DIRT IS MY GURU

A Beginner's Guide to Growing Soil

FROM THE GREENLIFE PROJECT

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> *"The soil is the great connector of lives, the source and destination of all. It is the healer and restorer and resurrector, by which disease passes into health, age into youth, death into life. Without proper care for it we can have no community, because without proper care for it we can have no life."*
>
> — *Wendell Berry, The Unsettling of America (1977)*

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A NOTE ON SOURCES

This guide is grounded in the work of farmers, scientists, and educators who have spent lifetimes studying soil. Throughout, we identify the source of specific ideas, data, and findings so you can explore further. Green citation boxes like the one below indicate the primary source for the information just presented.

> ▫ *Example: Brown, Gabe. Dirt to Soil: One Family's Journey into Regenerative Agriculture. Chelsea Green Publishing, 2018.*

A full reference list appears in Appendix B. We are journalists and educators, committed to the vitality of our planet and empowering individuals with education.

INTRODUCTION

Dirt is My Guru: A Love Letter to the Ground

Kneel down and pick up a handful of it. Really look at it. What you are holding is not dirt. It is a universe. A single teaspoon of healthy garden soil contains more living organisms than there are people on Earth — billions of bacteria, miles of fungal threads, protozoa, nematodes, and creatures too small to see with the naked eye, all working in concert to sustain life.

Most of us were taught that plants eat fertilizer. The truth is far more beautiful and far more interesting. Plants eat soil — but only because the soil is alive. The living creatures in healthy soil transform raw minerals and decaying matter into exactly the nutrients plants need, delivered at exactly the right time. A plant growing in living soil is plugged into a network of relationships older than agriculture itself.

Gabe Brown, the North Dakota rancher whose book Dirt to Soil became a founding text of the regenerative agriculture movement, put the central challenge plainly: he had been farming the conventional industrial model for years before realizing it was “based on reductionist science, not on how natural ecosystems function.” The moment he shifted his lens — from killing to cultivating, from extracting to restoring — everything changed.

▯ *Brown, Gabe. Dirt to Soil (Chelsea Green, 2018), p. 4. Brown credits Canadian rancher Don Campbell: "If you want to make small changes, change the way you do things. If you want to make major changes, change the way you see things."*

This booklet will ask you to change the way you see things. The soil is the teacher. Dirt is the guru. Let’s learn from it.

CHAPTER ONE:

What Soil Actually Is — and Why It Matters

Soil is not ground-up rock. It is not just “dirt.” It is one of the most complex substances on Earth — a mixture of minerals, organic matter, water, air, and billions of living organisms. Getting to know what soil actually is changes how you garden forever.

The Five Components of Soil

A healthy soil is made of five things in roughly balanced proportions:

- Minerals (approx. 45%) — Weathered rock particles: sand (large), silt (medium), and clay (fine). These form the skeleton of soil and largely cannot be changed. They determine drainage, aeration, and nutrient-holding capacity.
- Organic matter (approx. 5%) — The most critical fraction. Decomposed plant and animal material, living roots, and soil organisms. Though small in volume, organic matter drives nearly everything: fertility, structure, water retention, and biology.
- Water (approx. 25%) — Held in pore spaces. Carries dissolved nutrients to roots and supports soil organisms.
- Air (approx. 25%) — Also in pore spaces. Roots and most beneficial organisms require oxygen to survive.
- Life (immeasurable) — Bacteria, fungi, protozoa, nematodes, earthworms, and more. Without life, the other four components are just rock dust.

▯ *Gardeners.com: "Building Healthy Soil." gardeners.com/how-to/building-healthy-soil/5060.html — Sources the approximate 45/5/25/25 composition of healthy soil and describes each fraction.*

Why Organic Matter is the Master Variable

- At just 5% of soil volume, organic matter determines water-holding capacity, nutrient cycling, disease suppression, and structural stability.
- Depleted industrial farmland averages 0.5–1% organic matter. Thriving prairie soils historically held 5–8%.
- Brown’s Ranch raised soil organic matter from 1.9% to over 6.1% in 20 years — and water infiltration from under 0.5 in/hr to over 30 in/hr.

▯ *Brown, Gabe. Dirt to Soil (Chelsea Green, 2018). Farm Progress: "Dirt to Soil," farmprogress.com/soil-health/dirt-to-soil, Jan. 2023.*

Topsoil: The Irreplaceable Few Inches

All life and fertility concentrates in the top 6–12 inches of soil. It takes nature 500 to 1,000 years to build one inch of topsoil. Industrial agriculture loses roughly 1.7 billion tons of topsoil annually in the United States.

The remarkable finding at the heart of the regenerative movement: topsoil can be rebuilt in a human lifetime. Brown's Ranch grew several inches of new topsoil in just twenty years. University of Washington research found topsoil thickness increasing by 0.86 cm per year under regenerative practices.

