

PREMIUM ISSUE



# MOTHER EARTH NEWS

## MODERN HOMESTEADING

• Expert Advice for Self-Sufficient Living •



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- Find Ways to Preserve the Garden Bounty
- Build Less-Expensive Garden Beds
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- Churn Sweet Homemade Butter for Your Table

Spring 2016



“I believe that there is  
a subtle magnetism  
in Nature, which, if we  
unconsciously yield to it,  
will direct us aright.”

—Henry David Thoreau







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# There's No Place Like a Modern Homestead

Imagine a more satisfying way to live, with time to enjoy life's simple pleasures. A quiet evening walk in the woods. Relaxed family meals of flavorful, homegrown food with thoughtful conversation. Curling up with a good book in front of a crackling fire after a day's work gardening or chopping wood ....

You can enjoy these rewards—the key is to recognize the full value of becoming a skilled, productive modern homesteader. What's "modern homesteading," you ask? Centuries ago, homemaking and homesteading involved a great deal of hard physical labor. Today, we have machines and scientific knowledge that make most tasks much easier, faster and safer. Modern homesteading taps the best of contemporary technology to help us master traditional skills to become more self-reliant and secure.

Modern homesteaders are part of a growing trend: More North Americans are choosing more self-sufficient lifestyles. For some of us, the quest for self-reliance begins simply: The search for a decent-tasting tomato steers you to a seed catalog, which opens the door to gardening, canning and composting. After a few years (or sometimes decades), this journey toward more sustainable living may lead you to an abandoned farmstead, which becomes home complete with a small-scale market garden, all a way of making a living from the land (Page 4). Another experienced homesteader shares his list of habits to sharpen your self-reliance skills (Page 8).

Whether you live in a country farmhouse, a home in town or a city-center apartment, you can get closer to self-sufficient living. Expensive designer clothes,

factory-made convenience foods, and long commutes to work become less attractive the more we take control of our lives, food systems and expenditures.

Modern homemakers take pride in growing a steady supply of organic fruits and vegetables, as well as producing cheese, meat, eggs, and even wine and beer. Some bake homemade bread (Page 81), raise chickens (Page 26), and preserve their homegrown food (Page 66).

Others spin and weave their own clothing or make their families' soap and personal care products. Homesteaders often limit fuel costs by heating their homes with firewood, and by installing renewable energy systems—for more on off-grid living, check out Page 12. They recycle, reuse and renovate, sometimes combining all three to build debt-free homes (Page 90).

For others, the desire to homestead arrives in a pivotal moment. One day, while sitting in a

traffic jam, you realize you crave a different kind of life—one that's closer to the natural world, less dependent on goods and services from corporations, and, ultimately, more rewarding.

Join us in avoiding "affluenza" by choosing to pursue an alternative bottom line. Instead of measuring your wealth by job status and how much you own, become a modern homesteader. Embrace simple living, healthful foods, strong relationships and, in turn, discover deep life satisfaction. You, too, can live with less cash income but greater security and personal contentment—and MOTHER EARTH NEWS is here to help you get started and keep you company along the way.

—MOTHER

Modern  
homesteading  
taps the best of  
contemporary  
technology to  
help us master  
traditional skills.





*Les Jardins de la Grelinette* is the author's thriving 1.5-acre market garden in Saint-Armand, Quebec.

# Anyone Can MAKE A LIVING ON 1.5 ACRES

Learn from these seasoned market farmers and grow your own fulfilling farming career on less acreage than you ever thought possible.

By Jean-Martin Fortier

Many people believe that a small-scale market garden can't compete economically with larger industrial growers. For more than a decade, however, my wife and I have supported our four-person family solely by intensively farming 1.5 acres. We offer our experience here as a road map to help you start your own successful market farm.

We began our farming careers as “WWOOFers” (volunteers with World

Wide Opportunities on Organic Farms), and later worked as farm managers on someone else's market farm. After we spent some time learning abroad, we came home to Quebec to pursue our own farming project. We started small by growing produce on one-fifth of an acre and by living simply—in a tipi! After a few years, we longed to put down roots in the community and expand our farm, but we needed to generate income. To make payments on a small plot, fund the construction of a modest home, and cover the

expenses that surround a growing family and business, we made a decision that might sound contradictory to economic growth: we decided to stay small.

We wanted to continue relying on inexpensive hand tools and light power tools. We even named our farm *Les Jardins de la Grelinette* after *la grelinette* (“broadfork”), a tool that epitomizes efficient hand labor in organic gardening. We've always believed that it's possible—even preferable—to intensify production through smart gardening





Jean-Martin and his wife, Maude-Hélène, tend their 1.5-acre farm with the help of hand tools, including this innovative, six-row seeder.

techniques. Our motto became “Grow *better* instead of *bigger*.”

## A Biologically Intensive Approach

We began by investing in a large quantity of organic matter to create rich, living soil. We continue to add compost regularly, while restricting the tilling of the soil to the surface. This method keeps the soil’s structure as intact as possible. By improving the soil’s structure, we’ve been able to sow crops close together, resulting in higher yields and reduced weed growth.

We further maximized our growing space by planting as many succession crops as possible. To make a crop-rotation plan, we had to first determine the length of time each crop would spend in the

garden, and then schedule our plantings so we could replace harvested crops with new plants or seeds as soon as possible. With our crop-rotation plan in hand, we succeeded in producing multiple harvests from the same permanent garden beds.

## No Need for a Large Mechanical Steed

We wanted to avoid the investment necessary for maintaining a large, four-wheeled tractor, so we rely on a small-but-mighty walk-behind tractor with multiple detachable implements. Learn about two-wheeled tractor options at <http://goo.gl/fY8jkS>.

The soil’s integrity is our top priority, so we’ve opted for a rotary-power harrow (shown below), which stirs and prepares the topsoil for planting while retaining

the vitality of the bed’s subsoil. We also use a “tilther” —a clever tool powered by an electric drill that does a great job of mixing amendments into the soil (available at [www.JohnnySeeds.com](http://www.JohnnySeeds.com)). All of our tools, including row covers and two-wheel tractor implements, are sized to work efficiently in our uniform, permanent beds, which are all 30 inches wide by 100 feet long, with 18 inches between each bed.

Weeding can be extremely time-consuming, so to discourage weed growth, smother crop debris and dedicate our time elsewhere, we cover the soil with black plastic mulch. UV-resistant, black polyethylene tarps do an especially good job of diminishing pesky weed pressure. The explanation is simple: Weeds germinate in the warm, moist conditions created

ALEX CHABOT (2); TOP RIGHT: CLARISSE LE GARDIEN



Walk-behind tractors are the middle ground between efficient hand tools and large, four-wheeled tractors.



by the tarp, but are then killed by the absence of light. This weeding technique is called “occultation,” and it saves us *a lot* of work. The great thing about these methods is that they’re relatively inexpensive, especially when compared with the large equipment and expensive chemical inputs used in traditional farming setups.

## Kick Out the Middleman

Direct selling via farmers’ markets and community-supported agriculture (CSA) programs allows market farming to be a financially successful career choice in today’s economy. These expanding avenues for direct producer-to-consumer sales allow growers to recover the large portion of profit that’s traditionally scooped up by distributors and wholesalers. For example, most grocery stores take a cut of between 35 and 50 percent of an item’s selling price. The distributor, who transports and handles the product, takes another 15 to 25 percent. This means that salad greens sold for \$2 in a store will only bring the vegetable grower about 75 cents. That’s a big loss! Market farmers, on the other hand, can receive all the profit for their product if they’re willing to put forth their own time and effort on marketing, sales and distribution.

At *Les Jardins de la Grelinette*, we favor the CSA model because it guarantees sales

and simplifies our production plan (see “Advantages of the CSA Model,” above). Last year, we sold 46 percent of our produce to our 140-member CSA program; 44 percent at two farmers’ markets; and the remaining 10 percent, which was mesclun mix, to a few local restaurants and a nearby grocery store. We peddled produce to approximately 250 families. Don’t forget, we live in Quebec, where the growing season is shorter than most

U.S. regions, despite our application of season-extending techniques. If you live in a warmer climate, you should be able to sell even more.

Whether you choose to use a CSA model, farmers’ markets or a combination of avenues, direct selling builds a loyal customer base and develops interdependent relationships with clients. This can take a few years, and you can’t overlook two key components: quality

## Advantages of the CSA Model

- **Guaranteed sales.** The main advantage of the community-supported agriculture (CSA) model is that production is prepaid at the start of the season, often before the first seed has even been sown. This model allows the farmer to budget with greater precision.
- **Simpler production plans.** Because members have already purchased the produce, the farmer can plan production based on sales. After determining the number of customers, the farmer can plan the contents of each delivery beforehand. This is even more important for growers who don’t yet have much farming experience to base their year on.
- **Risk sharing.** The idea behind CSA programs is that the risks inherent to agriculture are shared between the farmer and the members. When members sign up, they authorize a contract inviting them to be tolerant in case of hail, drought or any other natural catastrophe. If the season is good, the members will receive more than planned, but if the season is bad, they’ll receive less. For the farmer, it’s similar to taking out an insurance plan on the harvest.
- **Customer loyalty.** CSA models allow farmers to build customer loyalty and tangible relationships between consumers and the farm. Many of our members have been buying vegetables from us for many years now. These people know us, they’ve come out to visit the farm, and they greatly appreciate the work we do. As its name suggests, community-supported agriculture really does have the power to build community.

## Start-Up Costs

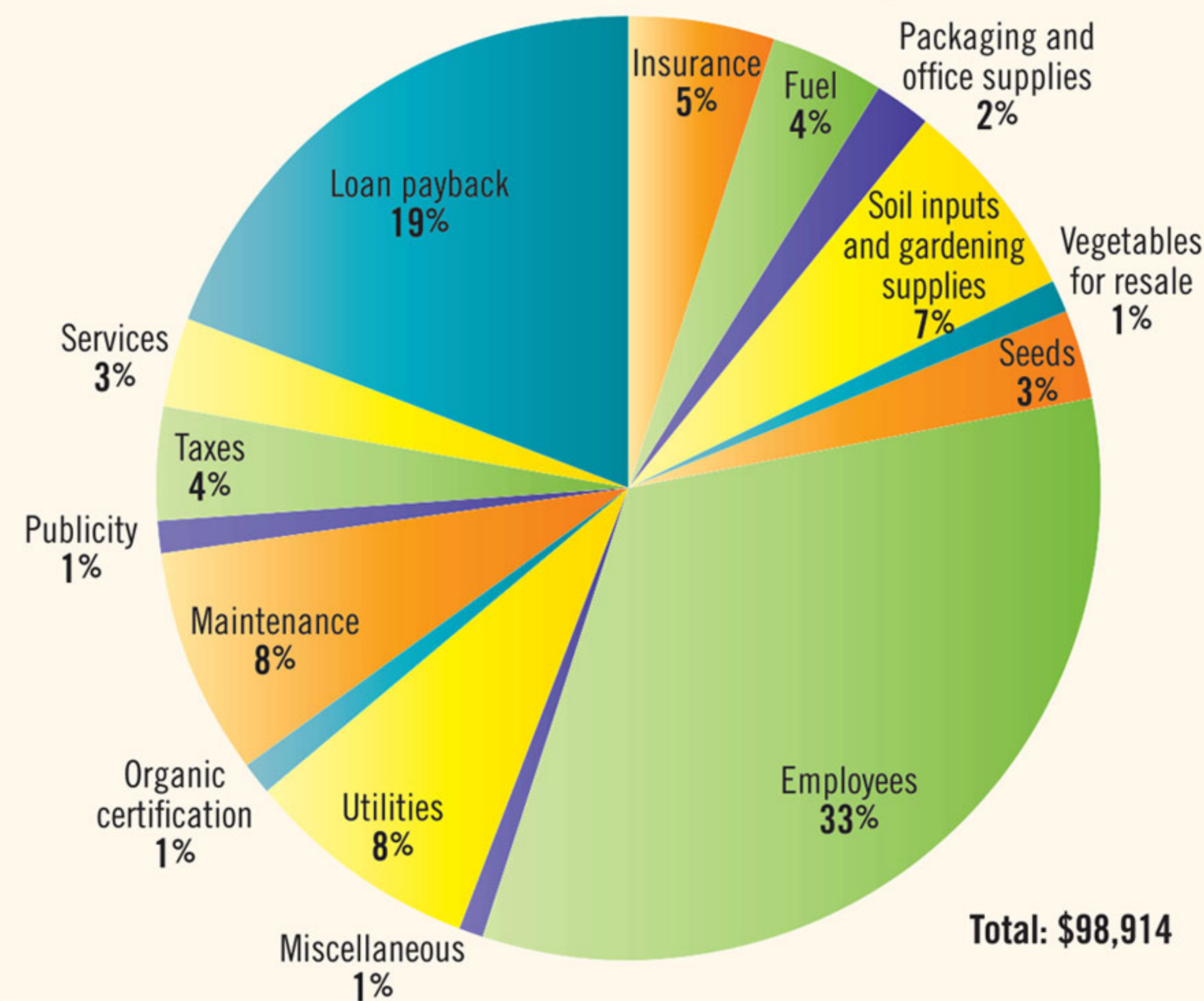
Greenhouse (25’ x 100’)	\$11,000
2-wheeled tractor and accessories	\$8,500
2 hoop houses (15’ x 100’)	\$7,000
Cold room	\$4,000
Irrigation system	\$3,000
Furnace	\$1,150
Flame weeder	\$600
Indoor seeding equipment	\$600
Hoes and wheel hoe	\$600
Floating row cover, insect netting and hoops	\$600
Electric fencing	\$500
Harvest cart	\$350
Seeders	\$300
Harvest baskets and scales	\$300
Broadfork	\$200
Rakes, shovels, spades, wheelbarrow	\$200
Sprayer	\$100
<b>Total</b>	<b>\$39,000</b>



Because CSA program members invest in produce at the beginning of the year, market farmers can create ultra-efficient production plans and budgets.



## Annual Expenses: Farming 1.5 Acres



and presence. When it comes to customer loyalty, quality of the product is vital. Always wash and neatly display your vegetables. Be present at market stands and CSA program drop-off points. Bigger, mechanized, faceless operations will never be able to compete with you if you're producing top-quality produce and consistently showing up to form an ongoing, positive relationship with your customers.

### Small Can Be Profitable

Market gardening provides the opportunity to get started little by little. In our first year of production—on less than one-fifth of an acre of rented land—we sold \$20,000 worth of produce.

The following year, our sales more than doubled to \$55,000. In our third growing season, we invested in new tools and settled on our current farm site. By increasing our amount of cultivated land to 1.5 acres, we increased our gross sales to \$80,000. When our sales broke the \$100,000 mark the following year, our micro-farm reached a level of production and fi-

nancial success that most people in the agricultural industry had previously believed to be impossible. We've only continued to grow since then.

For us, \$39,000 was enough to provide all the tools and equipment we needed to start a small-scale market garden, including one greenhouse, two hoop houses, irrigation equipment, a walk-behind tractor with implements, a cold room for vegetable storage, and more (see "Start-Up Costs" on Page 6 for a full list of equipment). This may sound like a lot of money, but consider that a bank loan of \$39,000, spread out over five years at 8 percent interest per year, meant that our

annual payments were about \$9,500.

Compared with the potential revenue of an intensively managed market garden, these payments were entirely manageable. Plus, this figure is much less than the costs for an industrial farm on hundreds of acres.

Of course, this initial investment wasn't our only business expense. It doesn't include certain necessities, such as a reliable delivery vehicle, land rental or

purchase fees, or utilities. As you can see from the pie chart above, 19 percent of our annual budget is allocated to paying back our loan. The largest portion (33 percent) goes toward paying our two full-time employees.

After those two large cuts, we spend the remaining 48 percent of our budget on utilities, insurance, fuel, seeds, soil inputs, packing and promotional materials, and other miscellaneous necessities. All in all, last year's production expenses added up to \$98,914.

This may sound intimidating, but before you back out, know that our revenue last year was \$154,386, for a net income of \$55,472. My wife and I have been able to support our four-person family with that level of income—plus, we're our own bosses, live a life that's connected to the Earth and the food we produce, eat really fresh, healthy fare, *and* have winters off. We're not getting rich, but we believe our work is honorable, and we're living the life we set out to create. 🌱

Jean-Martin Fortier is a broadfork-wielding market farmer from Quebec, and the award-winning author of *The Market Gardener*. He is featured in the upcoming documentary *The Market Gardener's Toolkit*, which will premiere in May 2016. Watch the trailer at [www.PossibleMedia.org/MarketGardener](http://www.PossibleMedia.org/MarketGardener).



The author's heated greenhouse is dedicated entirely to trellised tomatoes, a profitable crop.



# The Most Important SELF-RELIANCE SKILL EVER

Put into practice these six habits to master the true make-or-break homesteading skill: getting the right work done, the right way.

By Steve Maxwell

**I**n October of 1986, I cut through a tumbledown wire fence and drove my old pickup truck onto the rural property I'd just bought with my life savings. I was a 23-year-old dreamer, with a desire to live in the country by the labor of my own hands. I'm now living that dream and thriving on that same property along with my wife, Mary, and our five children. We built our own house, and

we enjoy food, fuel and beauty from our land. We're blessed to see the next generation setting up their own self-reliant homestead on our family acreage.

