



Regenerative Garden Intern Capstone Project

TomKat Ranch Educational Foundation

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Note From TomKat Ranch

We want to thank and acknowledge our Summer 2022 Interns for this Capstone Project. This document was created to capture the lessons the interns learned over the course of their summer internship in a way that could be shared with others interested in regenerative gardening and/or how we at TomKat Ranch grow and raise healthy food on working lands in a way that regenerates the planet and inspire others to action.

As with our grazing efforts, everything we do in the garden is rooted in the Principles of Regenerative Agriculture: 1) understand your context, 2) cover the soil, 3) maintain living roots, 4) minimize soil disturbance, 5) maximize diversity. Through these principles, we activate the power of photosynthesis in plants.

The Regenerative Garden Summer Intern Program included learning to:

- understand the aim and value of regenerative agriculture and its sub-sphere, regenerative gardening;
- acknowledge and appreciate the role that healthy soil plays in ecosystems and seed development;
- see the connection between the greenhouse and its associated outdoor garden as well as understand the layout and functioning of TomKat Ranch's Greenhouse and Garden;
- view compost as a natural fertilizer and cover cropping mechanism as well as feel familiar with ways to create, amend, and apply it;
- grasp the critical steps of preparing, planting, and maintaining a regenerative garden and basic considerations within each—including bed prep, the two planting techniques (transplanting and direct sowing), irrigation, weeding, and harvest; and
- recognize how flowers attract pollinators and contribute to garden well-being.

About TomKat Ranch Gardens

TomKat Ranch's gardens showcase regenerative gardening practices including no-till soil management, cover-cropping, composting, and crop diversity—including natives, perennials, and other plants that attract beneficial insects. TomKat Ranch's gardens have benefitted from the wonders of a regenerative approach, including reduced pests and disease, and delicious produce.

TomKat's garden network consists of three gardens—a vegetable garden at the main ranch, the Rose garden, and the Westside garden. The main ranch vegetable garden includes 15 raised beds, a perennial flower garden, and a working greenhouse. The Rose garden features perennial flowers, berries, and kiwis. And, the Westside Garden—established in 2020—spans roughly a quarter acre of in-ground cultivation space full of seasonal vegetables and beneficial pollinator flowers. The gardens promote both learning and teaching; this document seeks to combine the two by communicating the knowledge gained from the gardens to those hoping to incorporate and build upon these insights.

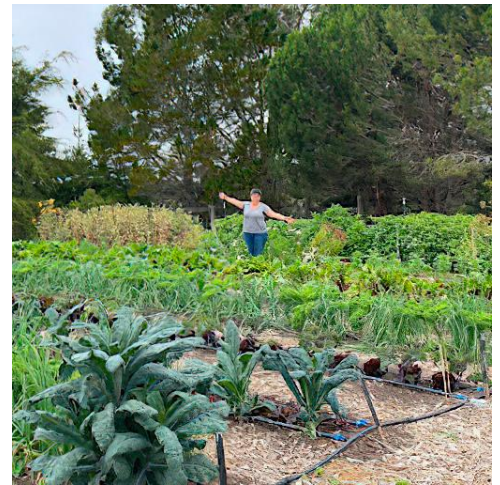
Main Garden



Rose Garden



Westside Garden



Introduction to Regenerative Gardening at TomKat Ranch

Regenerative gardening works in synchrony with nature and is rooted in an understanding of the interactions and relationships of complex systems. For soil life, plant life, animal life, and human life, we work together to repair, rebuild, revitalize, and regenerate. Put simply, regenerative practices work to emulate natural ecosystems.

Context

When starting a regenerative garden, location is key. You have to factor in the land's exposure to sun, its ability to drain, its access to water, and the type of soil. Google Earth can be a great tool to assess all these factors. Additionally, one has to think about what sort of infrastructure already exists and is needed. Do you have or will you need gates and fences, raised beds, a greenhouse, proper plumbing, etc.?

TomKat Ranch decided to establish the Westside Garden during Covid to respond to the growing needs of the community for fresh produce donations. Once the location had been determined, it was time to begin establishing the garden! At TomKat Ranch, we use a no-dig method. That is, we don't disturb the underlying soil by digging into or tilling it. Instead, our garden was built with materials we had on hand, recycled cardboard, finished compost from the ranch horse manure, garden green waste, kitchen waste and local wood chips.

Setting up a no-dig, no-till garden method may take more time/effort on the front end, but the process provides long-term benefits, including: significant weed reduction, increased water retention, and a resilient soil food web underground, producing beautiful and nutritionally dense plants.

No-Dig Garden Design

After grazing the area with cattle, we laid out the cardboard on top of the ground and outlined the bed length and width using wood planks. We then filled this space with finished compost & covered the pathways with wood chips; the wood planks were removed once beds were in place. Irrigation was then placed in the beds and we planted a variety of starts from the greenhouse or via direct seeding. More detail on these steps can be found below:

- 1. Collect and lay out cardboard and bed design**

Cardboard suppresses weeds and significantly reduces maintenance time in the garden.

The cardboard breaks down quickly and acts as a nutrient source to microorganisms in the soil.

2. Apply Compost

About 8-10 inches of compost cover the cardboard and fill in the frame of the garden bed. These beds are approximately 40 feet by 3 ft. We have adjusted the width of our beds to 30" over time. This width accommodates the tools we use to reduce the number of passes with a 30" rake and is ergonomically easier to work around. Compost is used throughout the growing season in between planting rotations and at the end of the season as a cover for the soil during the winter months.



3. Apply Wood Chips

Wood chips make an excellent pathway cover between the garden beds. They cover the ground, absorb and hold water, reduce water use by keeping vegetables cleaner, and reduce the need for washing. Wood chips break down and encourage mycelium which feeds microorganisms, all aiding soil health. It also looks great for anyone who visits the gardens.



Introduction to Soil

Soil Health

Building a thriving soil community underlies all our efforts at Tomkat Ranch. Maintaining healthy soil is vital for both a flourishing ranch and a regenerative garden. Thus, one must fully understand the basics and importance of soil to successfully implement regenerative gardening practices.



Soil Composition and Types

Soil is made of a variety of minerals, organic decaying matter, air, water, and, critically, living microorganisms. The main nutrients within soil are Nitrogen (N), Phosphorus (P) and Potassium (K)—elements needed to produce healthy plants. In addition, micronutrients such as boron, sulfur, and magnesium, to name a few, are found in the soil and needed by plants and animals (including humans!) for health.