▯ *Montgomery, David R. Growing a Revolution* (W.W. Norton, 2017). *Macray & Montgomery* (2023), *"Trends in Soil Organic Matter and Topsoil Thickness Under Regenerative Practices."*

CHAPTER TWO:

Reading Your Soil: Texture, Structure & pH

Before adding a single amendment, you need to understand what you're working with. Three things matter most: texture, structure, and pH.

The Jar Test: Understanding Texture

1. Fill a clear glass jar one-third full with garden soil.
2. Add water to nearly full, plus a teaspoon of dish soap. Shake 2 minutes.
3. Let settle: sand settles in 1 minute, silt in 2 hours, clay in 24–48 hours. Remaining cloudiness is organic matter.
4. Measure layers. Ideal garden loam: roughly 40% sand, 40% silt, 20% clay.

▯ *CAES Field Report, UGA Extension: "Your Ultimate Guide to Healthy Garden Soil." fieldreport.caes.uga.edu.*

Soil Type	Feel	Characteristics	How to Improve
Sandy	Gritty, granular	Drains fast, warms quickly, loses nutrients	Add generous compost; mulch heavily; repeat annually
Silty	Smooth, floury when dry	Holds moisture; compacts easily	Add compost; avoid working when wet; keep covered
Clay	Sticky when wet, hard when dry	Nutrient-rich; drains poorly; compacts	Add compost, gypsum; plant deep-rooted cover crops
Loam	Crumbly, dark, earthy smell	Balanced drainage and fertility; ideal	Maintain with annual compost and permanent mulch
Sandy loam	Slightly gritty but workable	Good drainage, moderate retention	Annual compost; keep covered

▯ *Blooming Expert: "How to Start a Garden From Scratch." bloomingexpert.com.*

Testing pH: The Foundation of Nutrient Availability

pH measures acidity or alkalinity on a scale of 1–14. Most vegetables thrive between 6.0 and 7.0. pH controls nutrient availability: a tomato plant in pH 5.0 soil may starve for calcium and magnesium even if those minerals are abundant — they are locked in a form plants cannot access.

For a comprehensive analysis, send a sample to your local cooperative extension service — typically $15–25 — for a full nutrient profile, pH, organic matter percentage, and specific amendment recommendations.

▫ *CAES Field Report, UGA Extension. Recommends testing vegetable gardens every 1–2 years; most vegetables thrive at pH 6.0–6.5.*

pH Adjustments

- Too acidic (pH below 6.0): Agricultural lime or dolomitic lime. Apply 2–3 months before planting.
- Too alkaline (pH above 7.5): Elemental sulfur, pine needle mulch, or acidic compost. Takes months.
- Wood ash raises pH quickly — use sparingly and test first.
- Generous compost buffers extremes in both directions.

CHAPTER THREE:

The Living World Beneath Your Feet

Once you understand who lives in your soil and what they do, you will stop thinking about feeding your plants and start thinking about feeding your soil — because a living soil feeds plants far more effectively than any bag of fertilizer.

Bacteria: The Foundation

Bacteria are the most numerous organisms in soil — up to one billion in a single teaspoon of healthy earth. They fix atmospheric nitrogen, suppress plant disease, and produce geosmin — the earthy smell that tells you your soil is biologically alive. Aerobic soils support beneficial bacteria; compacted, waterlogged soils shift toward anaerobic bacteria, which produce acids harmful to plants.

▯ *Lowenfels, Jeff, and Wayne Lewis. Teaming with Microbes: The Organic Gardener's Guide to the Soil Food Web. Revised ed. Timber Press, 2010. Part 1 — bacterial roles, counts, aerobic/anaerobic dynamics.*

Fungi: The Network Builders

Fungal hyphae weave through soil in networks spanning acres. Most remarkable are the mycorrhizal fungi, which partner with 80–90% of all plant species. The fungal network extends a plant's effective root zone by up to 1,000 times, trading water and minerals for plant sugars.

▯ *Lowenfels & Lewis, Teaming with Microbes (Timber Press, 2010), Chapters 5 and 19. Mycorrhizal partnerships with 80–90% of plant species; nutrient exchange mechanisms.*

> *"When you till deeply, you are severing miles of fungal networks that took years to build. The mycorrhizal web does not rebuild overnight."*

Earthworms: The Architects

A single earthworm processes its own weight in soil daily, releasing castings that contain 50% more organic matter than surrounding soil. Worm tunnels create pathways for air and water that roots follow gratefully. Charles Darwin devoted forty years to studying earthworms and concluded they were among the most consequential animals in Earth's history.