Few other dreamers I've known have managed to fulfill their ambitions. In my experience, most dreams don't die because of a lack of passion or practical homesteading skills, but instead become casualties of the failure to get enough of the right kind of work done. Bills pile up, gardens don't get planted, roofs continue to leak, enthu-

siasm wanes. The cause of these problems often goes unrecognized until passion is cold, relationships frazzled and finances exhausted. Knowing how to work efficiently on a homestead where you are your own boss requires a specific skill set that contrasts sharply with the skills needed to work a traditional office job. I've worked for wages and now I work from home on my own land, and the two experiences are entirely different. If your goal is to be in charge of your own successful modern

The author's family hand-built this handsome home on their rural Ontario acreage.







**Steve and Mary Maxwell started out small in 1986 as self-reliant dreamers—with big goals.**

homestead, you must learn *how* to work, which is just as important as learning practical skills. Put into practice the following six homesteading habits to help you get the right work done in the right way, and you'll bring the satisfaction of self-reliant living one big step closer.

## ① Set Guiding Principles

A homesteader without goals is like a ship without a rudder. You may be sailing,

but you won't end up where you want to go. You need to decide at the outset what kind of lifestyle you want. For us, it came down to three main guiding principles: Earn all family income without leaving the property, raise our kids with us at home, and provide for as many of our basic needs as possible from our own land and labor.

Determine your own principles, and let them be the rudder that guides your voyage toward self-sufficiency. Use them to

set long-term goals, broken down by year and month—being specific will help you figure out what you need to accomplish each day in order to achieve those goals and live in line with your principles.

## ② Follow a Disciplined Schedule with Rest

No boss, no outside schedules, no imposed deadlines—these are some of the attractions of working from home, but they're also likely to contribute to failure. Not having a boss means your success will depend almost entirely on how well you determine what must get done. When setting your own schedule without imposed deadlines, you'll thrive only if you fill your day with productive activities. Self-reliant living is really about responsibility.

So why bother with self-reliance if it doesn't get you out of work? The satisfaction of gaining directly from your own efforts is one reason. This connection between productivity and benefit is one of the things I like most about my modern homestead. Plus, completing many of the wide variety of homestead tasks alongside

## A Day in the Life

My day starts at about 7 a.m., when I either work on digital projects or hands-on jobs, such as fixing machinery, tending cattle and fences, or working in the garden. My wife, Mary, is a full-time homemaker. She has lunch ready for the family at noon, and then I go back to work until 6 p.m. For a while, I spent my afternoons cutting and splitting firewood, before helping my son build his own house for him and his wife. The children handle cleaning up after supper, so Mary and I are free to walk with our dog along a forest trail for a couple of miles. It's quite a treat to hear whippoorwills sing while a full moon rises through the trees. As I write this article, my to-do list includes putting the garden to bed; completing a promotional video and website for a local marina; helping one of my sons finish a simple, portable chicken coop he's building; picking some apples for Mary to use for a pie bee that she's participating in with friends of hers; extending the watering system on our cattle pasture; and working on my websites with my digital assistants, Mike and Kristena, who live 400 miles away.

This is the general pattern of our day-to-day work for six days a week. Beyond the essential chores, we don't work on Sundays. The variety of a homestead workweek makes it so much nicer



**Steve shows his son Jake how to properly use a lathe in his on-farm workshop.**

than hourly paid work, at least for me. I look forward to Mondays just as much as I do Fridays, and I'm excited to get out of bed each day. Our carbon footprint is smaller than it would be otherwise, because we don't travel for work, we heat with wood, and we make, reuse and repair a lot of what we need. This isn't the life for everyone, but it certainly is for us.





**Robert Maxwell (above) learned from his father, Steve (right), that having the proper tools and the dedication to get work done are vital to keeping their tractor running and their gardens mulched.**

family and friends makes work more like serious play.

Day-to-day living on a successful modern homestead starts with a schedule that includes eight hours of constructive work each day. You'll probably want to work longer, because your work will be fulfilling. But all work and no play isn't sustainable either. The older I get, the more I value setting aside a day of rest. We work hard for six days, and then relax and enjoy the fruits of our labors on the seventh day.

### 3 Do the Right Work

Today, we have easy, unprecedented access via the Internet to the information

needed to create a thriving homestead lifestyle. You can pick up almost any self-reliance skill imaginable, learn how to work from home, and establish international connections with like-minded folks online, which makes the Internet an invaluable tool for the modern homesteader. You'll need many more tools, of course, but the Internet is crucial—I'm sure our homestead life would never have succeeded without it.

All that said, even essential how-to information is wasted if it's not applied to the tasks that matter most. That's why you must prioritize where you invest your efforts. The best way to do so, I've

found, is to make—and use!—lists. In the evening, write down everything that needs doing the next day based on your predetermined goals for the following week and month.

Don't let personal preference for certain jobs delay you from tackling what you know should be high-priority items, and don't worry about items on the list you aren't getting to yet. Just be sure you get to them later, after you've handled the immediate to-dos.

### 4 Work the Right Way

Having the proper tools to work efficiently will make a huge difference.

## Making Ends Meet

When my wife and I began in the mid-1980s, our plan was to work from home by building furniture and running a pick-your-own berry farm. That began to change when my interest in writing led to my first published article in 1988. Today, I earn most of my income from creating articles, blog posts and videos about woodworking, construction and power tools. I do business from the shop and studio I built on our property. We still grow berries and work with wood, but it's usually for our own use, with cash coming in mostly from digital projects.

What will you do to make ends meet on your homestead? Whatever it is, make it an extension of your interests and aptitudes, and include the Internet as part of the mix. The Internet can enhance any business, and few rural areas have the population to support small businesses that don't also have a digital outlet.

Farmer friends of mine are using the Internet to market their high-quality beef to urban markets. A young mother I know makes exquisite chocolates in the commercial-grade kitchen she set up in her country home, and then sells her confections online to consumers across the continent. Living in a remote geographic location often creates a big challenge for rural homesteaders trying to earn money at home, and the Internet helps remove that barrier.



**Joseph Maxwell shows off a bountiful raspberry harvest from when the family sold commercially.**

STEVE MAXWELL (2); TOP RIGHT: JOSEPH MAXWELL





Setting goals—and meeting them—are the keys to turning a stand of young trees into a thriving orchard and a passel of piglets into plenty of pork.

Doing work in the right way means equipping yourself the way a professional would, not as a hobbyist would. You probably won't be able to buy professional-grade tools and gear right away, but work toward it.

You can also buy or rent equipment to share with a group, hire your neighbor who owns a tractor to till your garden, barter labor for a side of beef, or trade work for the opportunity to borrow a wood splitter until you can build your own collection of equipment. Aim to become not a jack-of-all-trades, but a well-equipped master of most self-reliance skills. It's a long-term goal that will set you up for lasting prosperity.

## 5 Carry a Notepad

Pound for pound, my notepad and pen are the most valuable physical tools I own. They're always with me to catch the little thoughts that waft through my head throughout the day: "Buy 5 pounds of 4-inch deck screws," "Call Rob about shingle order," "Take photo of spiders in pasture for blog," "Harvest garlic." This habit prevents me from letting tasks that need doing escape my memory, neglecting details, and wasting trips to town by forgetting to buy all the items I need.

Whether you use a smartphone, tablet, or simple paper pad, as I do, recording crucial details that come up during each workday will be vital because it will ultimately boost efficiency.

## 6 Work Efficiently and Avoid Distractions

An old-timer I know tells a story of how things used to be in the countryside where he grew up during the 1930s: "We were dirt-poor, but everyone managed to keep their barns repaired and houses painted. Nowadays, people sit inside watching satellite TV or YouTube while their places fall apart around their ears."

The most spectacular homesteading failures I've seen all involve people who talk a lot and move slowly. While the Internet is an essential homesteading tool, it's also full of distractions that turn people into spectators and consumers rather than participants and producers. No responsible boss would allow you to watch television, play games or socialize online while you're on the clock. What you might not realize is that, when working from home, your homestead can actually fire you. When your garden doesn't get tilled in time and your woodpile is too small come November, the homestead will hand you a pink slip—and it will be at least as shocking as the regular kind. You're free to indulge in these distractions during the workday, but they could cost you your dreams of a self-reliant, hands-on life. They probably will.

Simply moving quickly as you walk around and perform tasks can significantly add to your productivity. Don't run about frantically, but rather work efficiently and be deliberate and focused. After picking up the pace becomes a

habit, productive work will become the new normal—and you'll thrive.

Learning the practical nuts and bolts of hands-on living is vital, and just as imperative is mastering the six homesteading habits detailed here, which will keep you working efficiently and effectively. In my experience, *how* you work will be the most critical part of making your dreams of successful self-reliant living your reality. 🌳



Steve Maxwell, shown here with his handy pen and notepad, is a self-dubbed "backwoods peasant" who connects digitally with a worldwide audience to share his homesteading and DIY expertise. He lives with his family on Manitoulin Island, Ontario. Follow him at [www.SteveMaxwell.ca](http://www.SteveMaxwell.ca).





# Lessons from OFF-GRID LIVING

Follow this advice from a  
20-year veteran homesteader to  
shift to a low-carbon lifestyle.

By Cam Mather

**B**oth idealistic and practical reasons led my wife, Michelle, and me to choose off-grid living 20 years ago. After a five-year search for rural property, we found 150 acres in the woods of eastern Ontario and struck out in 1998 to build our farm and homestead.

We suffered major sticker shock when our local utility quoted us \$100,000 to connect to the electricity grid. Today, we'd be looking at closer to \$200,000 to connect. Especially with today's lower prices for renewable energy and advancements in technology, if I were starting over, I'd still happily make the choice to go off-grid.

## Untethered Solar Power

When Michelle and I purchased our 1888 farmhouse, it was powered by eight 60-watt solar panels. We added four 75-watt panels, which were \$750 each, or \$10 per watt. The following year, we replaced our propane fridge with an electric model and added another four panels. (Today, those panels would cost us one-tenth of what we paid, because the cost has plummeted to about \$1 per watt!) My neighbor helped me build and weld my own solar tracker, which allows our solar array to follow the trajectory of the sun across the sky. While solar trackers aren't necessary, they've increased the energy output of our system by about 20 percent.

Several years later, we were offered four 175-watt panels at an excellent price, so I went to work building another solar tracker. For each solar panel we add to our array, life gets noticeably easier because we can use appliances that might have been too energy-intensive for our previous setup. Each addition also allows us to reduce our reliance on propane, which supplements our energy for cooking and heating water. Our arrays now hold 2,300 watts' worth of solar panels, which is more than sufficient to run a

ALL PHOTOS: CAM AND MICHELLE MATHER





The Mathers power their 150-acre homestead (opposite) with diverse renewable energy sources, including solar panels and wood they cut on site.

refrigerator, a freezer, two laptop computers, an LCD television and DVD player, satellite TV and Internet, a washing machine, and a kitchen fully stocked with appliances. We get by without air conditioning, which would be a major energy hog. (See “Daily Energy Consumption on the Mather Homestead,” below, for a breakdown of our appliances’ energy use.)

**Lesson: Purchase additional solar panels as soon as you can afford them.** In hindsight, I wish we’d had the money to purchase more photovoltaic panels sooner. Each additional solar panel has made off-grid living more comfortable—ah, the simple joy of a toaster!—and has given us more confidence to use less propane and more solar-powered electricity for our cooking and baking.

## Our Battery Storage

You can install grid-tied solar panels without batteries, but to be off-grid, you’ll need batteries to store power for use at night. We replaced our system’s existing nickel-cadmium battery bank that was at the end of its life with \$4,000 worth of large, deep-cycle, lead-acid batteries. The batteries are the only part of our electrical system that requires regular attention. I monitor the batteries’ state of charge and periodically add distilled water to them. You’ll need to ensure that your batteries never fall below 50 percent of their charge. Never paying an electricity bill or experiencing a power outage is more than enough compensation for the time I spend to maintain our batteries.

**Lesson: Don’t undersize battery banks in off-grid installations.** With today’s low PV panel prices, strive to oversize both your solar array and your battery bank. You’ll worry less about maintaining your electrical system, and you’ll run your generator less often.

## Daily Energy Consumption on the Mather Homestead

Our total daily energy consumption is 5,025 watt-hours, or about 5 kilowatt-hours. Compare this with the average U.S. home’s 30 kilowatt-hours per day. We have enough battery storage capacity to run our household for approximately three days if no sun or wind can power our systems.

Refrigerator .....	1,000 watt-hours
Freezer .....	1,000 watt-hours
Lights .....	500 watt-hours
Washing machine .....	1,000 watt-hours (4 loads per week)
Water pump .....	250 watt-hours (1,000 watts for 1/4 hr)
Two laptops .....	560 watt-hours (20 watts each for 14 hrs)
Satellite Internet dish ....	280 watt-hours (20 watts for 14 hrs)
Radio .....	105 watt-hours (15 watts for 7 hrs)
Television .....	330 watt-hours (110 watts for 3 hrs)

## Wind Complements Solar

When we moved here, a broken wind turbine on a 60-foot tower sat on the property. (Turbines are mechanical entities that operate in extremely unforgiving conditions and, therefore, have a tendency to break.) I ultimately replaced the unit with a 1-kilowatt Bergey wind turbine on a 100-foot tilt-up tower. That was a huge undertaking for me, but I couldn’t find a dealer willing to do the installation. The effort to install and maintain the turbine has proved worthwhile, however, because wind picks up the slack when solar conditions aren’t ideal.

**Lesson: Diversify your energy sources.** Renewable energy sources can complement each other. Before we erected our wind turbine, we ran our backup propane generator 12 to 15 times per year. By investing in a hybrid solar/wind system, we’ve reduced the frequency of our generator use to just five or six times each year, mostly during the dark days of fall and early winter, when there is neither enough sun nor wind to keep our batteries charged.

**Lesson: Consider wind turbine siting.** To get the most out of a wind turbine, try to locate it in an open area or near a body of water. Ideally, your wind turbine should be 300 feet from barns, silos and tree lines, and at least 30 feet taller than objects that may cause turbulence. Our tree line is about 60 feet tall, our tower is 100 feet high, and we are surrounded by a forest, so while we don’t have the ideal setting, our wind power output is satisfactory, especially during November and December (our cloudiest, windiest months).

**Lesson: Plan for surprises and prepare for emergencies.** We went to great lengths to carefully ground and protect our wind turbine and tower from lightning, but despite



our efforts, a bolt struck them in the summer of 2013. The broken DC rectifier was relatively inexpensive to replace, but we did have to lower the tower, which was a stressful experience. The takeaway? You'll be faced with emergencies, but a diversified mix of energy sources will create a more secure off-grid setup that can weather any crisis.

## Sustainable Wood Heat

Conventional grid-tied homes using fossil fuels produce about 60 percent of their carbon emissions from heating. In contrast, we heat our home with a highly efficient Pacific Energy non-catalytic woodstove and cut all of our firewood on our land. Heating with wood from our well-managed woodlot is carbon-neutral, because new growth will recapture the amount of carbon released from the trees we cut.

**Lesson: Choose electric tools and power them with renewable energy.** I cut more than half of our firewood with a corded electric Yardworks chainsaw run on renewable energy. To further reduce our use of gasoline, I acquired an Oregon 40-volt, battery-powered chainsaw to cut trees in the bush. I then pull the logs back to the house, where I buck the lengths into firewood with my corded chainsaw. In my younger days, I split all of our wood with an axe, but last year I purchased a Yardworks 4-ton electric log splitter, and I continue to be amazed by what it can split, as many typical gas-powered models are 28-ton. Electric equipment is rugged: I used my electric Poulan chainsaw for a decade and only replaced it when a newer model had some features I wanted to try.

## Multiple Methods to Heat Water

Five years ago, we added a solar hot water heater. I welded the system's frame, which sits on the roof of our back porch, and I



From top: Cam commutes on an electric bike, stores potatoes in sand for winter, and displays produce for his 50-member CSA.

did the plumbing myself. Tapping the sun's energy to heat water is much more efficient than using it to generate electricity. We have two tanks for hot water: a 60-gallon tank for the solar hot water heater and a 40-gallon tank for a diversion load from our solar electric system. During sunny periods when I know my batteries are fully charged, I can manually divert excess electricity to the heating element in the hot water tank by throwing a switch (which I turn off as the sun starts to go down). Six to eight hours of full sunlight will usually heat both tanks. Feeling how hot our water is after a sunny day is magical.

**Lesson: Vary the ways you heat water.** About 60 percent of our hot water comes from our solar hot water system. During cloudy days in late fall and early winter, neither of our systems produces enough hot water for us, so we rely on our woodstove. We always have large kettles of water on the woodstove to keep about 10 gallons of hot water on demand. During winter, we fill large stockpots with water for baths and heat the pots on our woodstove. We bathe in a cast-iron claw-foot tub that absorbs the water's heat and radiates it back into the bathroom throughout the night.

## Smart Food Storage

We eventually worked up the nerve to purchase a freezer to store some of the bounty from our garden. We've reduced the freezer's run time by putting it in our unheated basement, which stays at about 32 degrees Fahrenheit during winter. We've mastered growing vegetables that store well, such as carrots, onions, potatoes, squash and sweet potatoes. During summer, we run a community-sup-

ported agriculture (CSA) program and supply 50 families with a weekly box of vegetables from our garden.

**Lesson: Upgrade to energy-efficient appliances.** Thanks to improved energy-efficiency standards, a large modern fridge is much



You can enjoy a more  
secure and sustainable, off-  
grid lifestyle for less cost  
and hassle than ever before.

more efficient than a small older unit, so we upgraded to a new model.

