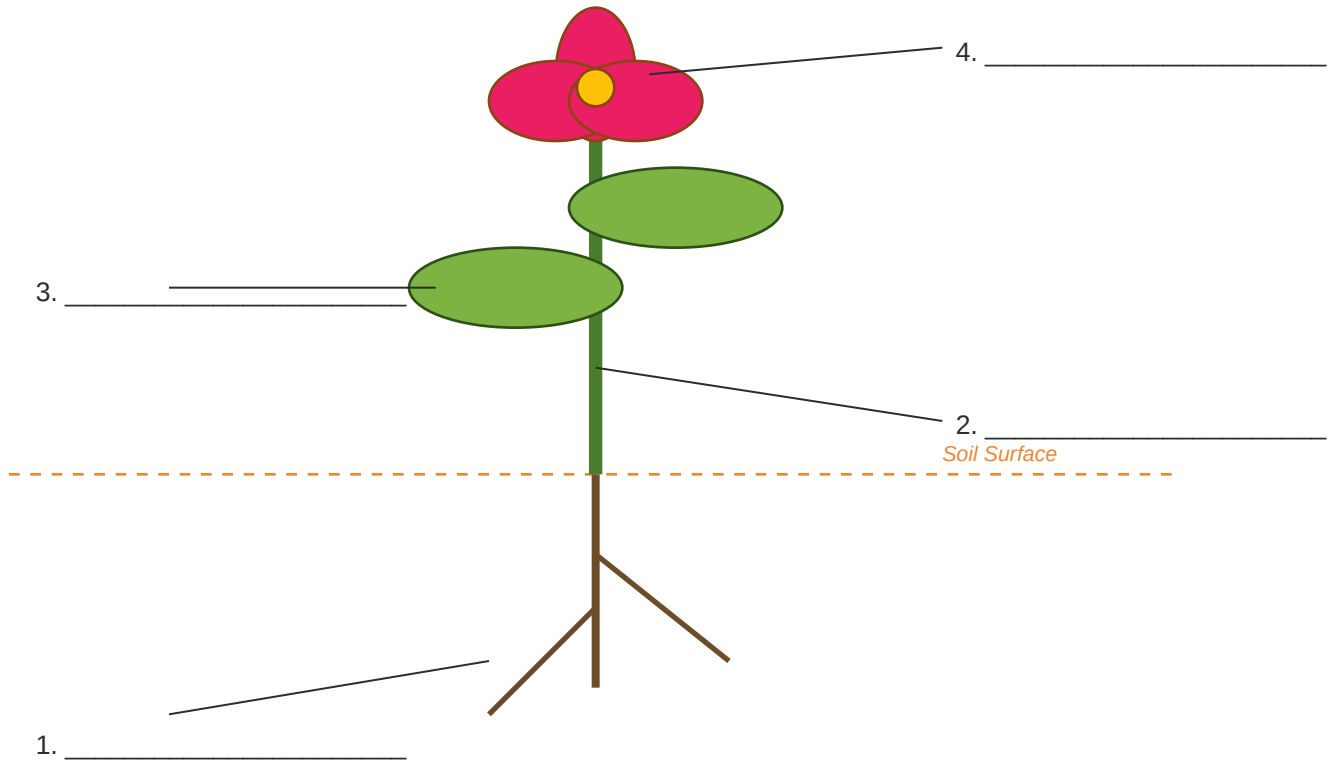
1. Display assorted seeds. Ask: *What do these all have in common? What differences do you notice?*
2. Distribute dry seeds and magnifying glasses. Students observe and describe properties (size, shape, color, texture). Sort seeds by different attributes.
3. Introduce vocabulary: **seed coat** (protective outer layer) and **embryo** (tiny baby plant inside).

