Part 1: The Tools

The Beginning

I like tools.

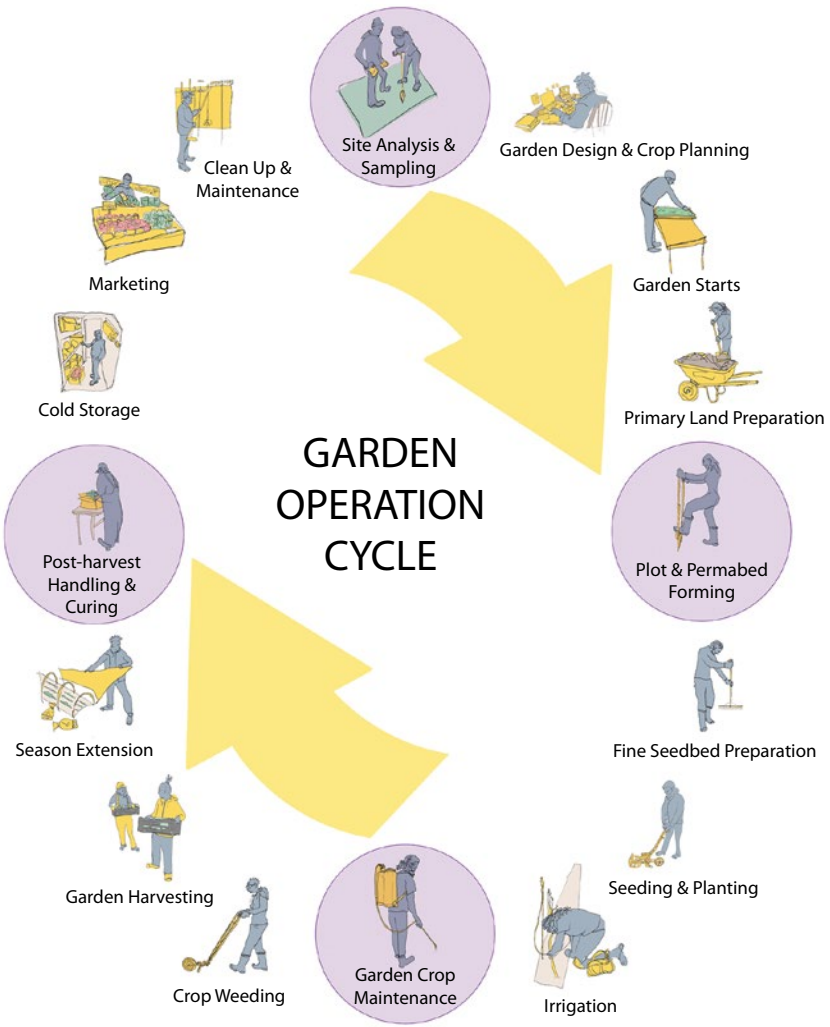
Tools have always been interesting to me. Growing up on a Permaculture homestead, we always had spades, shovels, digging forks, post-hole diggers, rakes, and trowels in the shed. I loved to explore our wellhouse and see the pump, pressure tank, and manifolds that sent water around our property. At my grandmother Deva's homestead in Sebastopol, California, I loved to see her tool buckets and her beloved garden journal (I still flip through its rose-scented pages). In my own start-up market garden, I gleefully strode to those *early-days'* fields with my essential tools: stirrup hoe, garden rake, spade, shovel, and wheel hoe, ready to do weed sweeps in the bean rows and prepare new beds for summer salad greens. I cruised up and down rural fence lines planting trees with a sturdy spade for many years—hand planting over 100,000 saplings on my and other rural properties as part of native woodland restoration, riparian buffer strip, and upland shelter belt projects for farms. As my market farm scaled-up, I gained new tools and equipment, but I continued to use practical favorites. I have forked more garlic and carrot beds than anyone would care to remember while gaining a thorough education in classic literature, good fiction, and awesome tunes on my ear buds while harvesting for a 300-member CSA, two urban farmer's markets, and on-farm sales. My seed garlic business burgeoned; as a pro grower, I grew over 100,000 heirloom garlic bulbs and over 125 different varieties each year—one of the most diversified online seed garlic sellers in Canada. It was for this endeavor that I designed a five-row DIY dibbler to improve accuracy, uniformity, and efficiency for fall planting of the cloves.