**Lesson: Build a root cellar for electricity-free food storage.** We have a cistern below our kitchen, which we use as a root cellar. The cistern is cool but never freezes, and it has a high level of humidity, which is optimal for storing our garden vegetables. We put up a significant portion of staple crops this way and continue to experiment to find vegetable varieties that keep well.

## Well Water and Water Pumps

We supplement water from our 50-foot-deep drilled well with water from a shallower dug well near our main garden. We use a small, solar-powered DC pump to fill up rain barrels. The solar pump also runs a drip irrigation system that we move throughout the gardens as needed.

**Lesson: Pump your water in large batches.** Pumping water requires a lot of power, and the biggest surge occurs when the pump first clicks on, so filling two water tanks at a time makes sense. Our cistern contains two 30-gallon water tanks that are pressurized by the deep-well pump in our drilled well.

## Carbon-Free Transportation

When folks move to an off-grid, rural homestead, they often end up burning a lot of fossil fuels (and spending a lot of money) driving to and from town in an inefficient farm truck. You may want to ride a bicycle, but time, long distances, consider-

able physical strain, and the amount of cargo you'll need to haul will be limiting factors. Electric cars are becoming more available, but they're still quite expensive.

**Lesson: Go electric on two wheels.**

We have an electric bicycle with a lithium battery that charges in about three hours when connected to solar power. This marvelous machine allows me to ride the 8 miles to town without having to pedal the entire way. While I can't haul loads that weigh more than about 50 pounds, I've made many trips with a good amount in tow.

Today, off-grid living is no longer a huge ordeal. We've had many challenges over our 20 years, but times have changed—technology is better and more affordable, and you can easily find information to master whatever off-grid skills you need. Size your energy systems properly and be mindful of checking your batteries regularly, and you can say goodbye to increasing utility bills and frequent blackouts that accompany extreme weather events. You, too, can enjoy a more secure and sustainable, grid-free lifestyle. 🌳

Cam Mather homesteads on 150 wooded acres in Ontario, where he and his wife, Michelle, run a 50-member CSA program and a publishing business, all powered by sun and wind. *Little House Off the Grid* is available online at [www.MotherEarthNews.com/Store](http://www.MotherEarthNews.com/Store).

Cam and Michelle Mather maintain an impressive organic food garden that they eat from year-round.





# Start a Self-Sufficient, 1-ACRE HOMESTEAD

Live off the land with these strategies for establishing self-sufficient food production, including advice on crop rotations and raising livestock.

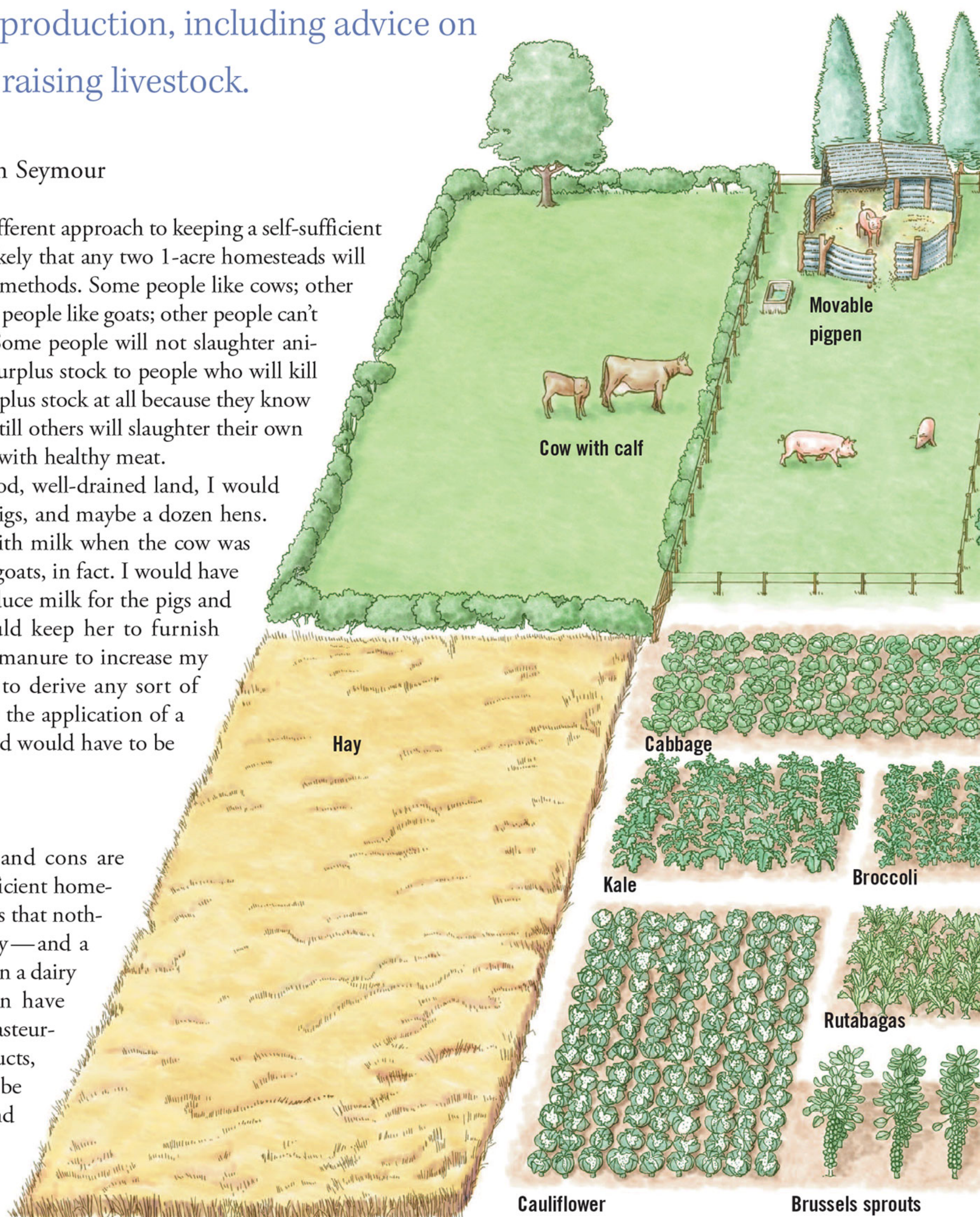
By John Seymour

Each person will have a different approach to keeping a self-sufficient homestead, and it's unlikely that any two 1-acre homesteads will follow the same plan or methods. Some people like cows; other people are afraid of them. Some people like goats; other people can't keep them out of the garden. Some people will not slaughter animals and have to sell off their surplus stock to people who will kill them; others will not sell off surplus stock at all because they know the animals will be killed; and still others will slaughter their own animals to provide their family with healthy meat.

For myself, on an acre of good, well-drained land, I would keep a cow and a goat, a few pigs, and maybe a dozen hens. The goat would provide me with milk when the cow was dry. I might keep two or more goats, in fact. I would have the dairy cow (a Jersey) to produce milk for the pigs and me. More importantly, I would keep her to furnish heaps and heaps of lovely cow manure to increase my soil fertility, because in order to derive any sort of living from that 1 acre without the application of a lot of artificial fertilizer, the land would have to be heavily manured.

## Raising a Dairy Cow

Cow or no cow? The pros and cons are many and various for a self-sufficient homestead. In favor of raising a cow is that nothing keeps the health of a family—and a farm—at a high level better than a dairy cow. If you and your children have ample high-quality, fresh, unpasteurized, unadulterated dairy products, you will be well-positioned to be a healthy family. If your pigs and poultry get their share of the milk byproducts—especially whey—they will likely be healthy, too. If your garden

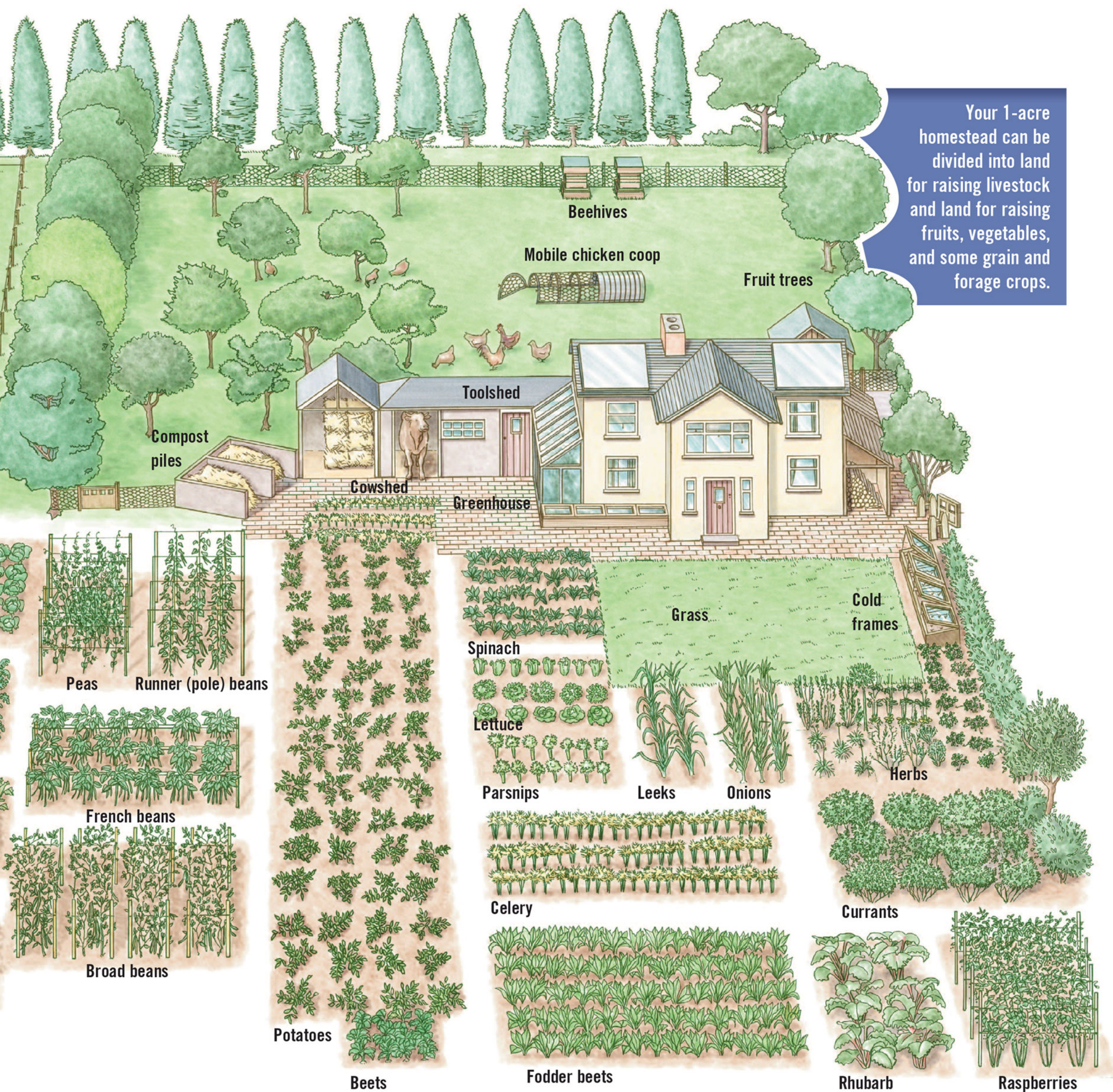




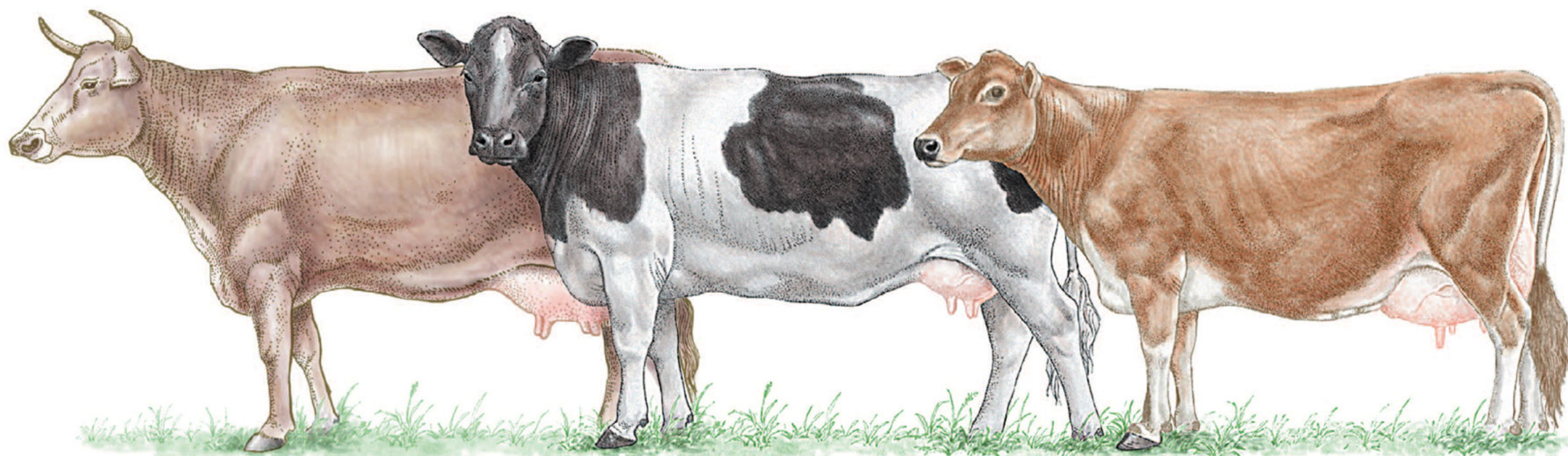
gets plenty of cow manure, your soil fertility will continuously increase, along with your yields.

On the other hand, the food you buy for this family cow will cost you hundreds of dollars each year. Compared with how much money you would spend on dairy products in a year's time, the fresh milk supply from the cow plus the increased value of the eggs, poultry and pig meat that you will get—along with your ever-growing soil fertility—will make a family cow a worthwhile investment. A serious counter-consideration, however, is that you will have to take on the responsibility of

milking a cow. (Read “Keep a Family Cow” at <http://goo.gl/cwU6JQ> for different milking plans and estimated savings.) Milking a cow doesn't take very long (perhaps 15 minutes). It's very pleasant if you know how to do it and if she is a quiet, docile cow—but you will have to do it. Buying a dairy cow is a big step, and you shouldn't pursue it unless you don't intend to go away very much, or unless you can make arrangements for someone else to take over milking duties while you're gone. So let's plan our 1-acre farm on the assumption that we are going to keep a dairy cow.







A dairy cow can supply milk, cream, butter, yogurt, cheese and whey, plus lots of manure to build soil fertility.

## 1-Acre Farm With a Family Cow

Half of your land would be put down to grass, leaving half an acre arable (not allowing for the land on which the house and other buildings stand). The grass half could remain permanent pasture and never be plowed up at all, or you could plan crop rotations by plowing it up, say, every four years. If you do the latter, it's best done in strips of a quarter of the half-acre, so that each year you're planting a grass, clover and herb mixture on an eighth of your acre of land. This crop rotation will result in some freshly sown pasture every year, some 2-year-old field, some 3-year-old field and some 4-year-old field, culminating in more productive land.

Smart crop rotations and proper grazing management will build richer soil.

## Grazing Management

At the first sign the grass patch is suffering from overgrazing, take away the cow. The point of strip-grazing (also called intensive rotational grazing) is that grass grows better and produces more if it's allowed to grow for as long as possible before being grazed or cut all the way down, and then allowed to rest again. In such intensive husbandry as we are envisaging for this self-sufficient homestead, careful grazing management will be essential.

Tether-grazing on such a small area may work better than using electric fencing. A little Jersey cow quickly gets used

to being tethered and this was, indeed, the system that the breed was developed for on the island of Jersey (where they were first bred). I so unequivocally recommend a Jersey cow to the 1-acre farmer because I am convinced that, for this purpose, she is without peer. Your half-acre of grass, when established, should provide your cow with nearly all of the food she needs for the summer months. You are unlikely to

get any hay from the half-acre, but if the grass grows faster than the cow can eat it, then you could cut some of it for hay.

## Half-Acre Crop Rotation

The remaining half of your homestead—the arable half—would be farmed as a highly intensive garden. It would be divided, ideally, into four plots around which all of the annual

crops that you want to cultivate follow each other in a strict crop rotation.