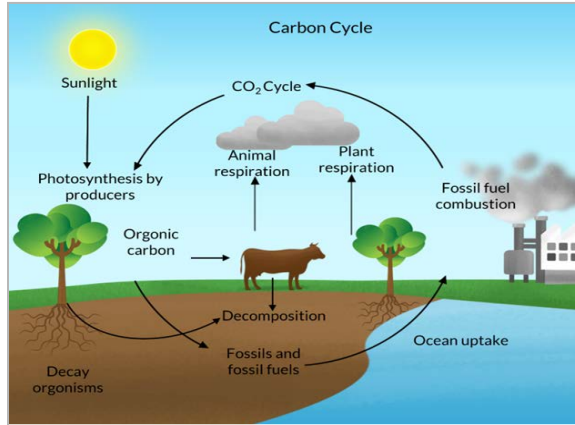
All soil is not equal. There are six main types: clay, sandy, silty, peaty, chalky, and loamy. Each has unique characteristics, benefits, and downsides—which affect its ability to deliver water, nutrients, and minerals as well as support microorganisms and provide effective drainage. Loam soil composition is an even mixture of sand, silt, and clay. This mixture creates a soil texture that can retain nutrients and water long enough for roots to absorb it, but also drain it before the roots rot. Soil varies based on location, and gardening can be successful in different soil types with proper management and attention. At TomKat Ranch, we primarily work with clay-based soils.

Role of Soil

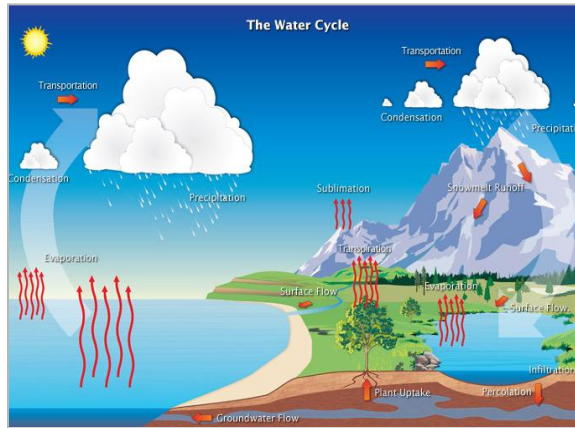
Soil provides a hospitable environment for plants to take root and also provides crucial nutrients. Most importantly, it facilitates the carbon, water, and nutrient cycles—which work together to

sustain healthy ecosystems. Specifically, healthy soil helps to recycle decaying plant material and nutrients, purify water, and sequester carbon.

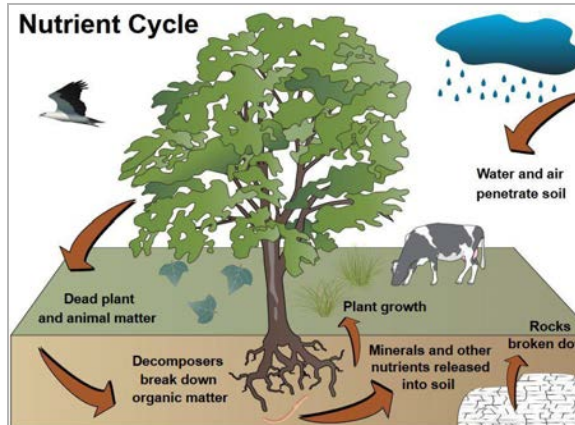
Carbon Cycle



Water Cycle



Nutrient Cycle

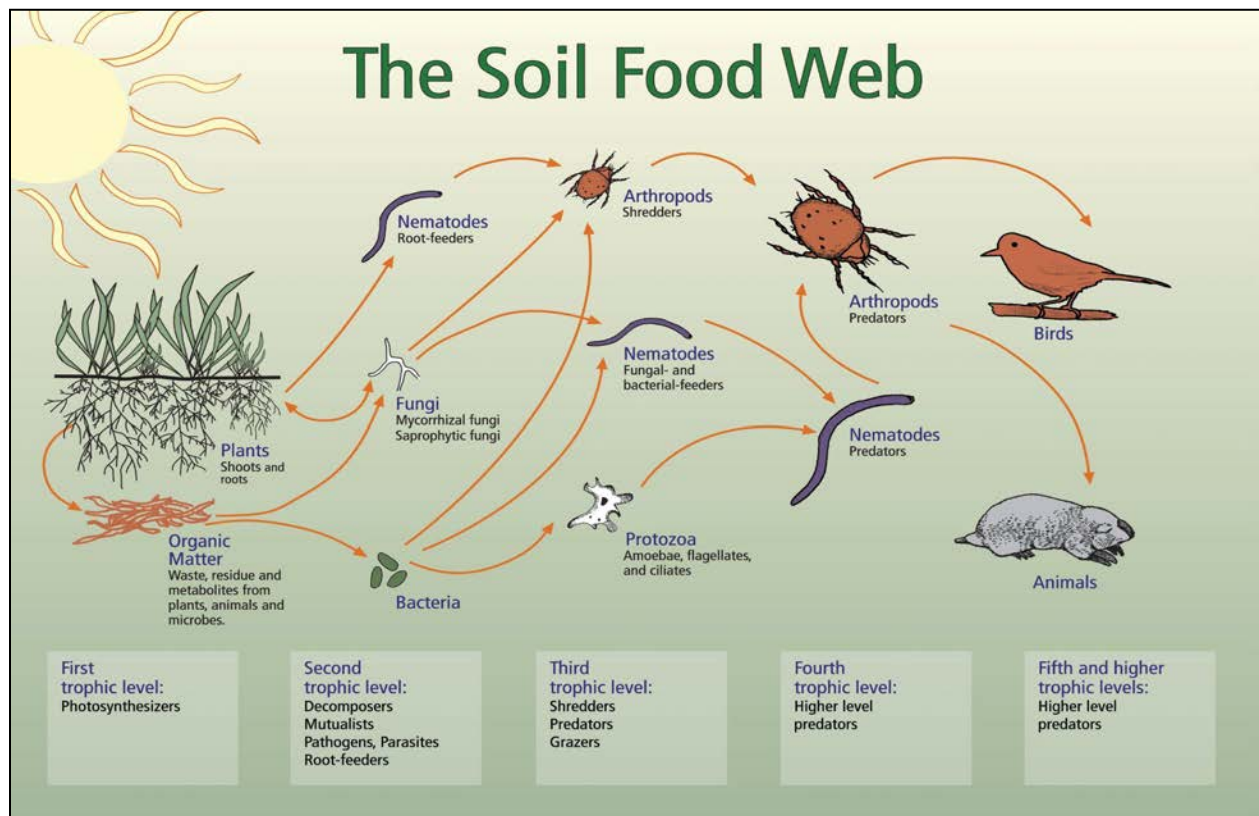


The Interconnected Soil Food Web

Soil is also home to a variety of microorganisms that make up the majority of the **Soil Food Web**. The community of microbes range in size and species but all ultimately contribute to the same

process. As microbes eat and move throughout the soil, they decompose organic compounds, prey on pests, sequester nutrients, and improve soil composition (aggregation and porosity). Their actions help increase water filtration, reduce run-off, and supply vital nutrients to crops, and most importantly, maintain healthy soil. Additionally, these organisms play a role in cycles mentioned above, helping contribute to clean air, water, and the recycling of nutrients.