I have shifted my work to innovative design, research, and installation of food forests and other edible ecosystems as organized diversified polycultures on my farm and for community projects, and I continue to do trials and experiments with tools to see which ones best serve the needs of different types of growers (home, market, Permaculture, etc.) at different scales and in different contexts (urban, suburban, rural). I like tools, and I hope this book encourages the same fondness in you. It is my intent to help you make strategic purchases and inspire you to build your own DIY tools whenever they are needed to get ahead of the weeds, master the harvest, and much, much more!

When we hold garden tools, there is a feeling of being armed for "right," prepared to grow local, healthy, and sustainable food for ourselves, our family, and our community.

What Is This Book About?

This is a no-nonsense, step-by-step handbook to systematic growing—from crop planning to harvest, and beyond. This book takes a **tool's-eye view**, telling the story of the garden season from the point of view of the tools you need to be successful. After the introductory sections, the book outlines a standard **seasonal operation cycle** broken into **16 major production stages**, presenting tools and techniques for critical garden tasks within each stage. The techniques given are tried-and-true best management practices that work with different tool systems at different scales for different enterprises.



For All Growers

This book is for the home gardener, market grower, homesteader, or small-scale farmer. Whether you grow 1,000 ft^2 or 3 acres, it will help you choose tools wisely as you ***start-up***, ***scale-up***, and, finally, ***pro-up*** your production. These three **scale phases** are ways of thinking about where you stand in your enterprise's growth process—and which tools might mend the weak links in your production stages. Solving weak links with sound decision-making based on scale, soil, and best practices will help you assemble your own **complete tool system** for each production stage and meet all your garden tasks with ergonomic efficiency and cost-effective resilience. Having the right tool at hand makes a world of difference (and the wrong one, a world of trouble). You'll decide for your context, and this book is a guide for those decisions by showcasing a wide array of tools and considerations.

Extending Human Power

Humans are the original tool! We have always used our hands to engage with the natural world, plucking seeds, pressing soil, pulling at debris, and gleaning its ripening fruits. Our hands and bodies were the first contact with food plants millennia ago. Then we learned to fashion wood, bone, sinew, and stone to maximize our power, reach, and ability. *Tools are extensions of our hands, bodies, and minds*—performing garden tasks with **greater power** and **efficiency**. We then made tools out of bronze, iron, and steel. In the modern era, we further extended human power with power tools and more ergonomic designs. Through the millennia, tools used in farming have been designed and redesigned countless times to do essentially the same things: turn, drag, and mix soil; burn, bury, or pull material; and open, close, or pack soil, etc. Is this not the same work of our garden operations today—and our farms at any scale?

Long Ago on a Journey

Long ago, maybe someone on a hillside field picked up a sun-cured limb from the ground. Maybe they used it to herd feral sheep along a ridgeline. Stopping in the shade of an apple tree, they enjoyed its fruit and put some in their leather bag for later. Further on, they ate more apples and curiously turned a seed-dotted pome core in their hand. Then, with the pointed earth-worn tip of their staff, they shoved it into the soil here, and there, and way over there as well. Into these dibbled holes, they placed the apple seeds (or perhaps they were from cucumber or squash…). Then turning their staff over, they pulled the crook end along the surface of the ground to cover the seeds in their depressions and patted the soil firm, watering it in from their bag and walking on to the next spring-fed seep to refill their bag and water the flock. When returning along this route weeks later, the person sees young plants growing and identifies the leaves of their favorites, and, pulling the staff across the soil around the emerging food plants, hacks the other vegetation down. This wooden stave may well have been *the first garden tool*, and a multi-functional one at that: shepherd crook, dibbler, trowel, spade, and hoe.