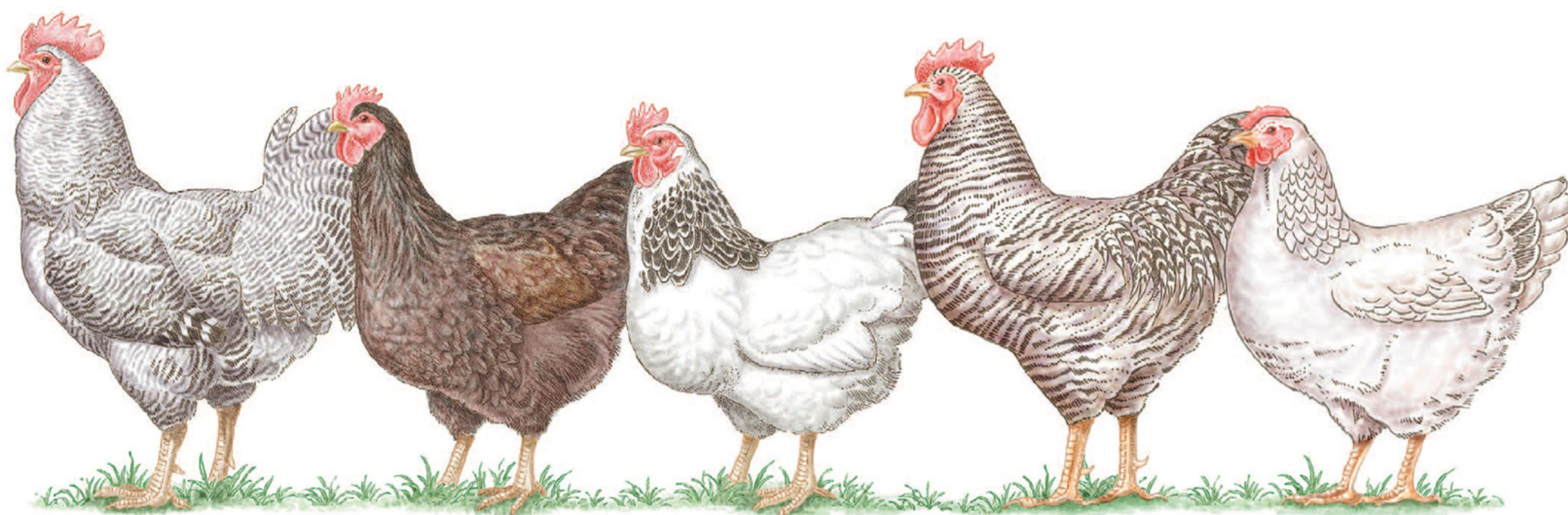
An ideal crop rotation may go something like this:

- Grass (for four years)
- Plot 1: Potatoes
- Plot 2: Legumes (pea and bean family)
- Plot 3: Brassicas (cabbage family)
- Plot 4: Root vegetables (carrots, beets and so on)
- Grass again (for four years)

Go the creative route by crafting your own chicken coop. This ark can be made out of used fertilizer bags for nearly nothing.







Multipurpose chickens for eggs, meat, manure and pest control are the top livestock choice on most homesteads.

With this kind of crop rotation, every year a quarter of your arable land will be a newly plowed, 4-year-old field, complete with intensely fertile soil because of the stored-up fertility of all the grass, clover and herbs that have just been plowed in to rot with four summers' worth of cow manure. Because your cow will be in-wintered on bought-in hay and she will be treading and dunging on bought-in straw, you will have an enormous quantity of marvelous muck and cow manure to put on your arable land.

All the crop residues that you cannot consume will help feed the cow, pigs or poultry, and I would be surprised if, after following this crop rotation and grazing management plan for a few years, you didn't find that your acre of land had increased enormously in soil fertility, and that it was producing more food for humans than many a 10-acre farm run on ordinary commercial lines.

Heavily manured,  
intensively planted garden  
beds will produce more per  
acre than most larger farms.

## Livestock Tips for the Self-Sufficient Homestead

A **dairy cow** won't be able to stay outdoors all year. She would horribly overgraze such a small acreage. She should spend most of the winter indoors, only being turned out during the daytime in dry weather to get a little exercise and fresh air.

Cows don't really benefit from being out in winter weather. Your cow would be better, for the most part, if kept inside, where she would make lovely manure while feeding on the crops you grew for her in the garden. You would let her out in summer, night and day, for as long as you find the pasture is not being overgrazed. You would probably notice that your cow doesn't need hay at

all during summer, but she would be entirely dependent on it throughout winter, and you could plan on having to buy her at least a ton. If you wanted to rear her yearly calf until he

## Intensive Gardening

Some might complain that having half of their acre down to grass confines gardening activities to a mere half-acre. But actually, half an acre is quite a lot, and if you garden it well, it will grow more food for you than if you were to "scratch" over a whole acre.

Being under grass (and grazed and dunged) for half of its life will enormously increase the half-acre's soil fertility. I think you will actually grow more vegetables on this plot than you would on a whole acre if you had no cow or grass break.

Dry your homegrown wheat  
on simple tripods  
assembled from  
wooden poles.







Omnivorous pigs will eat almost anything, and they can convert your surplus crops into delicious meat and valuable compost.

reached some value, you would likely need a further half-ton of hay. I have kept my cow on deep litter: The layer of straw gets turned into good compost, and I add more clean straw every day. I have milked a cow this way for years, and the perfect milk made good butter and cheese, and the milk stored well. Although more labor-intensive, you could instead keep your cow on a concrete floor (insulated if possible) and give her a good bed of straw every day. You would remove the soiled straw daily and carefully pile it into a muck heap that would be your fount of fertility for everything on your acre.

**Pigs** would have to be confined in a house for at least part of the year (and you would need to provide straw for them), because, on a 1-acre farm, you are unlikely to have enough fresh land to keep them healthy. The best option would be a movable house with a strong movable fence outside of it, but you could also opt for a permanent pigpen.

The pigs would have a lot of outdoor work to do. They would spend part of their time plowing up your eighth of an acre of grassland, and they could run over your cultivated land after you have harvested your crops. They could only do this if you had time to let them do it, as sometimes you would be in too much of a hurry to get the next crop in. As for food, you would have to buy some wheat, barley or corn. This, supplemented with the skim milk and whey you would get from your dairy cow, plus a share of the garden produce and such specially grown fodder crops as you could spare the land for, would keep them excellently.

If you could find a neighbor who would let you use a boar, I recommend that you keep a sow and breed her. She could give you 20 piglets a year, two or three of which you could keep to fatten for your bacon and ham supply. The rest you could sell as weanlings (piglets 8 to 12 weeks old), and they would probably bring in enough money to pay for the food you had to buy for all of your other livestock. If you could not get the service of a boar, you could always buy weanlings yourself—just enough for your own use—and fatten them.

**Poultry** could be kept in a permanent house in one corner of your garden, or, preferably, in mobile coops on the land, so they could be moved over the grassland to improve soil fertility with their scratching and dunging. I would not

recommend keeping very many birds—just a dozen hens should give you enough eggs for a small family, with a few to occasionally sell or give away in summertime. You would have to buy a little grain for them, and in winter some protein supplement, unless you could grow enough beans. You could try growing sunflowers, buckwheat or other food especially for your poultry.

**Goats**, if kept instead of a dairy cow (or in addition to), could be managed in much the same way, although you would

not have as much whey and skim milk to rear pigs and poultry on, and you would not build up the fertility of your land as quickly as you could with a cow. You would only get a fraction of the manure from goats, but on the other hand, you wouldn't have to buy nearly as much hay and straw—perhaps none at all. For a farmer wanting to have a completely self-sufficient homestead on 1 acre, dairy goats are a good option.

**Crops** would be all the ordinary garden crops (fruits and vegetables), plus as much land as you could spare for fodder crops for animals. Bear in mind that practically any garden crop you grew for yourself would be good food for your livestock as well, so any surplus crops could go to them. You would not need a compost pile—your animals could be your compost pile.

Half an acre, farmed as a garden and with wheat grown on the other half-acre, is worth a try even if you kept no animals at all, or maybe only some poultry. You would then practice a crop rotation as described earlier, but substitute wheat for the grass and clover field. If you are a vegetarian, this may be quite a good solution, though you could not hope to increase the soil fertility—and therefore the productiveness—of your land as much as you could with animals. 🌱

Just a dozen hens  
will lay enough eggs  
for you to eat, plus  
a few extra to sell.

This article is an excerpt from *The Self-Sufficient Life and How to Live It*, written by the late John Seymour and first published by Dorling Kindersley in Britain in 1976. The book has become a treasured classic for back-to-the-landers and is now available in a beautifully illustrated 400-page edition. You can order a copy of the book at [www.MotherEarthNews.com/Store](http://www.MotherEarthNews.com/Store).





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Free-range poultry scavenge in tall grass or fallen leaves for their meals, and ticks are often on the menu.

# Top Ways to Get RID OF TICKS

Nix ticks from your yard, home and body  
to prevent Lyme and other diseases.

By Barbara Pleasant

About 300,000 people are diagnosed with Lyme disease every year, according to new estimates from the Centers for Disease Control and Prevention (CDC). Lyme disease is caused by bacteria that multiply in bodies of ticks, people and animals, including mice, deer and dogs.

A whopping 95 percent of human Lyme disease cases are concentrated in only 14 states situated throughout the Northeast, Mid-Atlantic and Upper Midwest (see the map on Page 24), but infections have been reported across the country and into Canada. Scientists predict that Lyme disease will continue to spread as climate change causes an increase in the humid summer conditions

and mild fall weather favored by the tiny blacklegged deer tick, which is the most common transmitter of Lyme disease.

These deer ticks pick up Lyme bacteria (*Borrelia burgdorferi*) when they feed on the blood of infected mice, chipmunks and other hosts. Infected ticks in both the nymphal and adult life stages can then transfer the Lyme bacteria to humans if they latch on for a meal and feed for approximately 36 hours or more. Lyme disease is highly treatable when it's detected early, but devastating when



the infection goes unnoticed for more than a few months. An early-generation Lyme disease vaccine is available for dogs, but people must rely on other defensive measures to avoid ticks and the diseases they often carry.

If you're interested in getting a Lyme disease vaccine for your dog, discuss options with your veterinarian and read up on it at <http://goo.gl/WQwYpT>.

## Kill Ticks with Chicks

Leafy wooded areas and grassy meadows are the preferred habitats for black-legged deer ticks and American dog ticks, which both spend their larval stage in leaf litter, their nymphal stage on small animals, and their adult stage in tall grass or other shrubby vegetation.

People who keep free-range poultry have long reported that foraging chickens and guinea fowl will help rid a property of ticks. In April 2015, we launched the MOTHER EARTH NEWS Chickens and Ticks Survey, and the many responses revealed that:

- 71 percent had an existing tick problem before they purchased poultry.
- 78 percent kept poultry that helped control or eliminate ticks within the birds' feeding range.
- 46 percent experienced a drop in tick populations within a month after getting poultry; 45 percent saw good control after several months to a year.

Many respondents noted that small bantam chickens and game hens are able to get into the tight spots where larger birds can't fit, resulting in better overall tick control.

For maximum effectiveness, poultry should be allowed to feed in leaf litter starting in early spring, because that's where ticks and their eggs hide out during winter.

Poultry will eagerly work their way through leaf piles and ground debris when given the opportunity. Poultry also help control other pests, including mosquitoes, grasshoppers and even snakes; see "Poultry Pest Patrol" at <http://goo.gl/D44rRJ> for more information on these winged pest warriors.

## 10 Options for Tick Control

- 1 Raise free-range poultry.
- 2 Maintain wide, mowed walking paths.
- 3 Use herbal insect repellents.
- 4 Install deer fencing around your property.
- 5 Place "tick tubes" strategically.
- 6 Rake up and compost leaf litter in fall.
- 7 Wear protective, light-colored clothing.
- 8 Check your body for ticks after being outside.
- 9 After time outdoors, put clothes in a hot dryer for 15 minutes before washing.
- 10 Wear permethrin-treated clothing.

## Permethrin-Treated Clothes and 'Tick Tubes'

If you live in one of the 14 states where Lyme disease risk is highest—and you spend a lot of time outdoors in tick habitat—you might want to consider using permethrin, a non-organic pesticide that

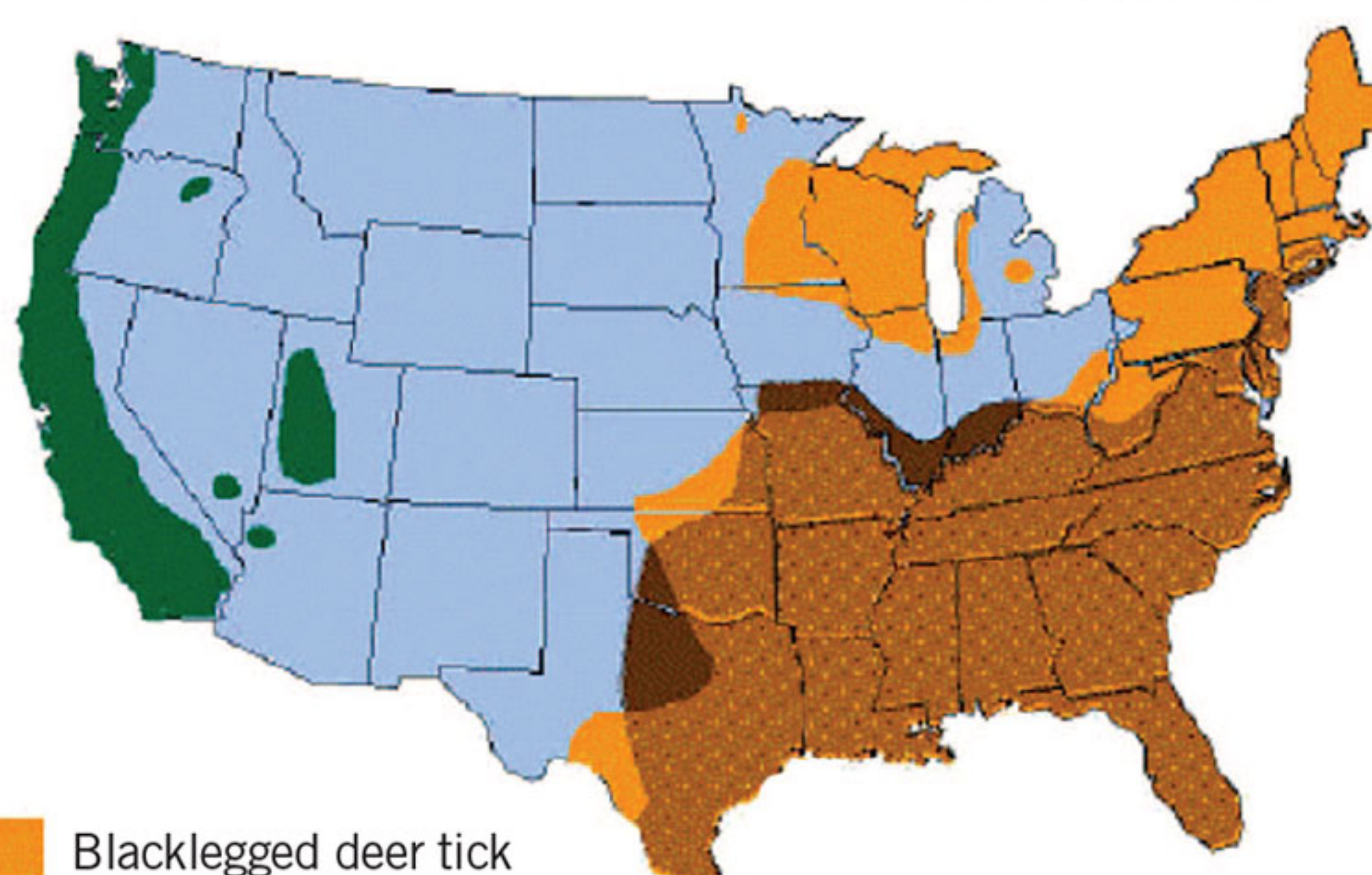
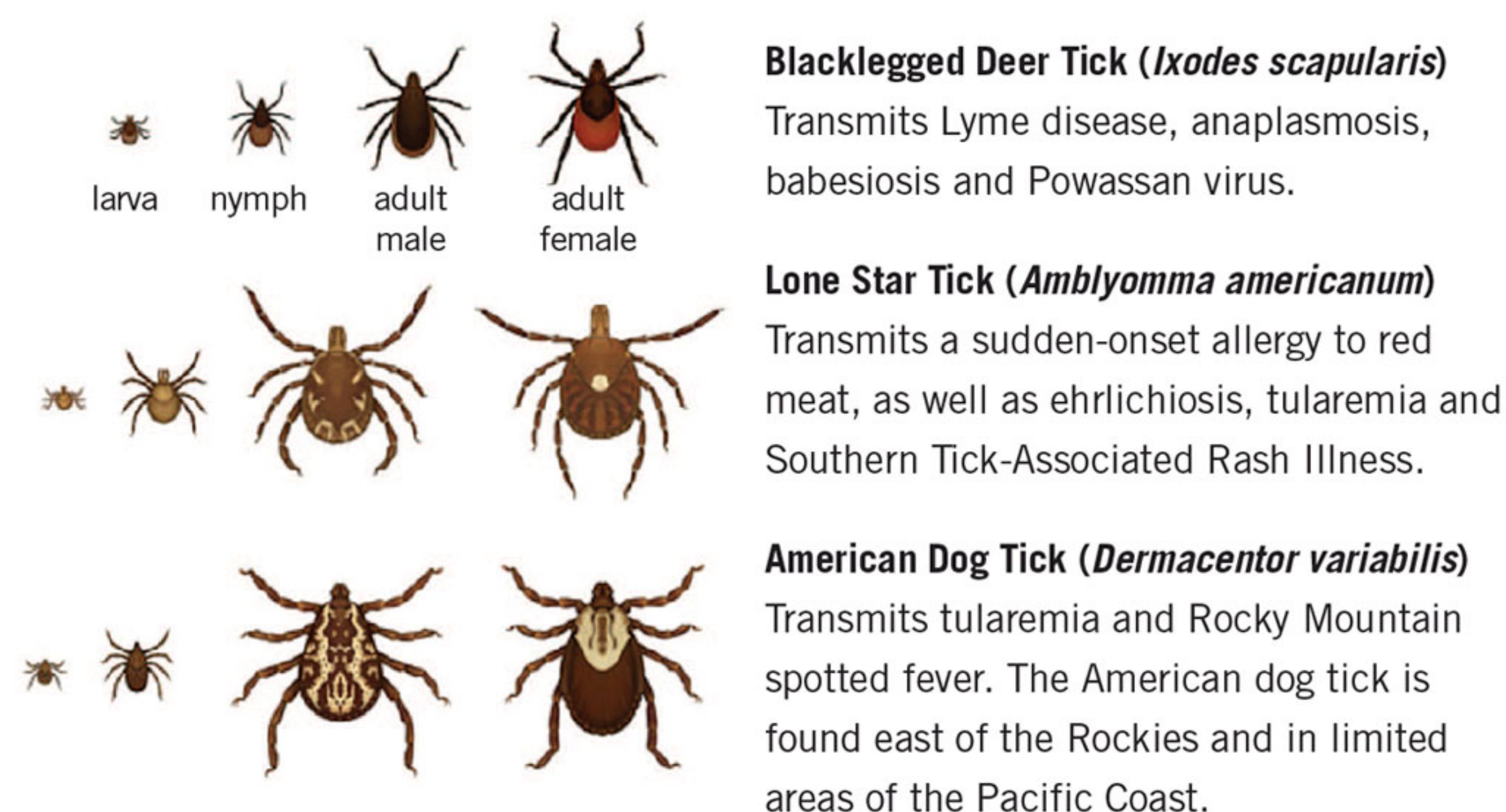
repels and kills ticks. Permethrin is more potent and persistent than the organic materials that we usually recommend.