This concept is perhaps best illustrated through the example of a worm (nematode). Worms eat decomposing organic matter, leaving behind extremely nutrient-dense castings within the soil. Their movement aerates the soil, increasing the flow of nutrients and water within the ground. Through their castings, worms make more nitrogen, phosphorus, potassium, and calcium than the surrounding soil, allowing organic compounds that were previously *inaccessible* to plants *accessible* and provide a host of benefits to microbes living in the soil.



Composting

A note on terminology: the words *compost* and *soil* are thrown around quite often and can present confusion. For clarity, we use the term “working” compost to refer to food scraps, horse manure, garden waste, etc. that is in the process of decomposing, and “finished” compost (or simply, compost) to refer to that which is ready to make potting soil and be applied to garden beds. Once compost is applied, it transforms into soil.

Composting is a natural process that recycles organic matter, producing a natural fertilizer that can be applied to soil to enhance it and promote plant growth. At its core, composting speeds decomposition by creating an environment in which decomposers—most notably, fungi and bacteria—can thrive. The practice of composting decreases the size of the waste stream, reduces methane emissions from landfills, improves soil health, and conserves water—enabling an array of critical human and environmental benefits. The practice can be applied on many scales, ranging from a small garden in the city to industrial size farm or thousands of acres or rangeland to stimulate soil regeneration.

When composting, one must pay attention to the compost ingredients, temperature, airflow, moisture, location, size, and bin, among other factors.

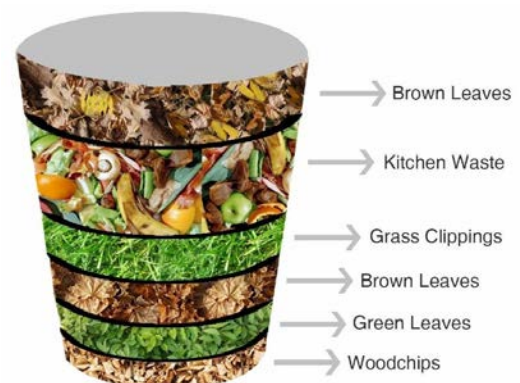
Additionally, composting can be active or passive. While faster in terms of decomposition and compost production rates, active composting involves the turning of the compost and therefore more work and monitoring. Passive composting, on the other hand, leads to slower decomposition and production rates, and requires less management. At TomKat Ranch, to reduce time and management needs, we primarily practice the passive composting process. The following sections detail our composting approach and methods.

Compost Creation

We use a few specific methods to create high-quality compost. These include the Johnson-Su Bioreactor and the SPICE compost inoculant.

Compost Ingredients

Compost is typically made from food waste, garden or yard clippings, and other ranch waste. Put simply, greens (such as horse manure) contribute to the nitrogen content of the compost, while browns (or woody inputs) add to the carbon content. See graphic for an example of potential compost ingredients.



Bio-Reactor

Developed by Dr. David Johnson and Hui-Chun Su, the [Johnson-Su Bioreactor](#) focuses on creating fungal-dominated compost through the BEAM (Biologically Enhanced Agricultural Management) method. It carries out static composting, characterized by low levels of salinity and high levels of fungal activity. The design utilizes accessible materials and follows straightforward construction. While the compost production process takes approximately 9 months until the output is ready to use, the compost can sit for much longer and maintain its soil-enhancing properties.



To build the bioreactor, one can refer to this [useful guide](#). In short, the contraption centers around a pallet, a cloth, a wire cage, and plastic pipes. The Johnson-Su Bioreactor must be filled with pre-processed materials—cleaned and cut up into the correct size. Washing the input (manure/wood chips/straw) is an important step. It removes dirt or sand which can interfere or even stop the composting process. We do this in a large trough, though it can be done with a wheel barrel. The materials should be added and allowed to settle based on their weight—not packed down. The pipes should be removed after about 2 weeks, and worms should be added once the compost process has begun to facilitate vermacast (which will be discussed later in this document). After these steps, one simply waits until the 9 month period has passed to extract and use the compost. High levels of fungal diversity signal that the compost process was successful and the product will be beneficial to the soil.



Large ranches and farms may build a network of Johnson-Su Bioreactors to meet their needs, and it is important to remember that a small amount of this compost goes a long way. The design produces a relatively small yield but contains essential microbes that will stimulate positive ecosystem transformation.



SPICE (Static Pile Inoculated Compost Extension)

The SPICE method is an easy, no-turn, fermentation process that creates effective compost. Rather than relying on more labor intensive turning to aerate the compost material, the SPICE method utilizes fermentation process which is a low to no oxygen levels and creates inoculates with the capability of producing finished compost statically. Essentially, SPICE creates the active biology (inoculates) that can then be sprayed on horse manure and other organic waste to break it down and produce a finished compost. [Complete SPICE Recipe](#)

TKR's SPICE process in photos:

Whey produced from rice/milk fermentation



Base Serum completed



Base Serum plus compost inoculant ingredients brewing process



Brewing complete, ready for application



Application of SPICE while compost is being turned.



Set up soaker hoses on top of the pile, connected to a water source and timer.



Cover pile, and secure tarps.



Vermicomposting

Vermicompost, or worm composting, is known as the “black gold” of compost because of its plethora of benefits to soil health and plant growth. As scientists have found, humans cannot replicate the material that worms create in a lab, deeming it the most valuable organic matter. Vermicomposting plays an important role in the remediation of soil through improving soil aeration, drainage, water retention, and aiding in germination and disease prevention. Vermicast is a mixture of the byproduct of earthworm’s digestive system and organic matter. Their biology produces a natural inoculate which holds highly-bioavailable nutrients from the material they feed on along with beneficial microbes and bacteria that are introduced through the digestive tract.



The following video is an excellent introduction to the benefits of vermiculture.

[▶ Vermicompost a Living Soil Amendment](#)

There are many ways to make and manage a vermicast system. We’ve gone with a [wedge method](#) to reduce the work of small worm cafes or boxes (which do not yield much casting and can be difficult to maintain). The wedge system is kept outdoors next to the garden area, shaded from sun and extreme weather and protected from scavengers.