Or maybe, in a grass field somewhere, a cured animal jawbone was lashed to a wooden staff and used to hoe a squash field. And, along a stream

at the base of a hill, long cuts in the ground were made to allow water to flow via gravity to the fields of squash. In a not-so-distant future, that once ancient squash garden could still be grown and picked by growers today, placed into crates, and loaded onto a cart for a farmer's market. Tools have always been used as ways of extending our reach, enhancing our power, and fine-tuning our techniques for growing food. Today, our tools are fine-tuned to perform an array of specialized garden tasks.

Top left: *Tools similar to these from Guatemala are found around the world as essential land preparation equipment. From left to right: a pick to open new stony ground, a broad hoe to form beds and trenches, a rake to finish bed tops, and a hand hoe for close action.*

Bottom left: *Wishing to tune into the uses of tools at the transition between hunting/gathering and more sedentary agriculture, I walked across a portion of the Anatolian highlands in Turkiye. Shown here is the oak stave I cut from a managed coppice in the hills. I traveled along shepherd trails, collecting seeds and sowing them into soil opened with the stave dibbler. I walked solo, but, historically, whole communities would have moved across the land at this time of year, settling only temporarily and leaving the land with more food varieties growing to return to when they passed through again.*

TOOL VIEW: Humans

Humans are born with tools: our hands and fingers, our feet and legs, our minds and spines. We are well-equipped in our human body to work soil, plant, harvest, and process food. You can reduce wear and tear on your original tools by employing fabricated tools (and remembering to stretch daily!).

FARM FEATURE

Life as Tools at the Edible Biodiversity Conservation Area

Are humans the original tool? Really, *all* of life can be seen as "tools" in the garden of Earth. This is an important mindset. Living organisms and our environment are important allies in productivity. We can bring compost to the garden with a wheelbarrow, but it is animal manure, rock minerals, and rotted plant debris that made that compost! For food growing, our primary tools are the soils (including the organisms that live in it) and the plants and animals that live on the farm. Climate, geology, and ecology equip us for success. When we remember these are the fundamentals of production, we can design farms to make use of these natural resources.

At the **Edible Biodiversity Conservation Area** (EBCA), plant diversity is our tool kit. Here, we are

researching (A) many varieties of **edible and useful** perennials and annual crops for their potential to maximize ecosystem services. Our successful varieties are grown in **nursery plots** (B), where soil is a key tool. We improve it with cover crops and composted manure, we inoculate it with soil life, and we strive to conserve soil structure with low tillage practices. We employ **ecological design principles** (more fully outlined in my book, *The Edible Ecosystem Solution*).

These plots yield saplings for use in education sites within the EBCA and in nearby communities. We grow mulberries, Asian pears, pecans, **hazelnuts** (C), and many other crops. We are also growing intensive coppices of hardwoods for our own tool handles, and **willows** (D) for biofuels, **basketry** (E), and living fence designs. Our heritage **Jacob sheep** (F) help maintain plant diversity by discouraging unwanted species in our orchards and cycling nutrients. My root knife (or Hori Hori) is required in a wild landscape to harvest fresh dandelion and echinacea roots for a **spring tea** (G), which I am sipping as I write this, contemplating *life as tools* for garden success and life success.

Life as Tools

Pro-Tip: *Learn to recognize plants, soil, and animals as tools (and allies), as they have been regarded for millennia. Yes, we now use larger tools, but it is important to understand the beauty of* life as tools/equipment. *With this in mind, we can venture into the modern realm of pro-grower tools for homes, gardens, and homesteads.*

Tools can be used for any job to make it easier and more efficient. I collect sweet acorns in urban areas to add genetics to the Edible Biodiversity Conservation Area research trials with the goal of enhancing native tree species in food forest garden systems—an ecosystem restoration development.