We suggest using a formula designed to be applied to clothing rather than misters, sprayers, foggers or other permethrin products. Clothing products that are pre-treated with permethrin are available, or you can buy permethrin with instructions for how to use it to treat your clothes. Take care to not expose children to this pesticide, as studies have linked permethrin exposure to autism in children. The EPA also classified permethrin as "likely to be carcinogenic to humans," so carefully weigh the risk of infrequent exposure to the risk of Lyme disease in your area.

You might also consider permethrin-

## Tick Identification Guide

Tick species found nationwide can carry a variety of harmful diseases.



- Blacklegged deer tick
- Western blacklegged tick (also carries Lyme disease)
- Lone Star tick
- Lone Star tick and blacklegged deer tick overlap

## Where They're Located

Ticks are found in every state, though species and population numbers vary with climate.





Maintain well-mowed areas and wide paths to prevent bites from questing ticks.

infused “tick tubes,” which are designed to kill ticks on white-footed mice as well as chipmunks and rats, the main animals from which ticks become infected with Lyme disease. The tick tubes offer nesting materials impregnated with the pesticide to such critters. The animals then take the material back to their nests, where it kills any ticks that may have latched on to the adults and their young. The small amount of permethrin used in tick tubes is not water-soluble, so it’s not likely to end up anywhere but in a nest.

Sold commercially as Damminix Tick Tubes ([www.TickTubes.com](http://www.TickTubes.com)), these devices are easy to make yourself. Wear rubber gloves and saturate cotton balls, strips of cloth, dryer lint or other rodent nesting materials with a permethrin

product made to go on clothing and tents. Then, loosely pack the treated material into pieces of plastic pipe that are about the size of a toilet paper roll, and place them behind logs, in brush piles, or in other locations rodents often visit.

In suburban and urban landscapes, dense ground cover has been found to attract mice, so it’s a good place to put tick tubes.

After mice and other rodents empty the tubes, replace or reload the pipes. This is best done twice a year—once in spring and again in fall.

## Herbal Tick Repellents

Many of our survey respondents reported that they apply veterinary-prescribed tick preventatives on their dogs and cats, but would prefer more

organic repellents. Two plant-based aromatics—sweet-scented “rose” geranium (*Pelargonium graveolens*) essential oil and eastern red cedar (*Juniperus virginiana*; also known as “red cedarwood”) essential oil—were repeatedly recommended by readers who use the essential oils as spray-on repellents for pets and family members alike.

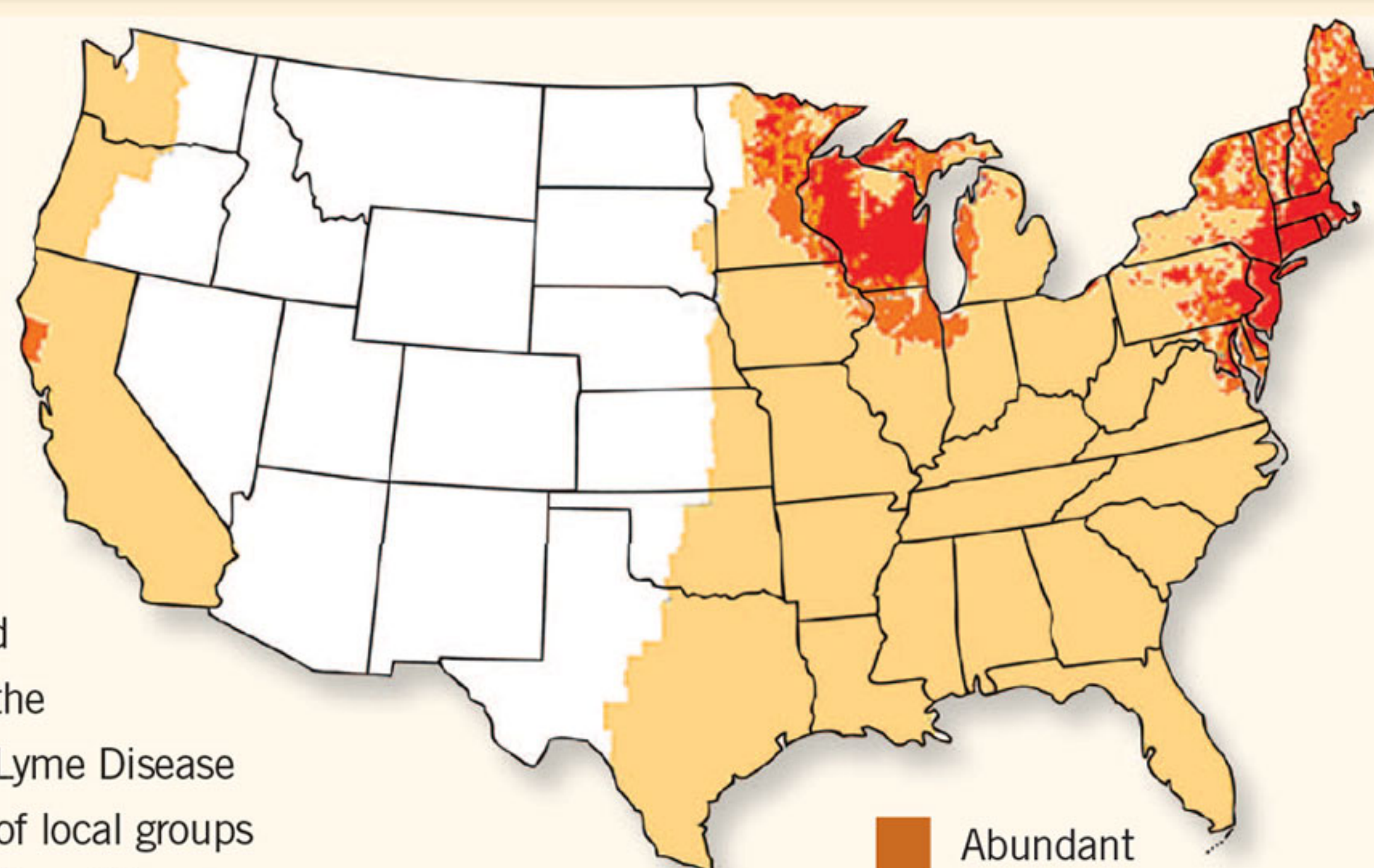
Respondents theorized that these two plant aromatics mask your natural odors, which makes it harder for questing ticks to find you. Both geranium essential oil and eastern red cedar essential oil have proven to be successful repellents against ticks in various life stages, according to the *Journal of Agricultural and Food Chemistry* and the *Journal of Medical Entomology*, respectively.

Using full-strength essential oil can injure human skin and overwhelm pets’ sensitive noses, so follow this simple recipe when making a liquid anti-tick spray: In an 8-ounce spray bottle, combine 10 to 20 drops of rose geranium or eastern red cedar essential oil with 1 teaspoon of vodka or rubbing alcohol. Fill the rest of the bottle with water and shake to combine. The spray can be applied to your skin or clothing. You can spray your dogs’ collars, or spritz the same spots where you would apply other tick preventatives—between the animal’s shoulder blades and at the base of the tail. Before taking your dogs into woods, where they’re likely to pick up

## Lyme Disease Update

A circular bull’s-eye rash around a tick bite is a common indication associated with Lyme disease, but any tick bite that stays red and inflamed should be seen by a doctor who is familiar with Lyme disease. A course of appropriate antibiotics taken within three weeks of infection usually cures it.

When untreated, Lyme disease can become chronic Lyme disease, which causes headaches, body pain, lethargy and other complications. Some patients with chronic Lyme disease respond to antibiotics, while others adapt as well as they can, often with the help of a Lyme-Literate Doctor (LLMD) and support groups. The Lyme Disease Network ([www.LymeNet.org](http://www.LymeNet.org)) hosts a support forum and a listing of local groups by state, and the American Lyme Disease Foundation ([www.ALDF.com](http://www.ALDF.com)) has a number of helpful online resources. Some online support groups follow the protocols outlined by Richard Horowitz, M.D., in his book *Why Can’t I Get Better? Solving the Mystery of Lyme and Chronic Disease* (available on our website).

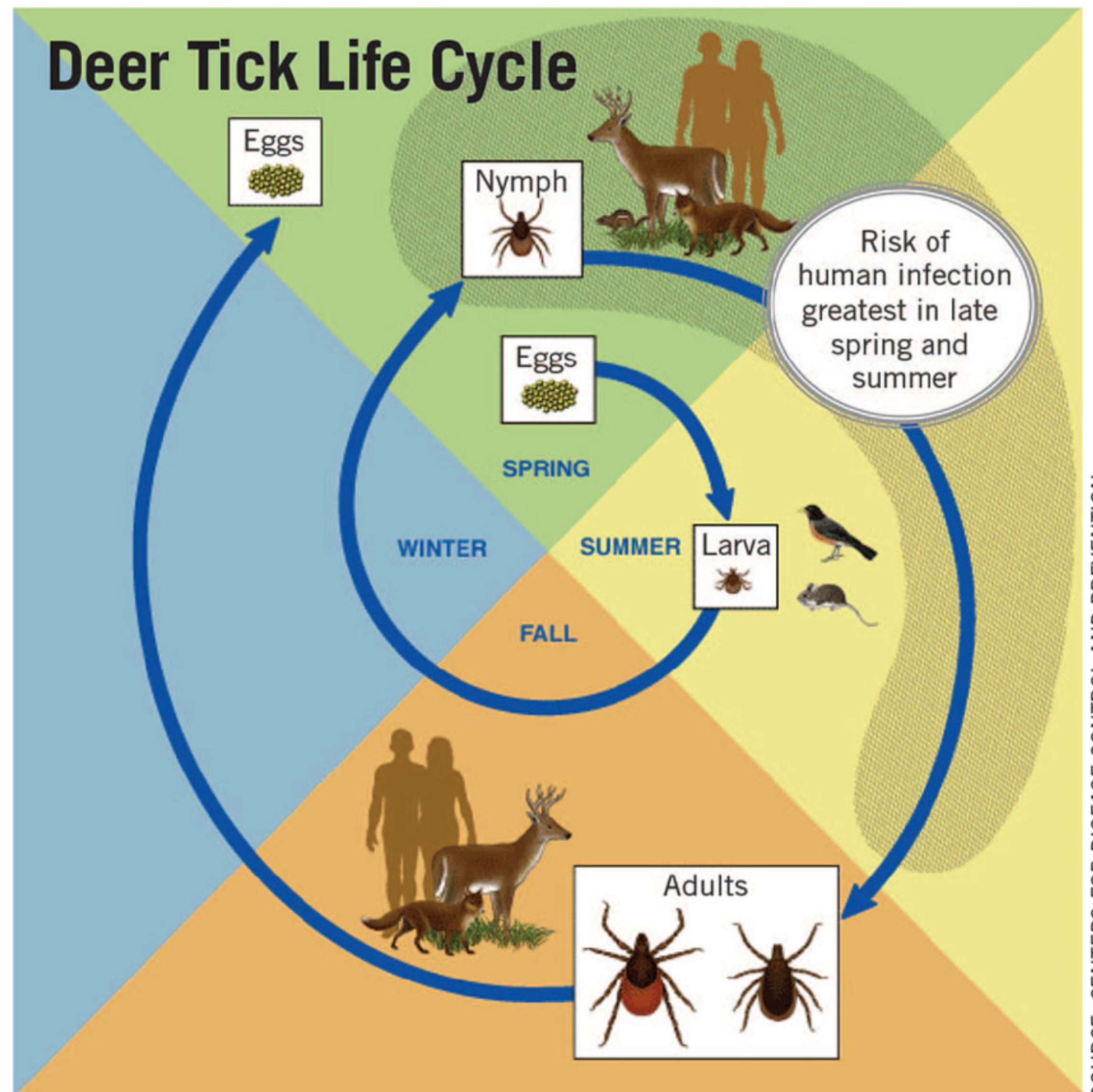


The highest risk areas for Lyme disease are in red and dark-orange.

- Abundant
- Common
- Rare
- None reported

SOURCE: THE AMERICAN LYME DISEASE FOUNDATION/MATTHEW T. STALLBAUMER





**Blacklegged deer ticks, a common carrier of Lyme disease, have two-year life cycles. Hard-to-find nymphs pose the largest threat during spring and summer.**

then washing them. Most ticks are sensitive to dry heat, but may survive even the hottest wash.

Studies have shown that it usually takes an infected tick about 36 to 48 hours after biting its host to begin transmitting Lyme disease, which is why spotting and removing ticks as soon as possible is important.

Ticks in the nymph stage—when they are about the size of poppy seeds—are active in late spring and early summer, and are the hardest to find on your body. These ticks pose the largest Lyme threat to humans and pets (see illustration on this page). 🌳

We thank Dr. Keith Clay, tick expert and distinguished professor of biology at Indiana University, for his review of this article.

ticks, you can lightly spray their legs, too.

You can also add dry herbs to your tick-fighting arsenal for pets.

Strew dried and pulverized wormwood (*Artemisia absinthium*) or pennyroyal (*Mentha pulegium*) leaves on pet beds and outdoor sleeping spots to repel mites and ticks. If you have beautyberry bushes (*Callicarpa americana*), you can use the leaves (or brew a strong tea made from them) to repel ticks, fleas and mosquitoes.

USDA scientists in Maryland have validated this historic use of beautyberry, according to findings published in *Experimental and Applied Acarology*. Two beautyberry compounds, callicarpenal and intermedeol, have even been found to repel fire ants.

Research continues into beautyberry's safety and best uses, so for the moment we suggest the pillowcase approach—add dried leaves to a cloth pouch placed in your pets' beds, or lightly spray your pets' beds with beautyberry tea.

insecticidal soap in the spring, when blacklegged deer tick nymphs are active, can provide treatment that is equally as effective as spraying areas with the insecticide chlorpyrifos.

After you've been outdoors, check your dogs for any ticks that may have latched on, and then make your way to a hot, soapy shower followed by a careful body check.

You can kill any ticks that have attached to your clothing by immediately putting your clothes into the dryer for 15 minutes on the hottest setting, and

## More Anti-Tick Tricks

Fencing out deer, the primary host of adult Lyme-infected ticks, can help prevent ticks from reaching your land. Low-cost, plastic-mesh deer fencing is available online and at farm stores.

Ticks rarely inhabit lawns that are mowed regularly. Raking up leaves and composting them deprives overwintering ticks of shelter.

When hiking where tick populations are high, stay on the trails and dress defensively—pull your socks up over your pants. When only shorts will do, some people cut off the ankle sections of old socks, spray them with a repellent, and wear the tubes around their calves like tick-detering leg warmers.

A study published in *Experimental and Applied Acarology* found that spraying outdoor areas with Safer-brand organic



**Ticks can make life miserable for your dog; check your pets regularly.**



# CHICKENS in the GARDEN

You can 'recoop' much of the expense of raising chickens by putting their manure to work in your garden and enlisting your birds for organic pest control.

By Patricia Foreman and Cheryl Long  
Illustrations by Elayne Sears

**F**resh, nutritious eggs and homegrown roast chicken dinners are reason enough to raise your own poultry. If you use your chickens in the garden, you can also harvest rich manure to create homemade fertilizer, and put your flock to work mixing organic wastes into superb compost. Plus, if you let your birds range on your property, get ready for a big bonus: They'll provide terrific control of ticks and other pests.

## The Cost of Raising Chickens

An adult standard hen eats about 84 pounds of feed per year, according to Ohio State University (she'll need less commercial feed if she is free-range, penned on pasture or given lots of table scraps). Bagged feed at a retailer, such as Tractor Supply Co., currently costs about 35 cents per pound, so feeding one hen for a year will cost close to \$30. This number will be higher if you pay a premium for organic feed, and lower if you buy your feed from a bulk supplier. How many eggs each bird lays will vary depending on her breed, age and your management choices, but you should get 200 to 250 eggs per year. So, you'll spend between \$1.40 and \$1.90 on feed per each dozen eggs. Not factoring in the other benefits we'll discuss later on, comparable eggs from a supermarket would have cost you \$2.50 to \$5 per dozen. (The cost of raising a chick to adulthood would require some initial investment, but this expense is offset by the value of using the hen in soup after her egg-laying days have passed.) For a thorough discussion of the costs of raising meat birds, see "Raising Broiler Chickens" by Gail Damerow at <http://goo.gl/i4q8mh>.