Vermicast Tea Inoculation

Vermicast is an extremely valuable and well-balanced fertilizer to help improve soil health and foster plant growth. Through steeping or brewing the vermicast in water, the nutrients and beneficial microbes can be absorbed and applied efficiently to the foliage and to the soil in liquid form. This process, known as vermicast tea, uses worm castings in dechlorinated water, “brewed” with an aeration to facilitate the extraction of microbial life from the castings. The air maintains high levels of oxygen and creates hydraulic lift in the system—homogeneous for both the compost and the oxygen—and eliminates anaerobic pockets. We use a simple homemade aeration system to brew the castings into an inoculant.

Procedure:

1. Once the worms have moved away from an area in the pile, remove that area via shovel and sift the casting to remove any unprocessed materials: seeds, pebbles, stems or even the occasional worm.
2. Once sifted, place castings in a fine mesh bag.
3. In a clean barrel, fill with water to the amount needed (we brew about 20 gallons at a time to cover our $\frac{1}{4}$ acre). Place the mesh bag in the water.
4. Set up aeration and brew for 48 hours. Once brewed, apply to the garden as soon as possible using a watering can or spray on plants/soil with a backpack sprayer.



Vermicast Application

The effects of vermicast tea application have been documented to increase plant growth while reducing plant fungal and bacteria diseases. Applying vermicast tea to the soil and plants can be seen as a “supplement” or power food to feed the biology in the soil and to build ecological resilience against future diseases.

Compost tea can be applied directly to foliage, soil, or both, and the appropriate method and rate of application depends on factors such as the site, crop, temperature, scale of operation, and available equipment. Compost tea can be applied every 14-30 days during the growing season; applying in the morning hours will minimize UV damage. For soil, compost tea can be poured on with a watering can to the root of the plant followed by water. For grass or grazing lands, the tea can be sprayed with conventional machines or irrigation equipment to cover large areas of land.

Garden Orientation and Etiquette

Garden Tools

See the Appendix for a brief guide to the basic tools used in the TomKat Ranch Garden. Common garden tools used in a no-dig garden include a wheelbarrow, shovel, various rakes, knives, clippers, and scissors. We also utilize the tilther, a simple tool that uses a hand drill to till the very top of the bed and provides an excellent platform for direct seeding, and the broad fork, which allows us to disrupt gopher holes, at least temporarily, lift any compaction, and gently aerate the soil.

Garden Safety

Before digging deeper into the concepts of regenerative gardening, we want to highlight the importance and nuances of garden safety. A healthy, safe gardener is essential to a thriving garden. In order to achieve garden safety, we recommend:

- Proper care and use of tools. Some tools can be quite sharp, heavy, and dangerous so use caution in operating them! Put away tools after use to avoid accidents.
- Wear closed-toed shoes.
- Wear gloves.
- Wear sun protection. This can include sunscreen, sunglasses, a hat, long-sleeves, and/or long pants. Gardening requires many hours outdoors, and being prepared is key.
- Hydrate. Always carry a water bottle and make sure to take a few sips every half hour or so. You will feel much more energized and ready to work.

TomKat Garden Expectations and Practices

We follow a simple yet effective approach to garden practices. The most important aspects of daily garden maintenance can be found below.

Clean up

- Wipe down all tools and equipment before putting away to avoid rust.
- Put all tools away in proper areas—no tools should be left out at the end of the day.
- Wind up and store hose.
- Always have compost and vermicast piles covered with tarps and weighed down (with tires or wooden planks).
- Put wheelbarrows away.
- Move any waste collected from the day into the green waste pile.
- Make sure to sweep and wash the tables and floors of the greenhouse to get rid of dirt. This is especially important after completing seeding.
- Keep everything tidy and better than when you arrived! A clean and organized garden and greenhouse makes life much easier.

Record Keeping

In order to understand and reflect upon garden activities, we record our seeding, transplanting, and harvesting. Whenever you seed, transplant, or harvest, write down what you did in the proper notebook. This may include the type of crop, the date, the bed number, the weight of the produce, and the destination for the produce.