FOCUS

Coppicing for Tool Handles

I head into one of our **agro-forestry projects** (1), an intensive **coppice woodland** (2) that is cultivated to provide limbs that can be used as fence posts, bows, garden tool handles, and other useful tools. When the trees reach a **desired diameter** (3), I cut them to a stump and allow the replacement growth to regenerate from **dormant buds** at the base of the stem or **adventitious buds** near the cut surface—to provide material for future uses. Weedy, fast-growing tree species are encouraged here. Sometimes, we find unique opportunities, like volunteer elms that we can leave in place to grow a **thicket** (4) along with the planted trees to provide small-diameter wood for various projects (these trees wouldn't ever get big due to Dutch elm disease). Every tree has a unique shape. After a while, you start to *see the tool you want* in the tree, like this naturally strong fork in an **elm** (5) for a rake, the curved end in this **boxelder** (6) for a hilling hoe, and the straight body of this **hard maple** (7) for a universal tool handle.

Traditional Tools

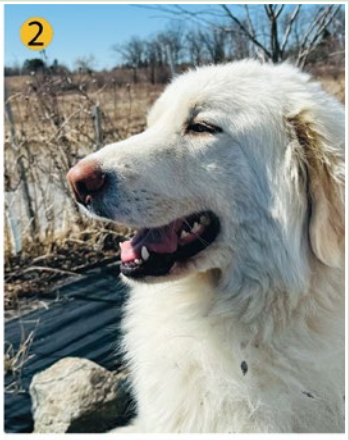
You can still find tools made the old way. Many are beautiful works to behold and can still be used on the farm or in the garden. The application of human power directly into the ground will always be relevant. Cutting grass, grain, and hay with a scythe or sickle is still an affordable and efficient means of small-plot management. Many of our most popular tools today are based on traditional designs. The trowel and root knife have their own roots in ancient tools like the **Hori Hori**, which has been part of Japanese culture and gardening for centuries. (A picture of one appears in "Life as Tools," above [G]). It is a multi-functional tool used as easily for troweling out holes for transplants as for cutting below-ground roots, dividing rhizomes, digging up weeds, and even cutting greens. The Hori Hori has been used not just by *farmers,* but also by *warriors*. Many swords were forbidden in the 1800s, so farmers and blacksmiths perfected the use and forging of a hidden warrior's tool. It is fitting that a serious gardener or small-scale farmer holds a Hori Hori or similar tool at their belt in an age where these growers are indeed the Earth warriors pushing the world forward to a better place.

TOOL TIME

Traditional Tools

We are familiar with traditional tools like the **hoe** (1) which has been used to work dry and wet soils since the start of agriculture. Let's go back further and remember the humble **guard dog** (2), the first domesticated animal—still used to keep our flocks and gardens safe from predators and scavengers. One of the most powerful and longest in-use tools out there is **fire** (3); it has been used for tens of thousands of years to clear land, change environments, and encourage food production and consumption. At one time, fire was one of the greatest allies in agriculture. This *swidden agriculture*, practiced around the world, used fire to clear land and release nutrients. The Milpa system is a great example of using fire to grow crops. Semi-nomadic peoples would plant the land into annual crops and perennial fruits. After a period of production, they would move on to a new plot, leaving behind a patchwork of land with a new diversity of forest including more food-bearing trees and habitat for wild game.

Original Tools



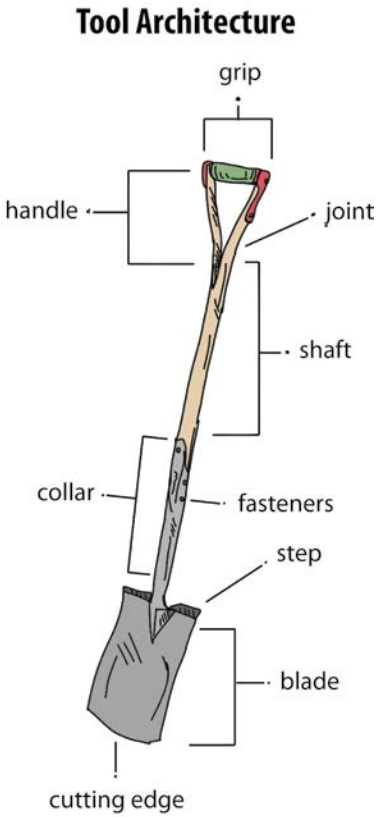
The tools to make fire include a hand drill with a **hearth board** (A) and **hand drill spindle** (B) that use friction to ignite **tinder,** such as **tree fungus** (C) or fuel **fibers** (D) from coconut, palm fiber, cedar, juniper, lichen, or dried corn husks. Using a **flint** (E) is another method to spark the fuel. A simple modern **fire starter tool kit** (F) can be a tin holding various natural and manmade tinders, like a **char cloth** (G), and **flint and steel** (H) for sparking.