## Bird Benefits: The Garden Factor

Now, what about the benefits of raising chickens beyond eggs and meat? Some people keep chickens or guineas in the garden solely for tick control. MOTHER EARTH NEWS readers remark year after year that free-range chickens are highly effective as a means of organic pest control. See Page 30 for their reports.

Putting a value on lowering your risk of contracting Lyme disease is pretty difficult—we can, however, estimate the value



You can incorporate your birds into your garden using wire tunnels, portable pens and uniformly sized permanent beds.



of the chicken manure fertilizer you can harvest from each bird. Chickens can use only a fraction of the energy from the grains they are fed; they excrete the rest in their manure. A backyard flock's poop, if applied correctly and especially if combined with high-carbon matter—such as wood shavings, straw or leaves—adds nutrients to the soil and increases the soil's organic matter content.

Each bird produces about 8 to 11 pounds of manure per month, as reported by Ohio State University and the University of Hawaii Cooperative Extension Service. Fresh chicken manure contains about 1.5 percent nitrogen along with good amounts of numerous other essential nutrients. Because nitrogen is the nutrient that's most often in short supply, we'll use it to estimate the value of chicken manure fertilizer.

The 8 to 11 pounds of fresh manure produced by one chicken in a month contain 0.12 to 0.17 pounds of

nitrogen. Each season, most garden crops require a target range of 0.25 to 0.33 pounds of nitrogen per 100 square feet, according to *Knott's Handbook for Vegetable Growers* and Woods End Laboratories. One hen, then, ranging in a 100-square-foot plot would deposit enough nitrogen to support healthy growth of most crops in just eight to 10 weeks (assuming all of her manure, including from under her roosting area, is harvested). If you were keeping the hen in a portable pen on a 3-by-10-foot (30-square-foot) bed, then one bird would deposit the target







## Use Portable Pens and Tunnels to Manage Chicken Manure

To run chickens in your garden, install long, permanent chicken tunnels along one or more sides of the garden, connected to a coop where the birds sleep. Lay out dedicated garden beds using a standard width so that portable wire pens can be moved from bed to bed. Your chickens will be able to enter from the permanent tunnel into pen-covered garden beds via small gates you can open and close as needed. The tunnel system allows you to give your chickens a large, protected area in which to range and distribute manure while staying safe from predators.

**1** To exclude deer and other critters, and to provide additional security for your chickens, install perimeter fencing using 16-foot-long livestock panels with 2-by-4-inch openings. These panels are durable, secure and easy to install—just pound in steel fence posts and tie the panels to the posts. To exclude rabbits and groundhogs, add a 2-foot strip of 1-inch chicken wire, bent so that 1 foot extends out from the bottom of the stock panels.

**2** Create a quick, low-cost gate by folding a long section of 2-by-4-inch welded-wire fencing in half to make it stiffer, and then clip one side of it to the stock panel.

**3** Install tunnels along the inside of the perimeter fencing, made from 4- or 5-foot-wide 2-by-4-inch welded wire fencing (see detailed illustrations, Pages 30 and 31), and bent to form a 3-foot-wide by 1- to 2-foot-tall tunnel when attached to the stock panels. The tunnels can be placed in overlapping 10-foot sections, which you can fold up and clip to the stock panels in order to rake out manure and litter.

A chicken-tunnel system makes easy work of harvesting manure from your backyard flock.

**4** Make dedicated garden beds that are all 3 feet wide so that portable pens (made using 5- to 7-foot-wide 2-by-4-inch mesh fencing, bent to 3 feet wide with 1- to 2-foot-tall sides) can be placed on beds to allow chickens to move from the perimeter tunnels to forage in garden beds as needed. If your garden beds are 6 feet long, a portable, 8-foot-long pen can

be placed on a bed, spanning a 2-foot path and attaching to the perimeter tunnel. Install a simple flap of wire fencing as a gate between the perimeter tunnel and the portable pen covering the bed (see close-up illustration on Page 30).

**5** Your coop can be a custom building including an optional toolshed, or, if you're keeping only a few birds, a couple of plastic doghouses or large storage tubs will do. (Chickens are cold-hardy as long as they are able to stay dry and out of the wind.)

**6** The permanent tunnels and selected beds can be sown with cover crops and managed to provide year-round pasture for your birds. You can toss fall leaves or wood chips into any of the tunnels, and the chickens will mix them with their manure and make rich compost. Your portable pens can do double duty to support clear plastic or row covers for built-in season extension.

**7** Roosters can be kept in the end section of a permanent tunnel—with a large plastic tub for shelter—and allowed to mingle with hens as desired. (Areas for housing roosters should be at least 2 feet tall.)

—Cheryl Long



amount of nitrogen in roughly three weeks. You'll likely keep more than one bird at a time on your garden beds, which will require you to monitor the amount of time you leave them in one spot. You'll only need to keep two birds on a 100-square-foot area for four to five weeks, or three hens in the same space for only two to three weeks.

Nitrogen is a challenging nutrient to manage in your garden—you can have too much of a good thing. If you apply excessive amounts of nitrogen, some crops—such as tomatoes—will not fruit well and will grow mostly leaves. Follow the guidelines previously discussed to ensure that you keep your chickens in the garden long enough to add a good dose of plant-boosting nitrogen, but not so long as to cause unintentional damage.

Some fraction of the nitrogen in chicken manure is lost when it volatilizes into the air.

You can prevent this by mixing the manure into the soil as soon as possible—watering it in if there hasn't been much rain—or composting it. Some of the nitrogen present will be in a slow-release form, which soil microbes break down gradually, making it available later in the season or even the following year.

### The Value of Chicken Manure Fertilizer

Your total potential savings from using your flock's manure as home-made fertilizer depends largely on what you currently use to fertilize your garden.

If you're applying grass clippings, for example, then your fertilizer is already free, and using chicken manure may not save you money (although a diversity of fertilizer sources is always a good idea). If you are buying bagged organic fertilizers, then you're probably paying anywhere from \$10 to \$35 for each pound of nitrogen. Applying those prices to chicken manure, each bird would then give you from about \$20 to \$70 of nitrogen fertilizer value every year. Ultimately, the value of your flock will vary based on the number of birds you keep, your management strategy, your garden size and your current fertilizer expenses.

**Summary of the benefits.** Spend \$30 per year to feed each hen, and you can get about 200 to 250 eggs; plus \$20 to \$70 worth of crop-boosting chicken manure; plus richer, faster compost (keep reading); plus organic pest control; plus great entertainment and the satisfaction of a more sustainable system.

### Estimated Net Value of Keeping Chickens

Cost	
Feed	\$30
Benefits	
200 to 250 high-quality eggs	\$40 to \$100
Manure fertilizer	\$20 to \$70
Organic pest control, including lowered risk of Lyme disease	Priceless

*The numbers are annual, per adult bird. The figures do not include the initial cost of purchasing equipment or chicks.*



### Pathogen Precautions

Though the risk of contamination is small, fresh manures can contain pathogens that could contaminate your crops and cause food poisoning. To minimize this risk, you should either apply the manure in fall and let it overwinter in your garden beds, wait at least three months after adding it to your beds before you plant any root crops or leafy greens in the plot, or compost the manure before using it. Pathogens present in fresh chicken manure die off as the manure dries, or is exposed to sunlight, oxygen, freezing temperatures, or pH extremes.

### Manure Management Methods

If you decide to tap the fertilizer value of chicken manure, you have several options for how to manage and house your birds. Weigh the pros and cons of each setup and decide the best choice for your situation based on the predator pressures in your area, how much time you have to care for your birds and the size of your garden. Here are several different strategies to consider.

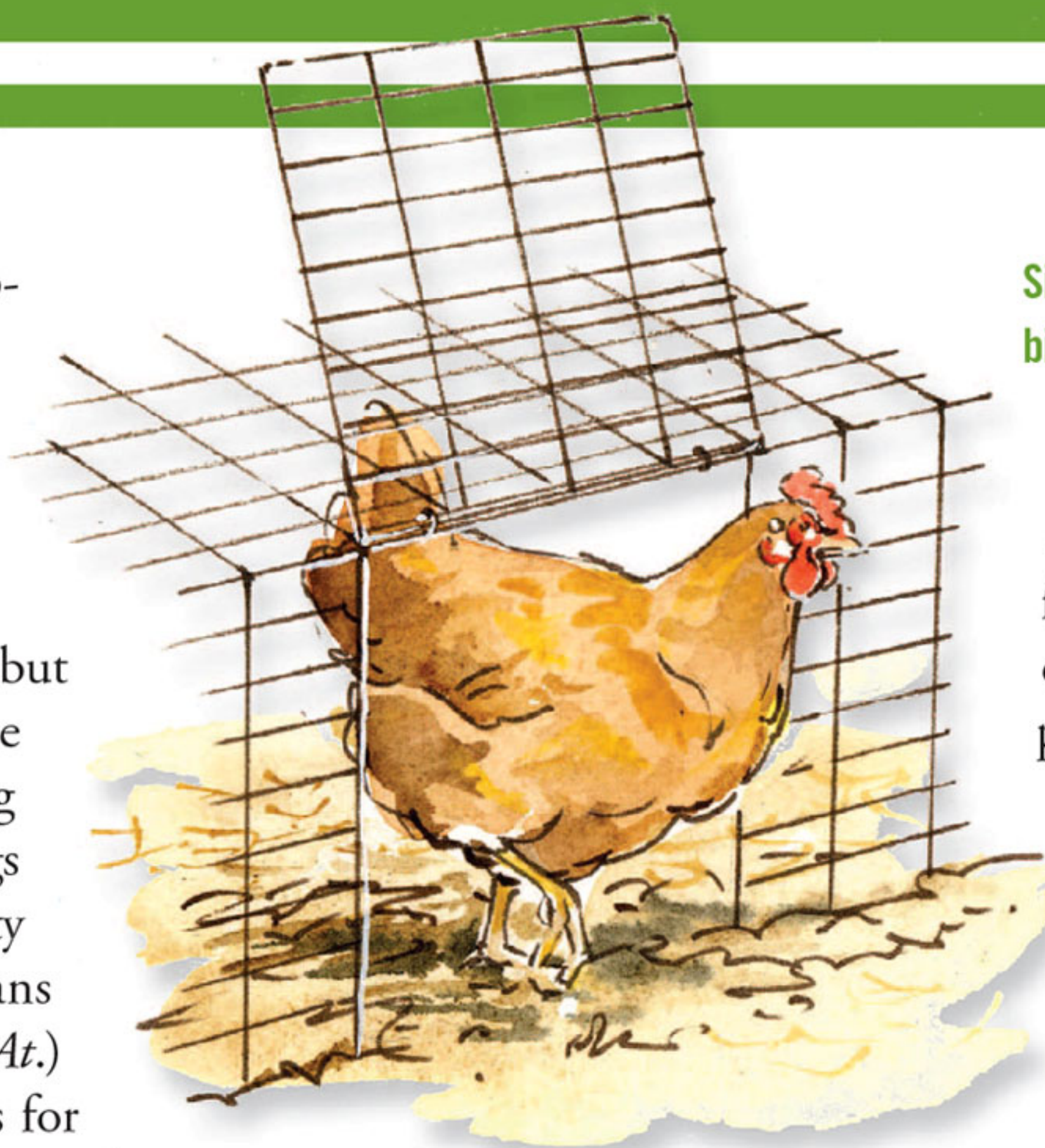
**Deep litter.** Nearly half of a chicken's manure is deposited during the night and early morning, so setting up deep litter bedding where your flock roosts can capture the bulk of your future fertilizer. This method takes advantage of a stationary coop with a protected chicken run setup. Plus, the deep litter strategy makes collecting the manure for your garden beds easier.

Layer 3 to 4 inches of bedding, such as fall leaves, grass clippings, straw or wood shavings in the chicken house, especially directly beneath the perches. Every few months you'll need to move the manure and litter to your beds, as your birds won't be depositing the manure directly in your garden for you. Read more about this method in "Save Work and Time With the Deep Litter Method" at <http://goo.gl/6Ty6C4>.

**Portable poultry pens.** You can make portable wire pens (sometimes called tractors) that fit over your garden beds, and then move your birds into the beds to apply manure in fall or when cover crops are growing. Use welded-wire fencing to make the lightweight pens. (Chicken wire,



also called poultry netting, is cheaper, but some predators can chew through it.) Sections of the wire can be clipped together with the J-clips used for rabbit pens. If the pens will be inside a fenced garden, you can make them without frames, but if the garden isn't fenced or you'll use the pens on pasture, you need a strong frame to protect your birds from dogs and coyotes. (Build MOTHER's Mighty Chicken-Mobile. Get these free plans for a portable coop at <http://goo.gl/ewaAt>.) You can use large plastic storage tubs for housing your feathered companions, and make a wire floor that flips up when you want the birds to work the soil and flips down for added predator protection.



Simple gates will allow you to control your birds' access to your garden beds.

**Pens plus tunnels and gates.** Use tunnels and gates made from welded-wire fencing to direct chickens from a main coop into garden beds covered with portable pens. See "Use Portable Pens and Tunnels to Manage Chicken Manure" on Page 28.

**Free range.** While this method doesn't capture chicken manure, it's a good option if you want your birds to eat ticks and other pests.

Your flock will provide pest control in addition to having access to a better diet that supplements the feed you provide, saving you money. You'll likely

## Organic Pest Control: Reader Reports of Poultry on Patrol

Every week, we invite our Facebook fans to share their wisdom on a given topic. Invariably they post some great firsthand information. Here's a sample confirming yet again what our readers have reported in the past—chickens, ducks, turkeys and guineas all provide amazing organic pest control. (For more firsthand reader reports, see [www.MotherEarthNews.com/Eggs/PestPatrol](http://www.MotherEarthNews.com/Eggs/PestPatrol).)

- We moved to our new home four years ago and got 12 hens. The waves of **grasshoppers** jumping in the yard have never come back, and we have never seen a **tick** anywhere, despite living in the bush and having a couple of bad years of ticks in our area. The birds free range, but the garden is fenced off. —*Rebekah Massey*
- They definitely make a difference. Compared with our neighbors, we have far fewer insects. As an added bonus, we have all the eggs we can eat and plenty left over to give away. As a side note, we had problems with weeds overtaking our pond. Instead of going the chemical route, we just got some ducks, and they have taken care of it. —*Alan Savoy*
- About the only thing they don't eat around here is the Lubber grasshoppers. Everything else that crawls or slithers is pretty much fair game: **snakes, frogs, bugs, worms** and **moths**. They even chase the **black flies** when they are bored. Two of my hens love to **de-flea the cats**. It freaked me out at first, because I thought they were attacking the cats,

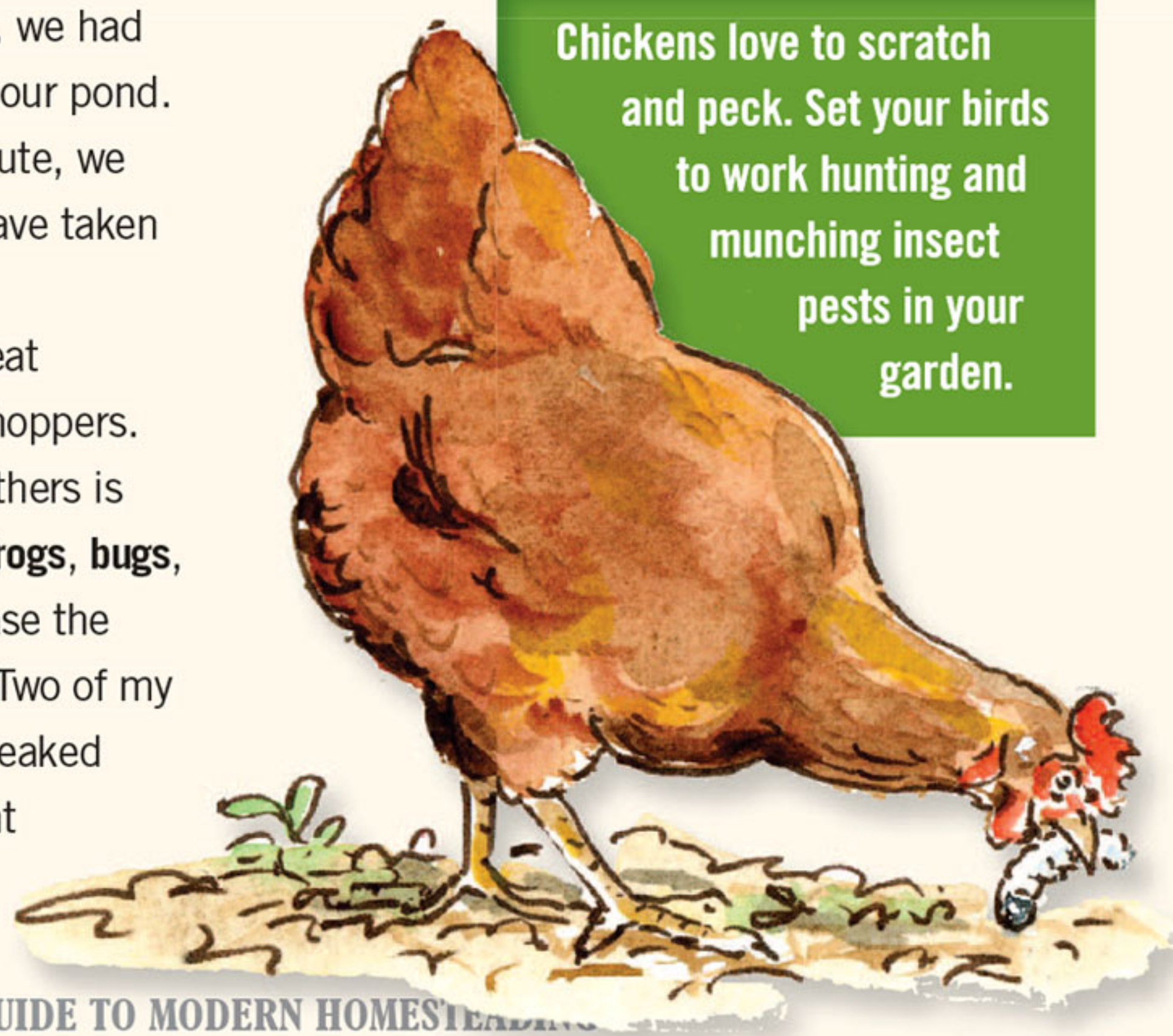
but then I realized they were pecking the same spots the cats were scratching near, and the cats liked it! The kittens will actually go find a hen when they are itchy! —*Jessica Marnik*