Plant Parts & Functions

Unit 1 & 4

Name: _____ Date: _____

Word Bank: Roots | Stem | Leaves | Flower | Fruit



Which part makes food using sunlight? _____

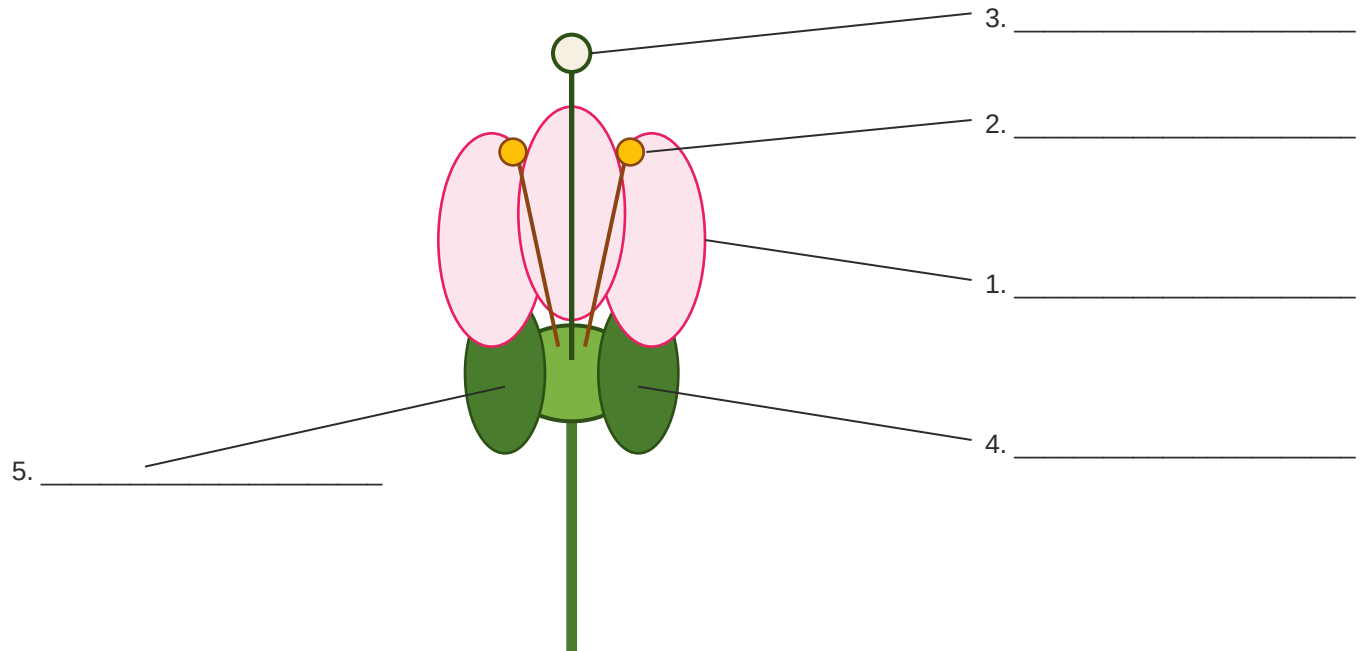
Which part absorbs water and anchors the plant? _____

Flower Anatomy

Unit 6: Pollination

Name: _____ Date: _____

Word Bank: Petal | Stamen (Anther) | Pistil (Stigma) | Ovary | Sepal



Which part produces pollen? _____

Which part catches pollen? _____

Which part becomes the fruit/holds the seeds? _____

STEM Connection Notes

A Teacher's Guide to Cross-Curricular Integration

This resource is built on the foundation that garden-based learning naturally integrates Science, Technology, Engineering, and Mathematics (STEM). The following reference pages provide a detailed breakdown of how each unit weaves STEM principles into every lesson. Use these notes to advocate for your school garden program, justify curriculum mapping, and highlight the rigorous academic value of outdoor education.

The Engineering Design Process (EDT) in the Garden

Many lessons in this curriculum utilize the Engineering Design Process: **1. Ask** (Identify the problem/garden need) → **2. Imagine** (Brainstorm solutions) → **3. Plan** (Choose a design/garden layout) → **4. Create** (Build the compost bin/plant the seeds) → **5. Test** (Observe growth/measure drainage) → **6. Improve** (Amend soil/adjust watering). This iterative process mirrors the NGSS Science and Engineering Practices (SEPs).

Unit 1: Plant Life Cycles

SCIENCE	Botany and plant morphology: Students study the biological structures of seeds (embryo, cotyledon, seed coat) and the physiological processes of germination and photosynthesis. They observe life cycle patterns from seed to adult plant, aligning with NGSS Disciplinary Core Ideas about growth and development of organisms.
TECHNOLOGY	Scientific tools: Students use magnifying glasses and hand lenses to observe micro-structures like the plant embryo. Digital technology integration includes viewing time-lapse videos of seed germination and plant growth to understand slow biological processes not visible in real-time classroom observations.
ENGINEERING	Modeling: Students construct a Life Cycle Wheel, a physical model that represents the cyclical nature of plant reproduction. They also model water transport in plants using the celery and food coloring demonstration, mapping a biological system to a physical model.
MATH	Measurement and Data: Students measure sprout growth over time using standard units (inches or centimeters). They collect germination data across controlled variables and represent it on data sheets. Counting and sorting seeds introduces classification and set theory.

Unit 2: Soil Science

SCIENCE	Earth Science and Geology: Students analyze soil as a complex mixture of organic and inorganic matter. They investigate the physical properties of earth materials (particle size, texture) and study the role of soil organisms in the ecosystem. Concepts of permeability, porosity, and erosion are explored through hands-on labs.
TECHNOLOGY	Analytical tools: Students use soil thermometers to measure temperature variables and graduated cylinders to measure water displacement and drainage volumes. Sieves and strainers are used to separate soil components by particle size.

ENGINEERING	Environmental Engineering: Students design and test erosion control methods by comparing bare soil to vegetated soil. They analyze the structural integrity of different soil types (sand vs. clay) and engineer optimal soil blends (loam) for plant growth.
MATH	Volume and Proportions: Students measure liquid volumes in milliliters to determine percolation rates. They calculate the percentage of water retained by different soils and express soil composition as fractions or percentages. They measure ribbon lengths in the soil texture test.