All about Tools

Familiarity with the diversity of tools and their forms and functions can help us make better decisions for our gardens and farms. You are already familiar with the basic types: the rake, spade, fork, etc., but there are many specialized tools, like the push seeder and flame weeder, that are also worth knowing about. Before we explore the use of tools in Part 2 (as they are used chronologically through seasonal operations), let's first get more familiar with the tools themselves, their architecture and types, and how form and function go hand-in-hand.

Architecture of a Tool

The most common tool architecture can be seen in any hand tool used for working the earth—from digging, to hilling, to furrowing, weeding, etc. As an example of **tool architecture**, consider this *spade's* construction (illustrated at right). It's a good spade because it has a strong **blade** with a **sharp cutting edge** that can be honed when needed. The **step** has a good ergonomic design. It has a wider step that has grip (grooved surfaces), which makes a big difference for safe and enjoyable use. This tool has a very strong **collar** that is well attached to the **shaft** with good-quality fasteners. (The collar is the weakest link on many tools; it is where they break if poorly made or poorly maintained.) There is also a **joint** where the handle attaches to the shaft. Sometimes this joint is a collar connecting the shaft to the handle, and sometimes it is made of the same material and is of a piece with either the shaft or the handle. The **grip** is where you place your hands, and this is another feature that should have good ergonomics. A well-designed grip like the one shown here will greatly improve your garden enjoyment.