Garden Basics

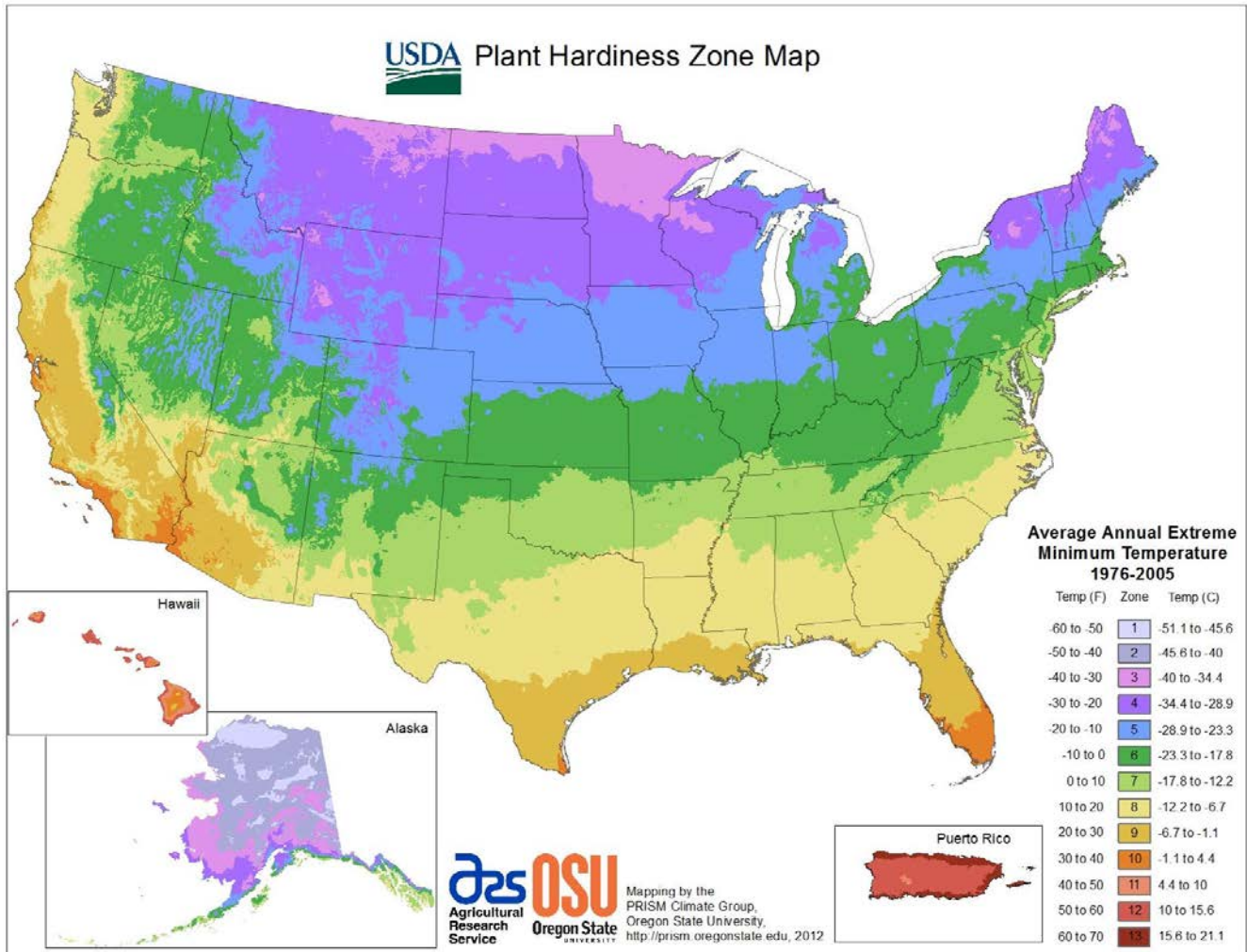
How Seeds Grow

Seeds represent the reproductive unit of the majority of plants. They contain an embryo—the cells that will form the roots, stem, and first leaves of the plant—and food reserve within a protective outer covering. In a process known as germination, the outer covering is moistened, the embryo cells expand, and they eventually burst out. Utilizing energy from the food stored in the seed, the embryo develops roots that push into the soil for water and nutrients, then a stem that stretches upward, and finally early leaves. Practicing photosynthesis, the new plant harnesses sunlight, water, carbon dioxide, and soil nutrients to grow. Each seed requires different conditions to thrive. Gardeners can facilitate the growth of seeds and health of young plants by using appropriate potting mix, following proper greenhouse seeding techniques, and planting seeds during the time of year that best meets their unique needs.



Seasonal Planting Guide

Depending on the geographic location of your garden, the growing season varies, determining the growth and distribution of your plants. You can look at which zone your garden falls in and then specific tips for that region.



The basics:

Perennial plants regrow every spring. Examples include kale, potatoes, sage, broccoli, artichokes.

Annual plants grow once and then die off. Examples include lettuce, corn, peas, marigolds, beets, turnips.

When seeding in the greenhouse or sowing directly into the outdoor garden bed, it is important to consider [geography](#) and time of year to ensure that your plants have the best chance for growth. Here is an example of a [Fall Planting Calendar](#) for the general Western Hemisphere.

Companion Planting

Companion planting is a key tenet to maintaining a regenerative garden, working to simulate a natural ecosystem in which compatible plants grow together. Planting certain plants together can create a synergistic relationship for both species, boosting growth, repelling pests, and improving the flavor of each other. The most classic example of companion planting is the Three Sisters—corn, beans, and squash—where the corn acts as support for the pole beans, which feed nitrogen to the corn and squash, and the squash acts as a ground cover to keep the ground cool, suppress weeds, and retain moisture. Gardeners can companion plant marigolds with other vegetables such as broccoli, cabbage, and cucumber to attract beneficial insects and act as a pest repellent to others.

There are many planting guides available and some may be specific to a growing area, here is a link to a good general guide: [The Secrets Of Companion Planting – Seattle's Favorite Garden Store Since 1924 - Swansons Nursery](#)

Nursery Care

Role of the Greenhouse

Greenhouses provide a stable growing environment for seeds and seedlings. In a greenhouse, a gardener can control the temperature and humidity to promote growth. This level of control protects the young plants from extreme temperatures and helps avoid soil drying out, before the seedling is transplanted to the outdoor garden bed.



Getting Started with Seeds

Seeding is the process of planting seeds in trays in the greenhouse. It involves making and using a potting mixture and systematically planting the seeds.

Potting Mix

Potting soil is composed of a mix between vermiculite and sifted compost. Vermiculite is a hydrated laminar mineral used as a growing medium to increase water and nutrient retention and aerating the soil for germinating seeds. For optimal seed germination, combine potting soil with a 3:1 ratio of sifted compost to [vermiculite](#).

Seeding Process

1. Fill seed container evenly with potting soil mix
2. Poke small divots in the center of each compartment 1/4 inch deep.
3. Pick seed type and plant a specific number of seeds into each compartment based on seed type. (ex. plant 4-5 leek seeds in each, plant 1 Kale seed in each).
4. Cover lightly with potting soil by sifting soil over the tray
5. Label the seed tray with type of plant and date of planting and record in the books.
6. Place the seed tray in a shallow tub filled with water and soak until the soil is evenly moist throughout (may take up to an hour).
7. Remove seed tray from water and set the seed tray in the greenhouse and watch carefully, watering carefully everyday.
8. Different varieties of veg. Mature at different rates, but generally in 4 to 6 weeks the plant starts will be ready to transplant into the garden.



Care for Seedlings

Once seeded, seedlings should be treated like babies, constantly tended to and nourished. Seedlings need to be kept moist, have access to direct sunlight, and thinned, weeded, the greenhouse needs good ventilation to control the temperature. Based on observation, seed trays should be kept moist –but not to the point of overflowing. We recommend using the “Shower” mode on the hose head and gently spraying the seedlings from above.

Preparing and Planting Beds

In a no-dig garden, preparing and planting beds is a simple process of renewing the bed without disrupting the soil through deep tillage as in some agricultural methods. To do this we apply compost to the beds after crops are harvested and beds are rotated from one crop to another.

There are a lot of great resources available on this method of gardening. Here is a link to one of our favorite instruction videos and one we've designed our garden after [The Ridgedale No-Dig method](#).

Compost as a Soil Cover

In regenerative gardening, it is important to keep your land constantly covered to ensure healthy soil. A cover crop provides a variety of services:

- Retains soil moisture
- Insulates the land
- Reduces run-off
- Adds nutrients to the soil
- Reduces amount of water evaporated from the ground

In the no-dig method of gardening, the repeated addition of compost during the growing season at each crop rotation aids in building and maintaining healthy soil for each rotation. At the end of the season, compost is added to the beds and works like a cover crop. Covering the soil during the winter months, protecting the soil from the sun and wind, adding nutrients from the applied compost through the rainy season.