Unit 3: Composting

SCIENCE	Microbiology and Chemistry: Students study the carbon cycle and the role of aerobic decomposers (bacteria, fungi) in breaking down organic matter. They observe exothermic reactions (heat generation) caused by microbial respiration and learn about the chemical elements essential for life (Carbon and Nitrogen).
TECHNOLOGY	Data tracking tools: Students use compost thermometers to monitor internal bin temperatures, correlating heat to microbial activity. Digital scales can be used to measure the mass of organic waste added and the final mass of compost yielded.
ENGINEERING	Systems Design: Students engineer a functional compost bin by layering 'Greens' (nitrogen) and 'Browns' (carbon) in specific ratios. They design aeration systems (poking holes, turning piles) to maintain aerobic conditions and solve the problem of anaerobic odors.
MATH	Ratios and Graphing: Students apply the Golden Ratio (2:1 or 3:1 Browns to Greens) to calculate the volume of materials needed for the compost bin. They graph temperature changes over time to identify the thermophilic (hot) phase of composting. Mass calculations track waste reduction.

Unit 4: Food Systems

SCIENCE	Agricultural Science and Nutrition: Students trace the flow of matter and energy from farms to consumers. They classify foods by botanical plant parts and nutritional value (MyPlate), understanding how agriculture and human biology intersect.
TECHNOLOGY	Geospatial Technology: Students use maps, globes, and online mapping tools to trace food transportation routes. They analyze grocery labeling (stickers/codes) to identify countries of origin and utilize digital databases for nutritional information.
ENGINEERING	Spatial Design: Students design cultural garden plots on grid paper, applying knowledge of plant height, root depth, and sun requirements to engineer a layout that maximizes yield and minimizes resource competition. They also design food preservation systems.
MATH	Distance, Area, and Economics: Students calculate 'Food Miles' using map scales and rulers. They compute the area and perimeter of garden plots on grid paper. Budgeting exercises introduce economic math, and fractions are used to represent portions of the MyPlate nutritional guidelines.

Unit 5: Seed Dispersal

SCIENCE	Biomechanics and Physics: Students study evolutionary adaptations of seeds. They explore the physics of flight (drag, lift, weight) for wind dispersal, density and buoyancy for water dispersal, and potential/kinetic energy conversions for mechanical (explosive) dispersal.
TECHNOLOGY	Aerodynamic testing: Students use electric fans as wind tunnels to test the flight capabilities of their designed seed models. Slow-motion video analysis can be used to observe the spinning action of maple helicopter seeds (samaras).
ENGINEERING	Biomimicry and Design: Students apply the Engineering Design Process to create models mimicking wind-dispersed seeds (parachutes, wings) and mechanical dispersal catapults. They design, test, measure performance, and redesign based on data.
MATH	Measurement and Forces: Students measure the distance traveled by dispersed seeds and the hang time in the air. They calculate launch angles for catapults, determine the density of floating seeds (Mass/Volume), and use the metric system for precise data.

Unit 6: Pollination

SCIENCE	Reproductive Biology and Coevolution: Students study the anatomy of flowers and the biological mechanism of pollination (moving pollen from stamen to pistil). They explore the concept of coevolution, where flower traits (color, shape, odor) evolve specifically to attract certain pollinator species (Pollination Syndromes).
TECHNOLOGY	Citizen Science Platforms: Students use apps like iNaturalist or the Great Sunflower Project to log pollinator data. They use macro-photography or digital microscopes to observe pollen grains up close.
ENGINEERING	Habitat Engineering: Students design Pollinator Gardens tailored to specific species, ensuring the engineered environment meets the survival needs (nectar, water, shelter, nesting) of the target organisms. They construct physical models simulating the pollination process.
MATH	Data Collection and Symmetry: Students tally pollinator visits and create scaled bar graphs to compare visitation rates. They measure the dimensions of flowers to correlate with pollinator body sizes, and they observe radial symmetry in flower anatomy, counting petals in Fibonacci sequences (an advanced extension).

Unit 7: Seasonal Harvest

SCIENCE	Phenology and Climatology: Students study how environmental cues (temperature, daylength) trigger biological events (bud break, flowering, dormancy). They explore the physiological differences between cool-season and warm-season crops and the science of vernalization.
TECHNOLOGY	Environmental Sensors: Students use soil thermometers to determine optimal planting windows and weather instruments to track seasonal changes. They reference almanacs and USDA Hardiness Zone maps to determine appropriate planting schedules.
ENGINEERING	Agricultural Planning: Students design Crop Rotation maps to optimize soil health and break pest cycles. They engineer season-extension solutions (e.g., cold frames, row covers) to protect crops from frost.



Thank You for Choosing This Resource!

We are so glad you chose the **School Garden Curriculum: STEM + Ecology Integration** for your classroom. Our goal at **UM Printables** is to create premium, standards-aligned resources that save you time and deeply engage your students.

Your feedback is incredibly valuable! It helps us improve and lets other teachers know how this resource works in real classrooms.

How to Leave a Review:

1. Go to your **My Purchases** page on Teachers Pay Teachers.
2. Find this resource and click **Leave a Review**.
3. Share your honest feedback and earn TPT credits toward future purchases!



Thank you for growing young minds with us!

— The UM Printables Team