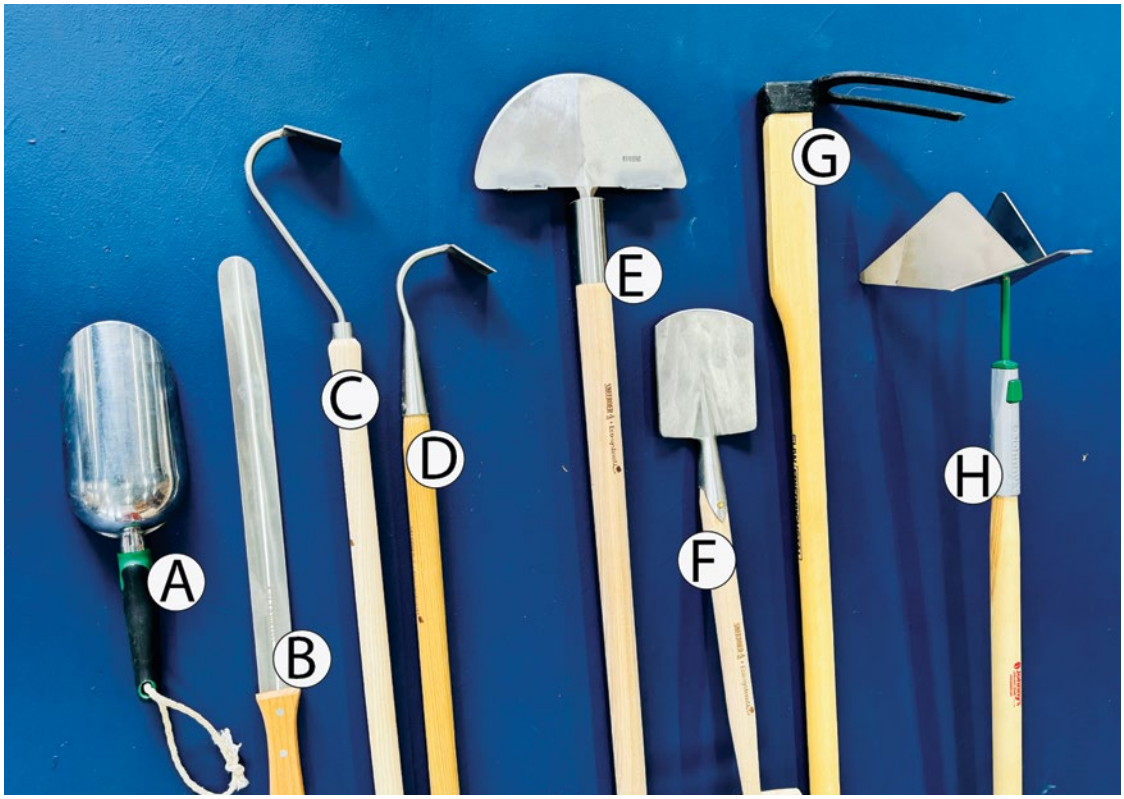


Collars and Fasteners

Collars and fasteners hold shafts to their various blades. The way this "business end" of the tool is attached to the handle is critical for longevity—this component is prone to break first. Although stronger collars resist breakage, certain designs lend themselves to being repaired more easily. If a blade breaks, it's a job for the forge or welder. But if the tool head is loose at the collar or the handle breaks, you'll appreciate having selected a tool with an easy-to-repair design.

This potting **soil scoop** (A) has a metal tang inserted into a molded plastic collar with no visible fasteners. It would only be strong enough for light-duty jobs; when any tool with this construction breaks, it's tedious to repair. This **pottery knife** (B) is assembled like most knives, with the metal tang (the solid forged metal part attached to the blade) inserted between two wooden handle pieces and fastened with rivets. This is a strong design for a handle; worn rivets can be removed, and new ones added. The metal collar for the first **hoe** (C) shown in the photo is fitted by forcing the hoe's metal tang into the wood, and expansion is limited by the metal collar. This is a popular design for metal files, but on a hoe, the metal will eventually come loose under heavy use. The handle on the other **pull hoe** (D) can more easily be fixed by simply removing a screw or bolt and inserting a new handle. The **edging tool** (E) has a variation of the metal collar on the first hoe (C), but it has a more substantial, longer tang inside. The small **hand spade** (F) has a metal insert collar that is much deeper than the **hoe** (D), and the wood handle is perfectly tapered for a snug fit. Considering that the long hoe will have more wear at the collar point (from pressure applied by a standing person whose hands are far from the blade compared to a short spade–handle distance), this spade collar is built very strong indeed. This **clevis hoe** (G) uses a standard split handle-and-wedge system to mount the blade. These eventually come loose, but it is easy to replace them by hammering a new wedge into the glued channel at the handle end (then break the wedge off and sand it clean). A second metal wedge can be hammered in across the first to further strengthen, but this metal wedge can be obnoxious to remove from an old hoe head! The multi-connection-style handle shown with the **furrower attachment** (H) on the right of the image fits many tool blades, but it has a completely custom collar, so repair requires ordering parts from the manufacturer.

TOOL VIEW: Collars and Fasteners



Handles, Joints, and Grips

When it comes to ergonomics, hand grip is critical (along with having the proper shaft length to suit your job and height). We can also look at the different joints of the handle for strength considerations.

The **joint** pictured on the left of the image (I) is tapering slightly to the handle, whereas the **shaft joint** (J) is straight into the handle grip. The Y-joint (K) is made of a solid piece of wood, whereas the Y-joint (L) has a **triangular support** of wood blocked between the divided handle wood coming out of the shaft of the tool. The tool (M) has a **metal Y-joint** to join the shaft and the grip, and the tool (N) has a **plastic** shaft and joint. The strongest of these are the **solid wooden Y-joint** (K) and the high-quality **molded plastic handle** (N). The most difficult one to repair would be the plastic handle, followed by the split wooden one with a triangular block (L). The most likely point of failure will be on the model (M), with its **metal joint** that is likely to become loose with time (actually, this one is!). This is the only model where a broken shaft doesn't require replacing the joint and the handle grip.