- Free-range chickens definitely helped us with our **tick** control. We were pulling ticks off my son and my husband every day before, but now only a couple ticks make it on them, and that's usually after the boys have visited the woods. —*Tina Smalley*
- Our chickens are doing wonders at organic pest control. I haven't seen a **tick** since we turned them out. But, oh my, do they love my flower beds. —*Greedith Butler*
- Since I've gotten chickens, my neighbors and I have noticed a great decrease in the number of insect pests. That said, chickens are vigorous diggers and scratchers. They'll tear up any garden or planting area

that has soft dirt or mulch. Our chickens first destroyed our yard, then they wandered over and did the same to our neighbors. Now we only let them out when we are gardening or mowing and can keep an eye on them. —*Suzanne Menear Lane*

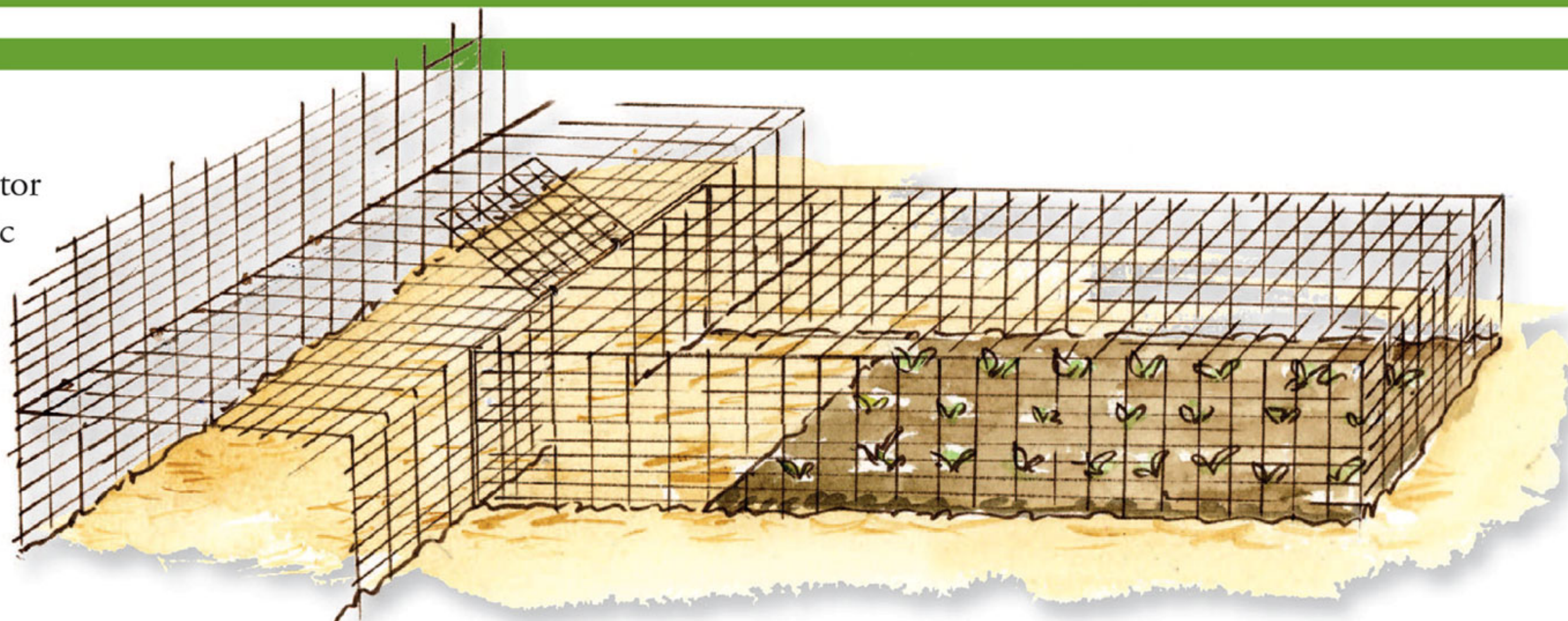
- I have more than 30 chickens that have cut way back on the yard bugs, especially **stink bugs**. They also till up the garden and help with composting. —*Lisa DeSantis*
- Our neighbor's free-range chickens patrol our yard, and those ladies seem to do a great job keeping the pests down. I think the mosquito population still has a leg up on them, though. —*Scout O'Brien Scott*
- I have definitely seen a drop in **mosquitoes** and **grubs** thanks to using my free-range poultry as my natural pest control method. —*Alexandra-Michael Hoxworth*
- In New York, before we got backyard chickens, we had to check the dogs for **ticks** often. After we got them, no more ticks! —*Elizabeth Rutherford Sinnott*
- **Black widow spiders** are common everywhere in the yard where the hens can't reach, but they're totally missing where my hardworking girls can get them. —*Sarah Sparklers*
- Our chickens have most definitely lowered the **tick** population here. Not so sure about the mosquitoes—we live right on a lake. —*Bear Lake Farm*
- Our flock of chickens is doing the best job—no more **grasshoppers** munching on the vegetables. All I need to

Chickens love to scratch and peck. Set your birds to work hunting and munching insect pests in your garden.





suffer a larger toll due to predator attacks, as even mobile electric fencing can't protect your birds from hawks. A good farm dog can lessen predatory pressures, or you can let your birds out only while you're outside or just before it gets dark, when the flock will naturally return to the coop to roost. 🌳



Use chicken tunnels and portable pens to let your birds deposit their manure directly onto your garden beds.

Patricia Foreman and her hen, Oprah Hen-Free, present workshops on how chickens can help save the world ([www.ChickensAndYou.com](http://www.ChickensAndYou.com)). Her book, *City Chicks*, is available at <http://goo.gl/TL8Ce>. After losing too many free-range hens to hawks, Cheryl Long now uses tunnels to protect her birds, grazing them on cover crops in her garden beds.

do now is teach them how to dig deep and get the moles; our cats can't keep up! —*Ludmilla Perez*

- Guinea hens are the best **tick** control, and for **scorpion** control, bantam chickens just can't be beat. I still like bats and purple martens for mosquitoes, though. —*Zemuly Ruth Sanders*
- This is purely anecdotal, but last summer Lyme disease was bad around here. My neighbors who live 1 mile away had bad **ticks**, and both their dog and my friend's husband were infected. I only saw one tick the entire year, on the other hand, and it was early in the season (when my hens were still young). I haven't seen one since that year, not even on my dogs whose commercial tick protection has lapsed. —*Brandis L. Roush*
- We raised free-range ducks. In summer, they spent most of their time happily eating insects, including those awful **Japanese beetles**. The cornfields around us were swarming with Japanese beetles that were attacking our fruit trees. My hubby put out a bag trap to lure them away from the trees. Every day he emptied it into the watering trough, and the ducks would run over for their crunchy, swimming snacks. My parents grew up raising guineas and chickens. They told me that guineas are not only great insect eaters, but they also go after **mice**. —*Judith Drayton*
- I have about 70 free-range birds (chickens, ducks and turkeys) patrolling my

acreage for light edibles. They really do make a difference. My ducks are funny to watch chasing flying insects and keeping my 300 berry bushes free of **aphids** and **stink bugs**. The chickens are great at keeping **tick**, **grub**, **mosquito** and **grasshopper** populations down. These birds are the beneficial predators on my farm, getting the job done naturally and organically! —*Melissa Ehrman Johnson*

- We have a backyard that is in a low spot of the neighborhood. When it rains, the

## Organic tick and pest control is only a free-range poultry flock away.

yard stays pretty damp, so we always had a lot of **no-see-ums**, or **midges**. After adding six hens last year, I have definitely noticed a decline in pests. Thank goodness—I can't stand those little blood-suckers! —*Gabe Simpkins*

- We used to have about two dozen hens that free ranged our 3 acres. We hardly had any **ticks**, **fleas**, **ants**, **spiders** or **mosquitoes**, and we even caught them on several occasions eating small **snakes**. —*Rachele Ruth-Hardy Tycksen*
- I fenced in my quarter-acre raspberry patch and let the chickens run. They eat **grasshoppers** and pests that threaten the

berries while fertilizing the patch. The canes protect the chicks from airborne attacks by magpies and crows. The chickens follow me as I pick the berries, and get any bugs I dislodge and berries I won't use. —*Anna Clark*

- My one free-range hen loves to eat **carpenter ants** and **termites**. I think she eats enough of them to keep us from having a problem. She does not, however, eat mosquitoes. —*Lorena McGovern*
- I found a significant drop in insects. I raised Rhode Island Reds, while my friend raised Barred Rocks, in different pens but in the same barn. I suffer arachnophobia something fierce, so it was easy to notice that **spiders** were thinning out in population. We opened the back wall of the barn to let the hens free range and noticed we weren't seeing nearly as many **grasshoppers**, and the **ants** weren't as noticeable either. One can't beat fowl for pest control! —*Thomas A. Reou*
- We've noticed that our **moles** have left our yard! (The chickens eat the **grub worms** that the moles feed on.) I love our chickens! —*Linda Johnson*
- Thanks to my chickens, along with barn swallows and small bug-eating bats, I have a greatly reduced insect population. My garden has few insects that chew up my vegetables. —*Stephanie Hanlon*
- I got guineas on my farm after finding **ticks** on my cat and goats. Since getting the birds, I haven't seen another tick on my animals. —*Nancy Barnaby Farrell*



# How to Make CHEAP GARDEN BEDS



Cheryl Long's garden near Topeka, Kan., features permanent beds edged with recycled cedar fence rails and logs.





## Here's how — and why — to create *permanent* garden beds and paths, and why framed or raised beds may be optional.

By Cheryl Long

Sometimes garden writers make things involve more work and expense than necessary. Raised garden beds are one example. Your crops will grow fine whether your beds are level, raised or even sunken (a good choice in dry, windy regions).

Maintaining *dedicated* beds — where you plant crops — and dedicated pathways where you walk is the important piece.

Compacted soil is the enemy of strong plant growth. The more easily a plant can send roots into the soil, the faster the plant can absorb the nutrients it needs, and the more drought-resistant it becomes. If the plant has to spend energy pushing roots into hardened soil, the plant will have less energy to grow and produce well.

In nature, meadow mice, moles, earthworms and other critters tunnel throughout the soil — and thus counteract compaction — and humans and other large critters do not often walk over the soil. But in a garden, we walk back and forth a great deal, and our footsteps definitely compact the soil. “One winter, we took a shortcut across a fallow field, using the path almost daily,” reports market gardener Anthony Boutard in his splendid book *Beautiful Corn*. “When I looked at an aerial photograph taken three years later, I could still see that pathway re-

flected in the reduced growth of the crop planted there.”

The best way to minimize soil compaction is to lay out defined areas for growing and defined areas for walking. First, measure the entire area and make a drawing on paper (or use our nifty Vegetable Garden Planner software, which you can learn about at [www.MotherEarthNews.com/Garden-Planner](http://www.MotherEarthNews.com/Garden-Planner)). Choose a bed width that will let you easily reach to its center from the path. Think about where you'll want composting areas, where you will want gates if you fence the garden, and where to leave room for a worktable or two and a bench with a nice view.

You can make paths as narrow as 1 foot if your space is limited, but always make a few main paths wide enough to accommodate a garden cart or wheelbarrow comfortably. If your garden area slopes, arrange the permanent beds across the slope rather than down it to minimize erosion. Build most of your beds the same size so you can use row covers, critter protectors and chicken tunnels interchangeably. Use wooden stakes, pipes or rebar to mark the corners of the beds. The stakes can do double duty as hose guides — simply slip a length of plastic pipe loosely over each, and hoses will slide around them easily.

Growing vegetables in garden beds is far more efficient than maintaining single rows of crops. From the paths on either

side of a bed, you can easily weed and harvest crops in a bed 3 to 4 feet wide. If you plant several rows next to each other in a wide, permanent bed without a pathway between them, crops will grow together to shade the soil and thus reduce weeds. But if you place pathways on either side of single rows, you compact more of your garden soil, as well as leave more area open to sunlight, which permits weed growth. Permanent beds and paths also let you apply fertilizer and water more efficiently.

We hear a lot of talk about “raised bed gardening,” but unless your site has drainage problems, there's really no reason for garden beds to be raised. In fact, choosing raised beds may have as many cons as pros (see the box on Page 35). Feel free to skip raised beds and just go for the cheap garden beds. You'll be glad you did.

### 6 Ways to Get a Cheap Garden Bed Growing

Here are half a dozen methods for creating garden beds from scratch while easily incorporating what we see as the most important tenet of building new beds: keeping your planting areas separate from your walking areas.

**Instant gardens.** For areas that are currently in grass or weeds, one of the simplest ways to create new beds without any tilling is to use bags of topsoil laid out to





If you make beds the same size, portable hoops can be shared among them (left). Straw on paths will “sheet compost” by season’s end (right).

cover your bed areas, with sheets of cardboard or newspapers covering the pathways. Cut out the tops of the bags, use a long knife to punch drainage holes in the bottoms, and you’re ready to plant smaller crops, such as lettuce, bush beans and basil. Use grass clippings or straw to conceal the edges of the bags and the cardboarded paths—then go get the garden hose! Over the summer, the bags and mulches will kill all the grass and weeds. You won’t need to do any digging until the end of the season, when you can gradually remove the plastic bags and work the topsoil into your native soil. (For more about “instant beds,” go to <http://goo.gl/yHDtQ>.) Instant beds probably won’t give you a harvest as good as what you’d get from other methods we cover here, but the advantage is the ability to create new beds quickly, with no initial tilling.

**Lasagna gardens.** If you have access to a good supply of grass clippings, fall leaves, straw or hay, you can start “lasagna” garden beds. Stake out your beds and pathways, lay cardboard down in the pathways, and then mulch the beds heavily with layers of whatever organic materials you have to smother the grass. If you use the lasagna technique in fall, the beds will be ready to plant in spring. Set transplants into the soil under the still-decomposing layers of mulch. To sow seeds, you’ll need to spread soil over the mulch, or dig to mix the thick mulch (which will be slowly turning to compost) with the native soil.

**Till and rake.** Bagged topsoil isn’t cheap, and sometimes it isn’t even as good as your native soil. Another less expensive way to convert lawn into garden—without buy-

ing soil—is to use a tiller to kill the grass. If you don’t own a tiller, you can rent one, or—perhaps even better—hire someone to till the area thoroughly for you. (Tilling sod is best done with a large tiller—check local classified ads or [www.Craigslist.org](http://www.Craigslist.org) to find someone who offers this service.) After the area has been tilled, use a garden rake (not a leaf rake) to go over the area thoroughly, and remove clumps of grass and roots to the compost pile. If your soil has lots of small rocks, you may want to invest in a rock rake from Lee Valley Tools (go to <http://goo.gl/xn4QA>). Next, use stakes to mark out where you want each bed and pathway. Rake loosened soil from

If the quality of your native soil is poor, then raised beds may be a good option.

the pathways into the bed areas, and you’ll have tidy, slightly raised beds without having to bring in soil.

**Buy some soil.** If your native soil is poor, however, you may want to hire a landscaping company to bring in a load of soil to spread out where you want permanent garden beds. If you go this route, choose a reputable company, ask for a product that includes compost blended with the soil, and verify that the company guarantees the mix is free of herbicide residues and seeds of noxious weeds (especially nutsedge and morning glory). If possible, till the beds before you spread the soil.

**Turn with a spade.** This method is probably the best because it loosens the soil deeply, but it does require more physical work than other methods. Mark out the garden beds and pathways, and then use a good spade to cut and turn the sod in the bed areas. Take your time, digging maybe one bed per day. Pave the pathways with cardboard or newspaper, covered with grass clippings or other mulch. If you can, apply several inches of compost, or mix a good layer of grass clippings into the beds. Rake them smooth, and you’re ready to sow seeds or set out transplants.

**Chickens in the garden.** If you have chickens and a portable coop, the birds can do a nice job of killing sod and scratching up the top few inches of soil in new or existing beds. They also add valuable manure to the soil. (Go to <http://goo.gl/wrqQA> for more on chickens in gardens, and see a portable coop plan at <http://goo.gl/bb5R7>.)