In some areas, such as the potato and squash beds of the market garden we do apply cover crops. Generally a mix of legumes, oats and other grasses. Choosing a cover crop often comes down to what your soil may need and what benefits a given crop can offer, for example legumes help fix nitrogen. Having your soil tested by a certified lab can often assist in determining what your soil may need to boost productivity and working with organic methods to improve soil overtime is well worth the effort.

Bed Prepping Steps

Direct Sowing

Direct sowing involves planting ungerminated seeds directly into the bed, thus skipping the greenhouse and nursery stages. Due to the lack of a controlled, early environment, direct seeding can be volatile but also incredibly effective. Some crops direct seed better than others, such as carrots.

Transplanting

Transplanting refers to the process of moving a plant from the greenhouse environment into the outdoor garden bed. These plants have germinated and established themselves prior to being transplanted. Once a bed is prepped, one can transplant a young crop by following the steps above.

Crop Rotation

Crop rotation refers to the practice of planting different crops on the same plot of land sequentially, essentially “rotating” the plant in a given section. Crop rotation improves soil health and plant growth by increasing the diversity of the above and below ground ecosystems. It helps reduce the pressure of certain pests and weeds and contributes to optimal aeration and water flow. For example, root vegetables penetrate deep into the earth, creating networks for air and water to reach the deeper soil levels. Deep roots also help microbial communities prosper in the soil, facilitating nutrient cycling.

When rotating crops, you want to ensure that you are rotating between crop families rather than within them. If you planted an onion, for example, you may want to consider a lettuce variety afterward. Time is also of the essence with crop rotations. It is important to rotate crops in quick succession in order to maintain soil moisture through ground cover.

Bed Preparation Process at TomKat Ranch

1. Harvest and clear out crops

2. Disconnect and remove drip tape.

3. Rake

With a small rake, pull away any leftover debris—such as wood chips and other obstacles that might impede plant growth from the bed.

4. Broadfork

If soil is dry, compacted, or plagued with gopher holes, use the broadfork to loosen up the garden bed. Often used when the bed has had kale, chard or other vegetables which are full season plantings.

5. Add compost to bed

Roughly 2 to 4 inches of compost throughout the season during crop rotations and 6 to 8 inches as winter cover.

6. Spread Compost

With Steel garden rake, spread compost evenly on the bed, keeping bed width to 30 inches.



7. Mark Planting Rows

Using bed prep rake with markers on the tines, pull rake down the row to mark your planting rows. This method can be used for transplants or direct seeding by hand

8. Transplant:

Hold the seedling/start at the base and carefully tease out seedling from the tray. Plant according to seedling's specific needs—each plant may need different depths and spacing.

OR

Direct Seed:

Each seed will require a different spacing and depth at planting. Cover bed with lightweight garden cloth when direct seeding to protect from birds and maintain moisture.

9. Water

To ensure successful transplants or seed germination immediately water the beds.

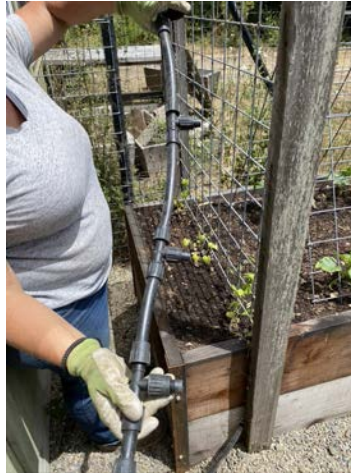
10. Record notes

Take note of transplanting or direct sowing in the record book, recording the type of crop, date, and bed.



Irrigation

Irrigation gives gardeners a break and peace of mind. It allows them to reduce manual watering and rely instead on a mechanical system that consistently waters crops. In California, irrigation is a necessity as it assists in conservation of water. An irrigation system usually involves a spigot, timer, filter, compressor, pressure gauge, piping, and connectors. Based on the size, number, and shape of the beds as well as the crops within them and the local climate, a gardener may opt for certain types of piping, specific settings on the timer, and different number of filters. Overall, building an irrigation system is essentially like building LEGOS! You have a vision and connect the available pieces to make that vision a reality. An overview of the irrigation system pieces is below:



Timers

An irrigation timer allows you to set when, how often, and for how long you want to water your beds. This will vary based on crop, location, and time of year. It often takes some trial and error to hit the sweet spot between over- and under-watering. It can be useful to start at one setting and observe the crops daily for a few days to see how they respond to that setting. Then, you can adjust accordingly. As an example, when growing vegetables in our area, we need to water crops each day, often twice per day to ensure proper saturation. A cucumber plant would receive 15 minutes of drip in the morning and evening. It is best to water when the sun is not at its peak – between 6-8 am and 6-8 pm, ideally.

Filters

Filters do exactly what you would expect—they filter the water coming out of the spigot. Some gardens may have cleaner water sources than others. Here, at TomKat Ranch, we use “ag water” which tends to have more dirt than we may want so we install a series of filters near the spigot to get rid of dirt particles before watering crops.

Pressure Regulators and Gauges

A pressure regulator allows a gardener to control the water pressure of the irrigation. Ideally, the water pressure should be at least 20-25 PSI, but not too high that it breaks the piping. The pressure gauge reads the water pressure and reports it.

Piping

Overall, there are two different types of piping: drip tape and poly tube. Drip tape inflates and deflates depending on whether or not the water is on. Additionally, it only has drip holes on one side so must be laid properly. It appears flimsier and is often used for long vegetable beds, such as those in TomKat’s Westside garden. The main downside of drip tape is that it breaks down over time. On the other hand, polytube is stiffer and more hose-like. It has holes on both sides and is best for landscaping and smaller, raised beds. Polytube tends to prove more durable and lasts

longer. Both drip tape and poly tube come in different sizes—with a range of diameters and spacing between the holes. When purchasing, take note of the size of your piping to ensure that you purchase the right size connectors.

Connectors

Connectors are used to connect different pieces of piping, shape the route of the water in the irrigation network, and turn on and off specific lines of irrigation. Connectors can be straight, 90 degree angles, T-shaped, four-way intersections, end caps, or on/off switches. These are super useful and allow gardeners to be creative and practical given their garden set-up.

Building an Irrigation System

Building the system involves integrating all of the critical elements into a working means of watering your crops. Begin at the spigot and create a line that runs through the different rows of crops. You can do this by measuring as you go, cutting the piping, and then attaching the different connectors. A common mistake is not securing connectors tightly enough; thus, be sure to wriggle them on as far as you can before turning the cap to lock them into place. This contributes to the durability of your design.