For grips, note that some designs (P, S, T) **taper at the edges**, whereas others (Q, R, U) **taper upward** at the center of the grip. These will feel different in different hands. Overall the **T-handle** style (P, Q) is better for tools for digging into hard earth (spades, digging forks, edgers) with your primary hand on the grip, and the **D-handle** style (R, S) is better for when the handle is held with the primary hand and the second hand holds the shaft for moving materials around (shovels, garden forks, hay forks, etc.). ***Note:*** This is also true for tools (like a fork) that are primarily for lifting material like soil and moving it up and into a space (like a wheelbarrow) or turning it over (mixing compost). On the other hand, long tools with a **straight shaft/handle** (O, V) are best for when you need longer reach with the tool and/or when the action is more downward. A long-handled shovel, for example, is used to skim the soil surface and turn the lightly moved material onto a row cover to hold it down. One of my favorite shovels had a pointed and curved blade to cut into soil and scoop and hold material; it was attached to a long, straight handle for easy reach. A straight handle will be found on earthwork hoes for *picking* into new ground (an action where a D- or T-handle would never be used) because hand positioning requires

the straight shaft. The most common is the variety of garden weeding hoes with a straight handle that the user holds upright with both thumbs up so the hoe can ergonomically be used to work rows of crops.

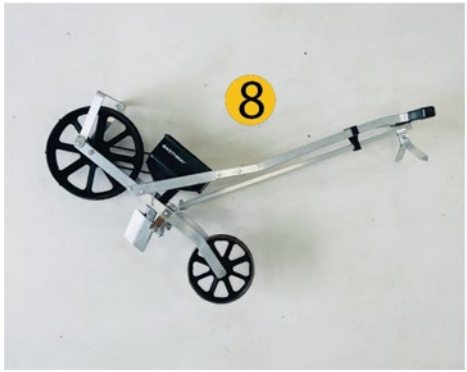
There are variations in grip *material* as well: **metal** (O) is cold and not fun in rain, but it's strong; a **foam** outer layer (V), which is soft and warm; a textured **rubber** grip (W), which is anti-slip and warm to the touch; and **wood** (X), which is also warm to the touch and anti-slip when finished correctly. Another option is the **stacked leather** grip on this **billhook** (Y), which is very cozy to hold. The classic **hard plastic** grip on this **harvest knife** (Z) is easy to keep clean, so it is very good for the fine work of pre-washed greens.

TOOL VIEW: Handles, Joints, and Grips

Specialized Tool Components

Most tools have similar components, but there are some differences. The **wheel hoe** (1) is noticeably different from your typical **hand tool** (2) because it (obviously) has wheels; the version shown here is a double-wheel hoe with a special toolbar for attachments. The attachment here is a tine weeder and torsion weeder, not unlike the tool head on the hand tool (2), which is a spring hoe. The **weed wacker** (3) is also different because it has an electric battery power source, but otherwise, it is essentially a scythe. Smaller hand tools like the **sledge mallet** (4) have handles and heads, and the **knife** (5) has a handle and a blade not unlike the spring hoe (handle and blade), but in this case, the blade of the knife is much sharper and the handle much shorter. The pruning scissors and **clippers** (6) have similar components as well, but their form has a different intention. The **backpack sprayer** (7) has straps for your back (similar to those on the weed wacker), but it adds several new components: a tank for solutions, a piston, a hand pump, and a wand with a sprayer nozzle. The **push seeder** (8) is also very different. It has wheels that drive a belt that operates the turning seed plate in the hopper. Some simple tools, like the **ripper** (9), are very specialized. Most tools are some version of these elements, with handles, blades, wheels, batteries, or hand-operated mechanisms. In all cases, the form of the tool is based on its function.

Specialized Tool Components



Tool Types

All tools come in many shapes and sizes, from the simplest dibble to specialized tractors. Most garden tools can be categorized as hand tools (meaning you hold them in your hands), but this is vague. Does that include hoes, power drills, push seeders, and garden carts, but not salad spinners? Garden tools are best categorized by the type name: shovel, seeder, trowel, fork, etc., and they are best understood by the jobs they perform. The categories overlap: a long-handled tool can be multi-functional and multi-row. However, the categories given below help to define the basic aspects of tools we should consider when creating complete tool systems.