▫ *Piedmont Master Gardeners: "The Soil Food Web." piedmontmastergardeners.org. Also: Bertrand et al. (2019), Frontiers in Environmental Science — peer-reviewed earthworm–microbiota interactions.*

Signs of a Living Soil

- Rich earthy aroma when you dig (geosmin from actinobacteria — a reliable health indicator)
- Earthworms visible: 5–10 per cubic foot is a start; 20+ is thriving
- Soil crumbles into aggregates when dry — not hard clods or loose dust
- Roots penetrate easily and deeply
- Decomposing organic matter with visible fungal threads at 3–6 inches depth

CHAPTER FOUR:

Brown's Five Principles of Soil Health

Gabe Brown credits Jon Stika, Jay Fuhrer, and Ray Archuleta at the USDA Natural Resources Conservation Service with articulating these principles. But Brown lived them for twenty years on 5,000 acres in North Dakota, transforming degraded, nearly bankrupt farmland into one of the most studied regenerative operations in America. The principles apply at any scale, including a backyard garden.

▯ *Brown, Gabe. Dirt to Soil (Chelsea Green, 2018). Principles credited to Stika, Fuhrer, and Archuleta — Farm Progress: "Dirt to Soil," farmprogress.com, Jan. 2023.*

Principle 1: Limited Disturbance

Protect soil structure by minimizing tillage and limiting chemical disruption. Synthetic fertilizers, pesticides, and herbicides all damage the living biology that sustains long-term fertility. When Brown stopped tilling in 1994, he was the first in his county's 700,000 cropland acres to do so. His soil eventually tested at 7 times the nitrogen, 5 times the phosphorus, and 8 times the potassium of comparable tilled farms, without synthetic inputs.

▯ *Farm Progress: "Dirt to Soil." farmprogress.com/soil-health/dirt-to-soil. Comparative soil test data.*

Principle 2: Armor — Keep Soil Covered

Bare soil is wounded soil. The protective organic layer on the surface moderates temperature, prevents moisture loss, feeds biology, and stops erosion. For gardeners: mulch every bed, always. If a bed is between crops, cover it.

Principle 3: Diversity

Brown's cover crop mixes grew from 1–2 species to 70+ over twenty years. David Montgomery's research confirms: the combination of no-till, cover crops, and diverse rotations consistently outperforms any single practice alone in rebuilding soil organic matter and biology.

▯ *Montgomery, David R. Growing a Revolution (W.W. Norton, 2017). Core finding throughout.*

Principle 4: Living Roots

Plants channel up to 40% of their photosynthetic energy underground as root exudates. A covered, rooted garden is a constantly fed garden. Never let beds sit bare and rootless — plant cover crops in the off-season.

▯ *Harvest to Table: "Understanding the Soil Food Web." harvesttotable.com (2025). Root exudate percentage; rhizosphere biology.*

Principle 5: Integrate Animals

For home gardeners: make your garden hospitable to earthworms, beetles, and birds. Welcome beneficial insects. Even chickens following garden beds convert pests and residue into fertility. These are the animal integrations available to every gardener.

▯ *Brown, Gabe. Dirt to Soil (Chelsea Green, 2018). Five principles: Limited Disturbance, Armor, Diversity, Living Roots, Integrated Animals. CSU Chico: csuchico.edu/regenerativeagriculture/demos/gabe-brown.shtml.*

CHAPTER FIVE:

Compost: Black Gold from Your Kitchen & Garden

Compost is the universal amendment. It improves every soil type: loosens clay, binds sand, buffers pH, feeds biology, suppresses disease, and slowly releases a complete spectrum of nutrients. Making it is free. The basic process is almost impossible to get wrong.

What Compost Actually Does

Compost is a soil amendment, not a fertilizer. It feeds bacteria and fungi, which in turn make nutrients available to plants in the right form at the right time. Plants grown in compost-amended soil consistently show improved disease resistance, drought tolerance, and nutritional density.

▫ *Bootstrap Farmer: "Beginner's Guide to Soil Fertility." bootstrapfarmer.com. Also: Montgomery, Growing a Revolution (W.W. Norton, 2017).*

The Compost Recipe: Browns + Greens

- Browns (C:N above 30:1): dry leaves, straw, cardboard, paper, wood chips, corn stalks
- Greens (C:N below 30:1): kitchen scraps, fresh grass clippings, garden trimmings, coffee grounds, manure
- The ratio: roughly 3 parts browns to 1 part greens by volume
- Moisture: moist like a wrung-out sponge
- Air: turn every 2–4 weeks, or build with bulky material that allows natural circulation

▫ *Cornell Cooperative Extension; OSU Extension: "Sheet Mulching and Lasagna Composting with Cardboard." extension.oregonstate.edu. C:N ratios; ideal materials.*

Hot Composting (active): Piles of 3×3×3 feet, turned regularly, reach 130–160°F in 6–12 weeks. Kills weed seeds and pathogens.