It can be helpful to remember that there may not necessarily be a 'right' way to irrigate your garden; various networks may be effective at distributing water. Before entrusting your irrigation system with watering your garden, give it a trial run and observe how it is working. You may find that a connector is loose, the piping has a hole in it, or one line is not straight. Noticing these things preemptively is key. Lastly, you will want to stake down your system to set it in place.

Garden Care and Maintenance

Weeding

Weeds, weeds, weeds... those pesky little plants! 'Weeds' are plants that grow among your cultivated, desired crops. They compete for available space, nutrients, and water, and can provide shelter and habitat for garden pests and disease. That said, we can learn a lot from the weeds growing in our beds. For instance, clovers are indicative of low nitrogen levels. Thus, when it comes to weeds, we work to limit their numbers but also gain knowledge from their presence.

Weeding involves removing the plants that you do not want in your garden beds. It is important to pick weeds from their roots in an effort to stop them from growing again. When weeding, you must be careful to not remove any young crops you have planted. To do so, check your planting records to be aware of what you are looking to grow in each bed. Here at TomKat Ranch, bindweed is very

invasive. For this reason, we pull it at its roots, untangle it from the plants, and dispose of it separately to reduce regrowth. Every area has its own weed issues.

Pest Control

Pests can be very frustrating in a garden, particularly when they are munching on or affecting your plants. Careful observation of your garden will allow you to figure out what pests you are dealing with, where they live, what they prey upon, and more. Such information can inform your approach to mitigating their damage. Each pest-garden combination is different, requiring unique considerations and strategies. As general rules of thumb: 1) avoid using poison and toxic chemicals (the impact of chemicals is never limited to just your desired target; chemicals impact your crops, get into our watersheds, and ultimately end up in our bodies); 2) stay on top of it, making pest control a daily practice rather than letting the situation get out of hand; 3) ask around to see if neighbors or experts have relevant tips; and 4) take a breath as it can get overwhelming.

At TomKat Ranch, our main pest is gophers. They raid our beds, eating and de-rooting crops. In an effort to prevent and suppress their negative effects, we take note of their activity on a daily basis, set traps if needed, and use the broad fork when bed prepping to break up existing networks of holes. We are also experimenting with a sonar machine that uses noise to deter gophers and garlic 'sticks' where strong odors can sometimes be effective. We also encourage natural predators by providing owl boxes and roosting areas for hawks to patrol the area.

Birds such as sparrows and quail can also damage crops. We use hoops and netting or garden cloth to protect from birds. For smaller predators such as aphids or other insect pests, the best approach for our context is the worm tea inoculant. We've found consistent use of this when planting aids in the overall health of the plants and reduces these pests significantly.

Watering

Watering has been discussed in other sections such as Irrigation, Preparing and Planting Beds, and the Nursery, but, when considering garden maintenance, it is vital to recall that watering is an essential step to ensuring that you have a healthy garden. Make sure to water seedlings, transplants, and any un-irrigated crops or plants in need of a little extra H²O! Irrigation systems can aid in not overwatering, but also run the risk of overwatering. Be careful not to overuse this valuable resource! Observation and careful use of water is always a constant in managing any garden.

Observation Skills

Regenerative gardening is quite adaptive and intuitive. It centers around the gardener knowing their garden and being attuned to it. This comes into play in every single step of the process—including when to water (or not water); what, when, and where to plant; when to harvest; when

and what to seed; how to manage pests; and determining why a seed did not germinate, to name a few. Nature is dynamic, and thus we must be too. Observation skills develop and improve with time and experience, so remember to be patient and embrace the journey, learning from your mistakes.

The Harvest

Harvest Overview

Now that all the seeding and transplanting is complete and maintenance is underway, it's time to wait and watch your crops flourish and get ready to harvest! Each crop differs on time until maturity. For example, lettuce is ready to harvest around 6 weeks after seeding while cabbage takes 60-80 days to mature. The label on the seed packet should indicate the information needed for how to grow the specific vegetable and how many days until maturity; however, projections are not always a reliable indicator of when your crop will be at peak flavor and nutrition for harvest. Many atmospheric factors such as weather fluctuations and water can influence a plants lifespan from germination to harvest, thus, it is up to the gardener to determine when the vegetables are at their desired peak.

Lucky for us, vegetables provide signs based on their **size, color, fruit opening, aroma, and leaf changes** signifying their state of maturity.



These guidelines provide a beginning gardener with the general framework of when and how to harvest, but remember, each harvest is unique and provides a new learning opportunity for the next time! Don't be afraid to experiment with tasting or picking produce at different points in their life cycle for different culinary purposes.

Vegetable Harvesting Principles

- **Harvest for peak nutrition and taste.** Vegetables such as summer squash, beans, baby beets, and turnips are at their peak of nutrition and taste when they are younger and tender. These should be harvested frequently to allow the plant to allocate energy to new fruits. Others such as winter squash and melon need to completely ripen on the vine so their flavors can be fully developed.
- **Harvest for size.** Size is an indicator of maturity for the majority of vegetables but it takes practice to know when some vegetables are just right for picking.
- **Harvest frequently.** Diversity of crop rotation and replanting is one of the most important aspects of maintaining soil health and growing healthy plants. One of the biggest mistakes a gardener can make is to neglect to harvest vegetables and plants regularly. Fruit and vegetables can go from tender to tough in a matter of days. The goal of plants is to reproduce, and if fully mature vegetables aren't removed, the plant will stop reproducing.
- **Harvest with the proper tools.** Ripe fruit can sometimes be easily hand picked off the vine, but others require snippers or knives to cut off. For single cycle plants like lettuce, cut off the head right above the ground. For perennial plants like kale, snap off single leaves from the outer edges of the plant leaving the crown in place to continue to grow. For root vegetables like beets and turnips, spot harvest the vegetables when their tops are emerging out of the dirt and their leaves have filled out.
- **Harvest under the right conditions.** The best time of day to harvest most vegetables is early in the morning when they are the sweetest and juiciest. Avoid picking during the heat of the day, particularly leafy greens, which will wilt immediately after being pulled. Harvest vegetables when they are dry to prevent spreading diseases.
- **Harvest the outer leaves of vegetables first.** Lettuces, kale, and other leafy vegetables sprout from the center of the plant. Unless you are picking the entire plant, harvest from the outside leaves first and leave the crown to continue developing in the center.
- **Handle plants with care.** Vining plants such as cucumber and peas must be kept properly trellised so that the weight of maturing vegetables is supported and doesn't cause the plant stems to break. To minimize distress to the plant during harvest, avoid tugging and ripping vegetables and leaves from the stems.