Tool Type Categories

1. **Short-handle tools,** like trowels, have handles around 6" to 9" long and require human proximity to what they are doing. You use them when kneeling in the soil to transplant or standing at the edge of a container bed to plant. These are popular for container growing, pot culture, and greenhouse work.
2. **Long-handle tools,** like hilling hoes, allow you to stand and walk while working the ground. These are popular with market growers and anyone working in raised beds between 2"and 12" in height.
3. **Medium-handle tools,** specifically designed for container growing, have handles long enough to work the soil in raised container beds that are 12"–30". Medium-handle tools like picks and broad hoes are also employed in hilly terrain where you stand downslope—you don't need the more typical long handle to break the ground uphill.
4. **Wheel tools,** like push seeders, wheel hoes, and carts, have the momentum of wheels; some make use of ground-driven power, as a push seeder does, with the front wheel driving a belt that turns the seed plate and plucks seed from the hopper to deposit them into the ground through a furrower.
5. **Multi-functional tools** are simply those that have many uses. A garden fork can be used to turn over soil, harvest root crops, and move compost into a wheelbarrow. You can find more specialized tools for such garden tasks, but multi-functional tools are invaluable, especially on

a small farm with many tasks that need to be done in a cost-effective way.

6. **Dual-purpose tools** include those that have been intentionally designed as two different tools in one, like the pickaxe, which is literally a pick on one side for breaking hard soil and an axe on the other side for chopping through roots when opening new land.
7. **Attachment tool systems** use a base tool that can be used with several attachments to serve different tasks. Long-handle tools can have multiple hoe heads that are interchangeable, while wheel hoes can use a system of different belly- and rear-mounted tool bars to attach different hoe types as well as other tool types like cultivators, hillers, and tine weeders.
8. **Multi-row tools** are popular with larger-scale growers because they perform the same job (weeding or seeding) across an entire bed top. For example, the 6-row seeder or tine harrow attachment for a wheel hoe can be used to seed an entire bed top and then blind weed the whole bed top.
9. **Power tools** are those with power (whether gas or electric); they can be pushed wheel tools, short handheld, or long handheld tools.
10. **Stationary tools** are those that have a fixed position and perform a task, like a root washer or salad spinner.
11. **Bins, Containers, and Trays** are all those vessels that hold what we need—from the seedling tray to the produce bin to the raised bed made of wood or metal.
12. **Irrigation** is really its own category because it is a *system* that only works when all its components are working together.
13. **DIY tools** are those built by growers to suit their needs; they might be innovatively purpose-built or built using design templates.
14. **Supplies** are anything that has a shelf life, including weed barrier, drip tape, and row cover. Proper handling of these will get you maximum longevity.
15. **Inputs** include immediate consumables like fertilizers, compost, and pest products.
16. **Life (ecosystem services)** includes the living organisms that serve your garden production—from soil microbiology to manure producers to the people who help it all run.

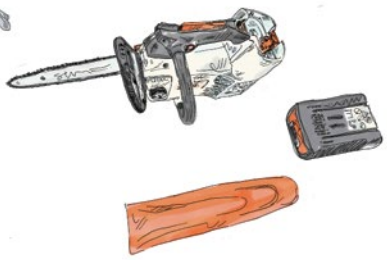
Tool Systems

Most tools work together to form a tool system—accomplishing a series of tasks. In some cases, the *system* is clearly a system, like an irrigation system, with its various components that pump and distribute water to your crops. A wheel hoe, though, can be seen as either a singular tool or, if various attachments are used, it could be seen as a system that maximizes humans' upper body strength and the quick movement of the wheel to accomplish different tasks. What type of weeding system do you use? We use a *wheel hoe tool system* for our garden cash crops, like carrots.

Hand Trowel

Push Seeder

Electric Chainsaw



Irrigation System

Hand trowels are short-handle tools; push seeders are wheel tools; chainsaws are power tools; and irrigation is best understood as a system.