Cold Composting (passive): Simply pile and leave. Slower — 6–18 months — but requires no work. Avoid diseased material or seeding weeds.

Vermicomposting: Worms Do the Work

A worm bin processes kitchen scraps into castings — one of the most biologically potent amendments available. Castings can be applied directly or steeped into compost tea, a liquid amendment rich in beneficial microbes.

▫ *Urban Worm Company: "Introduction to the Soil Food Web." urbanwormcompany.com.*

I Skip the Pile

I dig a trench in my raised bed, bury my kitchen scraps, and move to a different spot next time. That is my composting. No turning, no ratios, no pile cooking in the corner of the yard.

What surprised me is how fast it disappears.

That speed is the soil biology telling us it is alive!

Worms find the food and come to it. A whole different community of microorganisms moves in — the kind that work without air — and they are remarkably efficient.

The rotation is the secret. Give each spot a few weeks before you return to it. The soil needs time to finish what it started.

This method even has a name — trench composting — and it is likely the oldest form of soil feeding there is. The Wampanoag taught the Pilgrims to bury a fish beneath their corn. The principle has not changed: put organic matter where the roots are, and the soil will handle the rest.

One honest note: there is no heat here, so weed seeds and pathogens survive. Keep diseased material out. Kitchen scraps, coffee grounds, vegetable peels — those are exactly right.

Hemenway, Toby. Gaia's Garden: A Guide to Home-Scale Permaculture. 2nd ed. Chelsea Green Publishing, 2009. Chapter 4 — Bringing the Soil to Life.

CHAPTER SIX:

Mulch: The Blanket That Feeds

Mulch is the physical expression of Brown's Armor principle. A 2–3 inch layer across garden beds reduces water evaporation by 70–80%, suppresses weeds, moderates temperature, prevents compaction, and continuously feeds soil life as it breaks down.

Mulch Type	Depth	Notes
Wood chips	2–4 in.	Best for perennials and trees. Feeds fungi richly. Surface only — do not incorporate.
Straw (not hay)	2–3 in.	Excellent for vegetable beds. Use certified weed-free straw. Hay contains seeds.
Shredded leaves	2–3 in.	Free and excellent. Shred to prevent matting. Leaf mold is outstanding.
Compost	1–2 in.	Top-dresses and feeds immediately. Top with straw if weeds are a concern.
Grass clippings	1–2 in.	Nitrogen-rich. Apply in thin layers to prevent matting and odor.
Living mulch	Ground cover	Clover or thyme. Permanent. Feeds pollinators, fixes nitrogen.

▯ *The Micro Gardener: "5 Simple Secrets to Building Healthy Soil." themicrogardener.com. OSU Extension: "No-Till Gardening Keeps Soil Healthy." news.oregonstate.edu.*

The No-Bare-Soil Rule: No bare soil, ever. The moment you leave soil exposed, you lose moisture, invite erosion, trigger weeds, and begin losing biology to temperature extremes.

CHAPTER SEVEN:

Cover Crops: Living Soil Builders

A cover crop is any plant grown specifically to benefit the soil. Plants channel up to 40% of their photosynthetic energy underground as root exudates — sustaining soil biology around the clock. A covered garden is a fed garden.

▯ *Growing for Market: "Cover Cropping in No-Till Systems." growingformarket.com.*

- Fix nitrogen — crimson clover adds 80–150 lbs N/acre; hairy vetch 100–200 lbs N/acre
- Break compaction — daikon radish and cereal rye penetrate hardpan layers
- Build organic matter — above-ground biomass, chopped and dropped, adds rapidly
- Suppress weeds — dense cover shades the soil and outcompetes germination

Cover Crop	Type	Plant When	Key Benefit	Winter Survival
Crimson Clover	Legume	Fall or spring	80–150 lbs N/acre; beautiful; easy to terminate	Cool season
Hairy Vetch	Legume	Fall	100–200 lbs N/acre; pair with rye	Winter-hardy
Cereal Rye	Grass	Fall	Massive biomass; deep roots; weed-suppressing	Extremely hardy
Buckwheat	Broadleaf	Spring/summer	Fast; smothers weeds; feeds pollinators	Frost-tender
Daikon Radish	Brassica	Late summer/fall	Breaks compaction; winter-kills cleanly	Winter-kills
Phacelia	Broadleaf	Spring or fall	Outstanding pollinator plant; fast-decomposing	Cool season
Winter Peas	Legume	Fall	N-fixing; pairs with oats or rye	Cold-tender

▯ *Lawn to Garden: "Compost, Mulch & Cover Crops." lawntogarden.org. Growing for Market, growingformarket.com.*

Chop and Drop: mow or cut the cover crop at the base when it begins to flower (before it sets seed). Leave as surface mulch. Roots remain in the ground, decomposing and feeding biology.