Distribution

A problem many small farmers are facing across the nation is what to do with their surplus produce? The United States is plagued with food deserts and communities experiencing food insecurity, yet there is a gap in connecting farmers' extra fresh produce to areas in need. Once your crops start growing, you may have pounds of surplus lettuce and cabbage! If you are not a farm with reliable sales channels (stores, companies, restaurants, farmers markets), donating to local organizations or schools in need of fresh food is a great way to keep your garden rotating through crop varieties, save food from going to waste, and most importantly, support the local economy and food system.

How to Donate Food

1. **Locate food distribution centers in your community.** Reach out to the community web to find local schools, organizations, food banks, and friends. Gauge who is in need of food and how much. You can experiment with sending a variety of produce each week, building your own routine CSA boxes.
2. **Calculate amount of produce to be donated per week.** If you are planning to donate routinely, start to map out your growing cycles and calculate how much you will need to grow, plant, and harvest in order to yield a certain amount of vegetables. For a smaller operation and especially a regenerative garden, this will take time and practice and you may not be able to predict the exact amount of crop each week. Communicate this to your distribution partner(s).
3. **Source boxes.** Source organic cardboard CSA style boxes or any box that meets your needs. Reuse after each delivery and ask your partner(s) to return the boxes.
4. **Harvest, weigh, record, and track donations.** Time to harvest! Harvest in the early mornings, weigh the produce, and record where it is being delivered. This will help you estimate the amount of food produced, and how much you send away versus consume for yourself or the kitchen each year.
5. **Coordinate transportation and pick up times.** Communicate with your distribution partner(s) on transportation details and delivery times. Build a transparent relationship with partners to guarantee success and expand your network!



Farm-to-Table

Along with donating produce from the garden, organizing a Farm-to-Table culinary program is a great way to use and learn about the delicious and nutritious benefits of your home-grown food! You can connect your garden produce to your kitchen and allow one to inform the other. How will you center your meal around your recent harvest? What can you plant to have some fun in the kitchen? This is an awesome way to combine skill sets and experiment. Ultimately, the microbes in the soil will benefit the microbes in our guts, leading to regeneration of both land and people.



Conclusion

You are now prepared to not only assist in the TomKat regenerative gardens but also to begin your own garden! This resource does not have all of the answers—simply what we have learned during our summer internship and found valuable. Be sure to continue to ask questions, observe your garden, look for inspiration from others, and remember that each situation is unique.

Be adaptable, inquisitive, and tune into your surroundings.



Resource List

Regenerative Gardening

Videos:

1. Intro to Regenerative Ag: <https://www.youtube.com/watch?v=fSEtiixgRJI>
2. How to start a Regenerative Garden: [▶ What is Regenerative Agriculture?](#)
3. Regenerative Agriculture as a Solution to Global Climate Change:
[▶ Gabe Brown discusses how Regenerative Agriculture is a solution to global challenges](#)
4. Urban Farming [▶ Gabe Brown discusses how Regenerative Agriculture is a solution to gl...](#)
5. Richard Perkins [▶ THIS IS HOW REGENERATIVE AGRICULTURE WORKS](#) ,
[▶ The Ridgedale No-Dig method](#)
6. <https://www.richardperkins.co/2022/04/building-no-dig-no-till-beds/>
7. [Singing Frog Farm Garden Model](#)
8. Soil health: <https://soillife.org/>
9. Rescuing Mother Earth [Webinar Series](#):
10. Regenerating the Diversity of Life in Soils - [Webinar with Dr. David Johnson](#)

Podcasts:

1. [The No-till Market Garden Podcast](#)
2. [Farmer to Farmer with Chris Blanchard](#)

Trainings:

1. [TomKat Ranch Regenerative 101 Curriculum](#)
2. [Kiss the Ground Soil Advocate Training](#)

Articles

1. [The Future of Food](#)
2. [No Till Farming](#)

Books:

1. *Kiss the Ground* (Book & Netflix) – Josh Tickell
2. *For the Love of the Soil* – Nicole Masters
3. *The Soil will Save Us* – Kristin Ohlson
4. *The Hidden Half of Nature, Growing a Revolution, What Your Food Ate, Dirt: The Erosion of Civilizations* – David R. Montgomery
5. *Revolution on the Range* – Courtney White (or any of his other books)
6. *Holistic Management* – Allan Savory (There are two versions of this publication. The newer

version is a little more 'user friendly' (shorter!) than the older one.)

7. *Salad Bar Beef or You Can Farm*— Joel Salatin
8. *Cows Save the Planet* — Judith D. Schwartz
9. *Water in Plain Sight* — Judith D. Schwartz
10. *Reindeer Chronicles* — Judith D. Schwartz
11. *The Unsettling of America* — Wendell Berry
12. *The Omnivore's Dilemma* — Michael Pollan
13. *A Sand County Almanac* — Aldo Leopold
14. *The One-Straw Revolution* — Masanobu Fukuoka
15. *Teaming with Microbes* — Jeff Lowenfels and Wayne Lewis

Movies and Series:

1. Kiss the Ground - Netflix
2. Fantastic Fungi - Netflix

Where to buy Seeds

1. [Johnny's Seed Company](#)
2. [Hudson Valley Seed Company](#)
3. [Row 7](#)

Appendix

Garden Tools

A brief guide to the basic tools used in the TomKat Ranch Garden.

Wheelbarrow

Wheelbarrows are the garden mode of transportation. You can store compost or weeds in them!



Shovel

We all know what a shovel is! We love using shovels to fill the wheelbarrow with compost, remove deep-rooted plants, or basic maintenance.



Wide-Toothed Rake

The wide-toothed rake helps sow seeds by making seeding lines. You can adjust the teeth for different numbers and spreads of rows.



Landscape Rake

The landscape rake helps clean up debris after harvest.



Garden Rake

The garden rake effectively shapes a bed and moves soil.



Broad Fork

The broad fork is used to mix up the soil during bed-prepping. It is particularly effective for disturbing gopher networks. One steps on it to dig into the ground, lift up the soil, and move down the bed while repeating this motion.



Tilther

The tilther is a drill-powered tool that disrupts the top two inches of soil. This disruption mixes compost, amendments, and leftover organic material in garden beds with minimal tillage. It is used during bed prepping.



Knife

The knife helps harvest crops such as squash. You can cut the stems off the plant.



Hory Hory Knife

The hori hori knife has many purposes. It can be used to dig holes, remove old plants, and more.



Scissors

The scissors help cut twine for trellising or stabilizing plants as well as opening packages and pruning. They also are very helpful in harvesting crops.



Clippers

The clippers harvest vegetables, prune, and shape plants. Both scissors and clippers can cut irrigation piping.