CHAPTER EIGHT:

No-Dig & Sheet Mulching: Build Without Breaking

You do not need to dig to grow. In most situations, not digging produces better results. Every deep disturbance severs mycorrhizal networks, oxidizes organic matter, exposes weed seeds, and destroys structure built by millions of organisms.

▯ *OSU Extension: "No-Till Gardening Keeps Soil Healthy." news.oregonstate.edu. Brown, Dirt to Soil (Chelsea Green, 2018) — no-till as Principle 1.*

Sheet Mulching: Creating a Garden From Scratch

1. Mow existing vegetation as low as possible. Leave it in place.
2. Water the area thoroughly to activate soil biology.
3. Lay cardboard with 6-inch overlapping edges. Remove tape and staples. Wet thoroughly.
4. Add 2–4 inches of compost over the cardboard.
5. Add 3–6 inches of organic mulch (straw, wood chips, or shredded leaves).
6. Optional: top with 2–3 inches of compost for immediate transplanting.

▯ *Cornell Cooperative Extension: "Lasagna Gardening." warren.cce.cornell.edu. OSU Extension: "Sheet Mulching and Lasagna Composting." extension.oregonstate.edu. Cardboard decomposition: 6 months; earthworms colonize within weeks.*

Annual No-Dig Refresh: At season's end, add 1–2 inches of compost as a top-dressing. Let winter and biology do the rest. Plant into it in spring without turning.

CHAPTER NINE:

Feeding Your Soil: Amendments & Minerals

Amendments are tools for precision soil work. The key rule: always test before you amend. Adding minerals your soil does not need creates imbalances harder to fix than deficiencies.

▯ *UGA Cooperative Extension: "Your Ultimate Guide to Healthy Garden Soil." fieldreport.caes.uga.edu.*

Amendment	Best For	Notes
Compost	All types	Universal amendment. Generous applications always beneficial.
Worm castings	All types	Concentrated biology and nutrients. Top-dress or use in transplant holes.
Agricultural lime	Acidic soils (pH <6.0)	Raises pH; adds calcium. Apply in fall. Allow 2–3 months.
Dolomitic lime	Acidic, Mg-deficient soils	Raises pH; adds calcium and magnesium.
Elemental sulfur	Alkaline soils (pH >7.5)	Lowers pH slowly. Mix into soil. Retest after each application.
Gypsum	Clay soils	Improves clay structure without altering pH. Adds calcium and sulfur.
Rock phosphate	Low-P soils	Slow-release phosphorus. Most effective in acidic soils.
Kelp meal	All types	Micronutrients, trace minerals, natural cytokinins.
Biochar	Depleted soils	Porous carbon lasting centuries. Charge with compost before use.
Greensand	All types	Slow-release potassium, iron, and trace minerals.

▯ *Growing a Greener World: growingagreenerworld.com. Bootstrap Farmer: bootstrapfarmer.com. Montgomery, Growing a Revolution (W.W. Norton, 2017). Brown, Dirt to Soil (Chelsea Green, 2018).*

CHAPTER TEN:

Soil Enemies: What Damages Soil & How to Recover

Most soil damage is reversible with time and the right practices. Prevention is always preferable to recovery.

Compaction

Signs: water puddles on the surface; plants with shallow, twisted roots; soil that cannot be penetrated with a finger. Recovery: Aerate with a broadfork without inverting. Add compost and mulch. Plant deep-rooted cover crops. Establish permanent walking paths.

▯ *Old Farmer's Almanac: almanac.com. UMN Extension: extension.umn.edu.*

Chemical Residue & Synthetic Fertilizer Dependency

Synthetic fertilizers bypass and weaken microbial partnerships that sustain long-term fertility. Some herbicides — particularly aminopyralid and clopyralid — can persist in soil and manure for years. Always ask about herbicide history when sourcing straw, hay, or manure.

▯ *Lowenfels & Lewis, Teaming with Microbes (Timber Press, 2010). OSU Extension: "Sheet Mulching," extension.oregonstate.edu.*

Erosion: Keep all soil covered, establish deep-rooted perennials on slopes, and use swales on contour to slow water flow.

Overwatering: Saturated soil suffocates roots and beneficial aerobic organisms. Improve drainage with compost and raised beds. Avoid watering until the top inch of soil is dry.

The Monthly Dig Test

- Once a month, dig a small hole 8–10 inches deep in an active bed.
- Count earthworms: 5+ per cubic foot is a start; 20+ is thriving.
- Smell: earthy and pleasant = good aerobic biology. Sour or sulfurous = anaerobic conditions.
- Color: dark brown = organic matter building. Pale or grey = low fertility.
- Structure: crumbly and moist = good aggregation.

CHAPTER ELEVEN:

Your Soil-Building Calendar

Soil building is a rhythm, not an event. These seasonal practices create a self-reinforcing cycle of increasing fertility. See Appendix C for a month-by-month checklist you can post in your garden.

Season	Key Soil-Building Actions
Early Spring	Test soil pH. Broadfork compacted areas. Top-dress beds with 1–2 inches of compost. Start compost pile.
Mid-Spring	Plant through compost without tilling. Apply 2–3 inch mulch around transplants immediately. Sow buckwheat in empty beds.
Summer	Maintain 2–3 inch mulch. Observe soil — is water infiltrating well? Add kitchen scraps to compost daily.
Late Summer	Sow fall cover crops in beds emptying by mid-fall: crimson clover, daikon radish, winter peas + rye.
Fall	Chop and drop crop residues. Sheet mulch new beds for spring. Shred and collect fallen leaves.
Winter	Rest the soil. Continue composting kitchen scraps. Plan amendments based on fall soil test. Order seeds.
Year-Round	Keep soil covered always. Never walk in beds. Add compost or mulch whenever you have it.

APPENDIX A:

Troubleshooting: What Your Plants Are Telling You

Plants are the visible expression of your soil's health. Read the plant before reaching for a spray.

Symptom	Likely Cause	Soil-Based Solution
Yellowing lower leaves (older first)	Nitrogen deficiency	Add compost, blood meal, or fish emulsion. Plant N-fixing cover crop in fall.
Purple or reddish leaves	Phosphorus deficiency	Check pH first (P unavailable below pH 6.0). Add rock phosphate. Inoculate with mycorrhizal fungi.
Brown leaf edges, tip burn	Potassium deficiency or salt toxicity	Add greensand or kelp. Avoid synthetic fertilizer buildup. Deep water to flush.
Yellowing between veins (young leaves)	Iron or Mn deficiency (high pH)	Lower pH with sulfur or acidic compost. Minerals present but locked above pH 7.0.
Slow, stunted growth throughout	Low fertility and low biology	Heavy compost. Worm castings around roots. Check drainage and compaction.
Wilting despite adequate water	Root rot from waterlogging	Improve drainage urgently. Stop watering until soil dries.
Repeated pest pressure	Nutrient imbalance or monoculture	Rotate crops. Diversify plantings. Add diverse compost.
Poor seed germination	Soil too cold, compacted, or crusted	Test temperature (most seeds need 50–65°F). Loosen surface. Cover with row cloth.

▫ *Harvest to Table: harvesttotable.com. UGA Extension, CAES Field Report. Bootstrap Farmer.*

APPENDIX B:

Complete References & Further Reading

Primary Sources — Books

Brown, Gabe. Dirt to Soil: One Family's Journey into Regenerative Agriculture. Chelsea Green Publishing, White River Junction, VT, 2018. ISBN: 978-1603587631. Primary source for this guide. Brown's Five Principles of Soil Health are the structural backbone of Chapters Four through Eight.

Hawken, Paul. Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming. Penguin Books, New York, 2017. Frames regenerative agriculture as a top climate solution; introduced soil carbon sequestration to mainstream climate discourse.

Hawken, Paul. Regeneration: Ending the Climate Crisis in One Generation. Penguin Books, New York, 2021. Grounds soil-building practices within the broader regenerative movement; the Land chapter covers composting, vermiculture, biochar, and degraded land restoration.

Hawken, Paul. Carbon: The Book of Life. Viking/Penguin, New York, 2025. Explores carbon as the thread connecting soil health, climate stability, and all living systems; reframes carbon restoration as relationship-healing.

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Darwin, Charles. The Formation of Vegetable Mould through the Action of Worms. John Murray, London, 1881. Referenced in Chapter Three.

Films & Documentaries

Kiss the Ground. Directed by Josh Tickell and Rebecca Harrell Tickell. Narrated by Woody Harrelson. Netflix, 2020. Argues that soil is the missing piece of the climate puzzle, showing how regenerative agriculture can draw down atmospheric carbon, restore ecosystems, and stabilize the climate. Features Ray Archuleta, Gabe Brown, and scientists worldwide. Available on Netflix and Amazon Prime. A follow-up documentary, Common Ground, premiered 2023. kissthegroundmovie.com

Extension Services & Scientific Sources

CAES Field Report, UGA Cooperative Extension. fieldreport.caes.uga.edu. Soil texture, pH, organic matter; soil test recommendations.

Cornell Cooperative Extension. warren.cce.cornell.edu. Sheet mulching / lasagna gardening methodology.

Frontiers in Environmental Science. Bertrand, M. et al. "Earthworms Building Up Soil Microbiota, a Review." 2019. Peer-reviewed earthworm-microbiota interactions.

Oregon State University Extension. news.oregonstate.edu; extension.oregonstate.edu. No-till structure and compaction; sheet mulching with cardboard.

University of Minnesota Extension. extension.umn.edu. Soil food web overview; compaction prevention.

Macray, Julia E., and David R. Montgomery. University of Washington, 2023. "Trends in Soil Organic Matter and Topsoil Thickness Under Regenerative Practices." ResearchGate. Verified 0.86 cm/year topsoil increase under regenerative management.

Online Resources

Bootstrap Farmer. bootstrapfarmer.com. Compost benefits; N, P, K roles.

Blooming Expert. bloomingexpert.com. Soil type characteristics; raised bed soil recommendations.

CSU Chico Center for Regenerative Agriculture. csuchico.edu. Brown's principles overview; water infiltration data.

Farm Progress. farmprogress.com/soil-health/dirt-to-soil. Brown's Ranch comparative soil test data.

Gardeners.com. gardeners.com/how-to/building-healthy-soil/5060.html. Soil composition percentages.

Growing for Market. growingformarket.com. Cover crop species; root exudate percentages.

Harvest to Table. harvesttotable.com. Soil food web; root exudate percentage; mycorrhizal partnerships.

Kiss the Ground. kissthegroundmovie.com. Film resources, educator guides, and screening information.

Lawn to Garden. lawntogarden.org. Cover crop and mulch descriptions.

NM Healthy Soil Working Group. nmhealthysoil.org (2024). Fungal morphology; arthropods as shredders.

Old Farmer's Almanac. almanac.com. General soil preparation; seasonal timing.

Peaceful Plantings. peacefulplantings.com. Sheet mulching layers; cover crop termination.

Piedmont Master Gardeners. piedmontmastergardeners.org. Earthworm casting stats; soil aggregate formation.

Project Drawdown. drawdown.org. Comprehensive climate solutions database; regenerative agriculture ranking.

Project Regeneration. regeneration.org. Hawken's companion resource; action frameworks and case studies.

The Micro Gardener. themicrogardener.com. No bare soil rule; mulching principles.

Tenth Acre Farm. tenthacrefarm.com. Clay soil amendment; sheet mulching on clay.

Urban Worm Company. urbanwormcompany.com. Vermicomposting; worm castings; arthropod shredder roles.

APPENDIX C

Month-by-Month Soil-Building Checklist

Tear out, pin up, or photograph this checklist. Tick off tasks as you complete them. Soil building is a practice, not an event — returning to this page each month keeps the rhythm going.

JANUARY

- ☐ Order seeds and cover crop seed for spring
- ☐ Review soil journal from last season
- ☐ Research amendments needed based on fall soil test
- ☐ Plan crop rotations and bed assignments
- ☐ Clean and sharpen garden tools
- ☐ Start compost indoors if needed (worm bin)

FEBRUARY

- ☐ Continue seed ordering
- ☐ Check stored compost — is it ready to use?
- ☐ Review cover crop performance notes
- ☐ Start early seeds indoors (6–8 wks before last frost)
- ☐ Prep any new beds: lay cardboard base now for spring sheet mulch
- ☐ Check pH test kit supply

MARCH

- ☐ Apply 1–2 inches of compost as top-dressing to all beds
- ☐ Gently broadfork compacted areas (do not invert soil)
- ☐ Sow cool-season cover crops in empty beds (peas, oats)
- ☐ Begin outdoor composting as temperatures rise
- ☐ Test soil pH if not done in fall
- ☐ Start hardening off early transplants

APRIL

- ☐ Plant through compost top-dressing without tilling
- ☐ Apply 2–3 inch mulch layer around transplants immediately
- ☐ Sow buckwheat in beds not yet in use
- ☐ Turn or aerate active compost pile
- ☐ Watch for signs of compaction after spring rains
- ☐ Add kitchen scraps to compost daily

MAY

- ☐ Mulch all beds to 2–3 inches before summer heat
- ☐ Observe first earthworm check of season (dig test)
- ☐ Add compost to heavy-feeding crops (corn, brassicas, squash)
- ☐ Keep cover crop beds mowed or cut to suppress seeding
- ☐ Watch soil moisture — mulch should be preventing most evaporation
- ☐ Add compost tea or worm casting drench around transplants

JUNE

- ☐ Replenish mulch that has broken down (add 1 inch if needed)
- ☐ Side-dress nitrogen-hungry crops with fish emulsion or blood meal
- ☐ Continue daily kitchen composting
- ☐ Observe soil biology: any signs of dryness, crust, or compaction?
- ☐ Sow heat-tolerant cover crops (buckwheat, sunn hemp) in gaps
- ☐ Avoid walking in beds during wet conditions

JULY

- ☐ Maintain mulch layer — it is your best tool against summer drought
- ☐ Deep water less frequently to encourage deep root growth
- ☐ Turn compost pile if it has slowed
- ☐ Harvest worm castings if worm bin is full
- ☐ Begin planning fall cover crop mix
- ☐ Check soil temperature before sowing (most seeds need 65°F+)

AUGUST

- ☐ Sow fast-maturing cover crops in harvested beds: daikon radish, phacelia
- ☐ Begin fall cover crop sowing (last 6 weeks before first frost)
- ☐ Collect and shred leaves as they begin to fall for winter mulch
- ☐ Continue compost pile additions
- ☐ Do a mid-season dig test — how are the earthworms doing?
- ☐ Order fall soil amendments if needed

SEPTEMBER

- ☐ Plant main fall cover crops: crimson clover, hairy vetch + rye, winter peas
- ☐ Sheet mulch any new beds to be ready for spring planting
- ☐ Apply compost top-dressing to beds that will overwinter with cover crops
- ☐ Collect and store fallen leaves for mulch and compost browns
- ☐ Take a soil sample and send to extension service for fall test
- ☐ Begin heavy composting of garden cleanup debris

OCTOBER

- ☐ Chop and drop all finished crop debris in beds (or add to compost)
- ☐ Apply 1–2 inch compost top-dressing to all resting beds
- ☐ Sheet mulch any bare areas before winter
- ☐ Collect and shred all available leaves
- ☐ Check that cover crops are established before first frost
- ☐ Do final dig test of the season — note earthworm numbers and soil color

NOVEMBER

- ☐ Let the soil rest — no tilling, no compaction
- ☐ Protect beds with thick straw or leaf mulch if cover crops failed to establish
- ☐ Continue adding to compost pile as kitchen scraps accumulate
- ☐ Record final soil observations in your journal
- ☐ Review what worked this season and what needs to change
- ☐ Plan amendments for next year based on fall soil test results

DECEMBER

- ☐ Keep composting kitchen scraps through winter — the pile keeps working slowly
- ☐ Review your soil journal from the full year
- ☐ Order books to read over winter (see Appendix B)
- ☐ Plan next year's crop rotations and cover crop calendar
- ☐ Reflect: where did you see the most soil improvement? Why?
- ☐ Rest. The soil is resting too. Spring is coming.

FURTHER READING

The following books and films are cited in this guide and have been verified against the content presented here.

- Dirt to Soil — Gabe Brown (Chelsea Green, 2018). The farmer's account anchoring this guide.
- Growing a Revolution — David R. Montgomery (W.W. Norton, 2017). The scientist's global survey.
- Teaming with Microbes — Lowenfels & Lewis (Timber Press, 2010). The definitive accessible soil biology guide.
- Drawdown — Paul Hawken (Penguin, 2017). The climate strategist's case for soil as a top solution.
- Regeneration — Paul Hawken (Penguin, 2021). The regenerative movement's blueprint, land chapter included.
- Carbon: The Book of Life — Paul Hawken (Viking, 2025). Carbon as the living thread of all soil relationships.
- The Soil Will Save Us — Kristin Ohlson (Rodale, 2014). Journalists meet scientists on the soil carbon frontier.
- Call of the Reed Warbler — Charles Massy (Chelsea Green, 2017). Regenerative transformation on an Australian farm.
- Cows Save the Planet — Judith D. Schwartz (Chelsea Green, 2013). Regenerative grazing and the soil-water-climate connection.
- The No-Dig Organic Allotment — Charles Dowding. The practical no-dig guide.
- Farmers of Forty Centuries — F.H. King (1911). 4,000 years of fertility without synthetic inputs.
- The Unsettling of America — Wendell Berry (Sierra Club Books, 1977). The philosophical foundation.
- Kiss the Ground — Tickell & Tickell, narrated by Woody Harrelson (Netflix, 2020). The essential film companion to this guide.

Visit Our Soil Resources Page

Scan for additional resources, soil-building guides, and links to our growing community at The GreenLife Project.

thegreenlifeproject.com/soil-resources

YOUR SOIL JOURNAL

Record Your Progress

Track every amendment, observation, and experiment. The gardener who keeps records grows in wisdom as fast as their soil grows in fertility.

Date	Bed / Area	Amendment Added	Amount	Observation / Result

A Final Word

The soil is not inert. It is a living community that has been sustaining terrestrial life for 450 million years. We are not its masters. We are, at best, its apprentices — learning from practitioners like Gabe Brown who discovered through crisis that working with nature is more powerful than working against it, scientists like David Montgomery who verified those discoveries at scale, and authors like Jeff Lowenfels who made the invisible world beneath our feet visible and lovable.

Every shovelful of compost, every bed you keep covered, every cover crop sown in autumn is an act of trust in that ancient intelligence. Dirt is indeed the guru. It knows what it needs. Our job is

to listen, and to cite our sources carefully along the way.

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