Depending on how much time and money you have, you can combine these six techniques. For instance, turn a few beds with a spade the first year, and build the rest of the permanent garden beds using topsoil bags or lasagna layers. Then, after the season has ended, you can dig the remaining beds deeply as you have time, or move chickens onto them to add fertility and eat weed seeds.

## The Essential Broadfork

I recommend that you eventually buy a broadfork so you can loosen the soil before planting each crop. A spade or garden fork will work, but a broadfork will do the job faster and more deeply. I’ve



## Raised Garden Beds: Pros and Cons

Numerous articles and websites claim that raised bed gardening is easier and more productive than non-raised bed gardening, but I believe most of those claims are misleading. For example, some writers assert that soil in raised beds is better. Your soil's fertility is a function of the amounts of compost and other amendments you use; raised bed soil is not automatically more fertile. As long as you continually improve the soil in dedicated beds, whether the beds are raised, sunken or level doesn't matter.

If you have poor or contaminated native soil, you may want raised beds with better soil brought in from elsewhere, but the soil (and probably frames) will be quite expensive. If you raise beds extra high to make them easier to reach, they will cost even more. Raised beds are a good choice if your soil drains poorly, but they'll require more watering in most climates.



**Raised beds are attractive but not necessarily more fertile than non-raised garden beds.**

found that broadforks made entirely of metal are more rigid and work better than those with wooden handles. (I especially like the Vashon broadfork from Meadow Creature; go to <http://goo.gl/rJyR9>.) With a broadfork, you work the tines into the soil and then pull back the handles so that the tines lift the soil to loosen it without actually turning it over. That way, the soil is aerated for better root growth and faster warming in spring. By not turning over or mixing the soil (as happens when gardens are plowed or tilled), you've minimized disruption to the layers of soil-dwelling critters that create fertility.

### Should Beds Be Framed?

Framing is strictly optional. Frames can make your garden look tidier and provide locations to attach hoops for mini-greenhouses and row covers, but depending on the framing materials you choose, this can add significantly to your startup costs. New lumber is pricey, and most boards will begin to rot after a few years. (If you do choose to make board

frames, 2-by-4s will work just as well as more expensive 2-by-6s, and they'll require less soil to fill.)

Rather than buying lumber, look for low- or no-cost frames. For instance, my neighbor gave me a load of cedar fence rails he was replacing, and they have made perfect frames for my beds. I simply raked tilled soil from pathways into low raised beds and laid the cedar rails down on the long sides of each (see photo, Page 32). Even with no end pieces, the fence rails stay right where I put them, and I can easily adjust a bed's width if need be. Fencing companies replace rail fences constantly and would probably be happy to have you take used rails off their hands.

Four- to 5-inch-diameter logs also work well as frames—not on the ends, but just laid on the long sides of the beds. Shorter logs work well to form curves if any of your beds are not rectangular. If you don't have a place where you can cut logs, contact a firewood company and ask whether it will deliver what you need—logs

should cost less (and last longer) than boards. Rocks, reclaimed bricks or concrete blocks are other framing options.

### Best Mulches for Vegetable Gardens

Long-lasting bark mulches can be OK on pathways if you have the right kind of hoe to cut out weeds (see "Hard-Working Garden Hoes" at <http://goo.gl/KfFYK>).

In the growing beds, however, you'll be happier using mulches that are finer and will decompose over the season. Top choices are grass clippings, fall leaves, hay, straw, or aged fine wood chips or sawdust. Clippings and leaves are free.

If you have weed problems, simply put down cardboard or newspaper before you apply mulch. 🌳

**The garden at Thomas Jefferson's Monticello incorporates wide, permanent paths.**







*Floriani  
Red Flint*

# THE PERFECT STAPLE CROP FOR EVERY HOMESTEAD

Grow this productive heirloom grain corn for out-of-this-world flavor and exceptional nutrition.

By William Rubel  
Photos by Jim MacKenzie





**G**rain corn is a terrific crop for homesteaders who want to grow their own staple crops, and it's productive enough to be rewarding even in urban gardens. You can grow corn anywhere in the continental United States, and it's easy for any household to harvest, store, and process it into flour and cornmeal. Grain corn is much easier to process than wheat is, and, in many ways, cornmeal is a more versatile grain staple than wheat flour.

## A New World of Corn

Cornmeal is a culinary world in itself: cornbread, muffins, pancakes, waffles, polenta, grits, scrapple, cornmeal crusts for fried chicken or vegetable fritters, and, if you boil whole kernels with culinary lime, you enter the world of hominy, hominy grits, and Mexican tortillas and tamales. Yet it's ironic that despite 88.9 million acres of corn growing in the United States (the estimate for 2015), there are few choices of grain corn in the grocery store. Cornmeal is such a commodity product that it's rarely fresh in stores, packages don't tell you which corn variety was ground to make it, and it's nearly impossible to buy whole kernels for grinding. But there's hope.

'Floriani Red Flint' is a rare, open-pollinated red flint corn from Italy with unforgettable flavor—and the possibilities for cooking with it are endless. If you're hoping to become self-sufficient in grain, or if you're looking for a cornmeal with a rich, distinct taste and texture, then you'll love Floriani. This heirloom corn is an old variety from the Italian Alps that was originally selected for qualities that make great polenta. This particular variety is a landrace (a locally adapted variety that has more variation than a variety bred for specific qualities) from the Valsugana Valley, where subsistence farmers grew it as the staple food until the mid-20th century. The Alpine farmers dried their crop, shucked the ears, and ground the corn into a coarse meal that they boiled and served as polenta.

While the hulls are red, the meal is a deep yellow with a hint of pink. It is physically beautiful and has a rich, complex flavor to match. 'Floriani Red Flint' is the ideal grain corn crop for homesteading: productive, rewarding and not the usual industrial fare.

Fedco, a Maine-based seed company,



had this to say about Floriani in its 2015 catalog: “Steady appreciation from the cognoscenti. ... Beautiful cobs with fabulous flavor. The red pointed kernels (white when immature) are easy to shell and grind into a fine pinkish meal that bakes with an appealing spongy texture. Floriani’s richly sweet, delicious, corny taste beat the competition silly in our pancake and cornbread muffin bake-off.”

Growing Floriani and Selecting Seed

‘Floriani Red Flint’ is new to the United States. I first encountered it in Italy while visiting a friend whose family grew the corn for their nightly polenta. I admired the flavor of the corn and was given a kilo of it to bring home. With the help of MOTHER EARTH NEWS, growers tested the corn in Kansas, Maine, Nebraska, South Carolina and Northern California.

Floriani seems well-adapted to a wide range of North American growing conditions. Like all corn, it’s a heavy feeder. With enough feeding, expect to harvest ears that are at least 8.5 inches long with 15 or 16 rows of kernels. However, I’ve seen crops with 6-inch ears, so be sure to plant in rich soil and, if you can, side-dress with nitrogen-rich compost or apply an organic fertilizer.

Homesteaders can easily grow enough Floriani for many servings of grits, polenta, pancakes and cornbread. For self-sufficiency, and to grow enough to have a genetically stable crop to save seed from, plant at least 2,000 seeds (about 19 ounces). You can expect one ear per plant, roughly 100 ears per 100-foot row, and, if you’ve done well with your husbandry, this 100 feet will yield at least 10 pounds of grain. On a larger scale, a California farmer growing about 25,000 plants to the acre is getting yields in the range of 1 to 1½ tons per acre, using organic methods.



Holy Whole-Grain Corn Nutrition!

Cornmeal of whole-grain varieties, such as ‘Floriani Red Flint,’ is much more nutritious than de-germed yellow cornmeal (the type typically sold in supermarkets because of its long shelf life). Our testing shows that Floriani is an especially good source of fiber, protein and minerals. Based on a 1-cup serving.

Nutrient	Whole-Grain Floriani Cornmeal	De-Germed Yellow Cornmeal
Fiber	20.5 g	6.4 g
Protein	21.4 g	11.5 g
Minerals		
Copper	0.2 mg	0.1 mg
Iron	4.7 mg	1.7 mg
Magnesium	214 mg	56 mg
Manganese	1.2 mg	0.3 mg
Phosphorus	606 mg	167 mg
Potassium	630 mg	242 mg
Zinc	5 mg	1.1 mg
Vitamins		
Niacin (vitamin B3)	4 mg	1.6 mg
Riboflavin (vitamin B2)	0.3 mg	0.1 mg
Thiamin (vitamin B1)	0.5 mg	0.2 mg
Vitamin E	1.7 IU	0.4 IU

We tend to speak of “seed saving.” Yes, historically, farmers “saved seed,” but it would be more accurate to say they *selected* seed for the next harvest. They selected for traits they wanted to encourage and, in so doing, created variants of known varieties (landraces), and sometimes variants that were different enough to be classified as entirely new varieties. ‘Floriani Red Flint’ is an example of this. Its name in the Alpine Italian dialect is *spina rossa*

della Valsugana (red-spined of Valsugana).

The pioneering group of North American growers named it ‘Floriani Red Flint’ to recognize the generosity of the Floriani family in sharing their seed. This corn is the result of many farmers over a long period of time selecting for at least four traits: early ripening, large cobs, red color, and a markedly pointy or spiny kernel. Fortunately, attached to one or more of these traits is exceptional flavor. For the goal of repopulating our grain trade with grains that have terrific flavor and not just good growing qualities, ‘Floriani Red Flint’ is perfect. Alpine farmers already selected it for a short growing season, thus making it one of the earliest flint corns—an ideal trait for a country the size of ours that has such varied growing conditions. Fedco rates Floriani at about 100 days to maturity based on organic trials in Maine.

Keeping this grain corn variety true will take some extra work. In a large field, while most of the ears will be deep red, you can expect to see ears ranging in color from red to yellow. This is typical of this type of open-pollinated corn. If you harvest acreage mechanically, be sure to harvest for seed separately, by hand.

To keep ‘Floriani Red Flint’ true to its landrace, select for replanting the reddest corn with the most pointy kernels from the healthiest ears.

We can’t all grow our own corn. Fortunately, farmers and millers are so excited about this variety that more sources are becoming available for people who want to buy Floriani corn flour. One source is a new company, Community Grains in Northern California ([www.CommunityGrains.com](http://www.CommunityGrains.com)). ‘Floriani Red Flint’ is one of the reasons Community Grains was created, and the company specializes in milling it.



## Plentiful Polenta

In Italy, Floriani's reason for existence was polenta. In their more rustic forms, Italian polenta and American grits are basically the same thing: boiled whole-grain cornmeal. Whether you serve it as polenta or grits, this is a dense corn that benefits from long cooking. I suggest simmering it for three hours, or cooking it in a pressure cooker for 20 minutes. I usually prefer a ratio of 1 part cornmeal to 3½ to 4 parts water, but there's no right amount of water to use—go by your personal taste. Adding water is usually easier than evaporating it, so start on the conservative side.

Whether cooking in an open pot or in a pressure cooker, pour the coarsely ground 'Floriani Red Flint' into lightly salted, boiling water. Whisk to eliminate lumps, then, if using a pressure cooker, cover, pressurize and cook for 20 minutes. Otherwise, simmer for about three hours, adding water if the polenta gets too stiff. Polenta doesn't require constant stirring. It does stick, however, so check on it from time to time to ensure it doesn't burn. Polenta is done when it's creamy and tender.

You can enrich your polenta with butter or cheese. Stirring in grated, hard sheep cheese would be authentic to the corn's Alpine origins, as would making it with goat or sheep milk. My preference, though, is to keep the polenta as light and clean-tasting as possible because its intrinsic flavor is so good.

One of the great qualities of this corn



**You and your dinner guests will marvel at the flavor of polenta made with Floriani. Consider serving your polenta on a traditional wooden board, perhaps accented with lightly cooked kale.**

is that it tends to blend well with deep flavors. It's especially good served with strongly flavored greens, such as collards, kales and chicories, or wild greens such as dandelion and nettles. Polenta topped with a sauce of wild mushrooms is a classic, as is serving it with any toppings made of grilled sausage or game birds. Floriani also goes well with farmhouse stews, especially those made with meat from older farm animals that requires long cooking to tenderize. Rabbit, an old laying hen or a surplus rooster are traditional accompaniments to rustic-style polenta.

## Ample Scrapple Options

Scrapple is a rare American dish regional to Pennsylvania. As a Californian, I'd heard of it, but only recently tasted it for the first time. I have to say my first en-

counter with scrapple shocked me—in a good way. Why hadn't I made this before? It's wonderful!

At the center of scrapple's American history is a dish associated with pig butchering among the Pennsylvania Dutch. Historically, scrapple was essentially polenta boiled in a broth made from bits of pork that couldn't be used in sausage making. Cooks chopped up that same meat and stirred it back into the polenta, then poured the polenta out to cool and solidify, at which point it was sliced and fried.

Using 'Floriani Red Flint' brings to scrapple the type of cornmeal the Pennsylvania Dutch traditionally cooked with. I make the broth with pork shoulder, but you can substitute the meat you like. I also add a little thyme and rosemary to the polenta during cooking. Dip the slices in flour before frying them to golden brown.

Cheryl Long, editor-in-chief of MOTHER EARTH NEWS and a scrapple devotee, has a slightly different take on scrapple. She combines Floriani polenta with raw, ground, grass-fed pork to make a premium scrapple.

As Cheryl puts it, "Everyone who has tasted our Floriani sausage scrapple is astonished by how good it tastes. We use a premium pork sausage made from pastured heritage hogs, and have our local butcher mix 2 to 3 parts cooked polenta into each pound of sausage. We form patties and freeze them on cookie sheets.

"This way, the patties are ready to cook—no defrosting needed. Just be sure to dredge the frozen patties in wheat flour to reduce sticking. This is a great way to



**Grain corn is more versatile than you may think. You can serve slices of golden scrapple infused with thyme, rosemary or other herbs at any meal. Top with maple syrup for a yummy breakfast.**





## Amazing Corn Pancakes

Judging from the number of pancake recipes in cookbooks throughout the years, we don't eat pancakes as much as we used to. Pancakes were often made with 100 percent cornmeal or, as here, a mix of cornmeal and white flour. Flint corn was referred to as "Indian corn" until well into the 20th century, so if you want to find recipes in older cookbooks that use corn similar to 'Floriani Red Flint,' search for "Indian meal." In the 19th century, pancakes were leavened with yeast or with some form of chemical leavening, such as baking powder. I personally prefer either yeast or egg whites. In this case, I've chosen egg whites, and they produce pancakes with a lovely, soft texture.

2 cups cornmeal, bolted (larger pieces  
of bran sifted out)  
2 cups boiling water

2 eggs, separated  
 $\frac{1}{2}$  cup unbleached white flour  
 $\frac{1}{2}$  cup milk (approximately)

Add cornmeal to mixing bowl and pour boiling water over the meal. Whisk smooth. While the cornmeal is cooling, separate the eggs. Set yolks aside and whisk the whites to a soft peak. When the cornmeal is lukewarm, whisk in the flour, then whisk in the reserved egg yolks and the milk. Fold in the egg whites and immediately bake on a lightly oiled griddle heated to approximately 375 degrees Fahrenheit. Turn when the pancakes have set on the top. *Makes 12 medium pancakes.*

reduce the per-serving cost of premium, grass-fed meat."

## A Food Revolution

An aspect of growing 'Floriani Red Flint' or buying Floriani cornmeal goes beyond its suitability for the homestead or the kitchen: It's not a commodity crop. The shelves and bins of 21st-century grocery stores are packed with inexpensive foods, but have limited variety in many areas. Corn, of course, is a classic commodity crop. But things change. From the kilo of seed the Florianis gave me, actual acreage is now being grown in the U.S. Seed is already available through two seed companies and flour is available through a miller. All are small beginnings helping re-establish some of the variety we've lost—but beginnings nonetheless. MOTHER EARTH

NEWS promotes Floriani with the dual intention of providing homesteaders with the best possible staple grain corn, and, on an even larger scale, of helping to reverse some of the terrible trends in agriculture of the previous century.

The revolution is us. In many ways, this introduction of 'Floriani Red Flint' is a test. Can we compete with commodity grain agriculture? Can we bring real diversity back to the grain trade? Right now, in most parts of the country, the grain-processing system is unable to handle non-commodity products. The system isn't set up for cleaning, storing and keeping separate small batches of grain that may be from different varieties or grown by different farmers. Companies would need to purchase new machinery and construct new buildings to store grain in a new way.

## RESOURCES

Limited supplies exist for Floriani in the United States. Smaller amounts are currently available but that may change without warning.

### Southern Exposure Seed Exchange

540-894-9480

[www.SouthernExposure.com](http://www.SouthernExposure.com)

Offers Floriani seed.

### Fedco Seeds

207-426-9900

[www.FedcoSeeds.com](http://www.FedcoSeeds.com)

Offers Floriani seed.

### Community Grains

[www.CommunityGrains.com](http://www.CommunityGrains.com)

Offers freshly ground, organic, whole-grain Floriani cornmeal.

[www.MotherEarthNews.com/Grain-Mills](http://www.MotherEarthNews.com/Grain-Mills)

Information to help you choose a grain mill, including reader reviews.

Amazingly, in Northern California, interest in 'Floriani Red Flint' has been significant enough to begin the process of making this kind of fundamental change to the grain-processing infrastructure. By demanding a great product such as 'Floriani Red Flint,' you actually cause the agricultural system to change in some exciting ways. You help create the demand for excellence that creates the infrastructure for the processing of heirloom grains—a precondition for farmers to grow them on a larger scale.

Whether you are a homesteader, home gardener, or urban cook or baker, join with MOTHER EARTH NEWS and do what you can to grow and use this fabulous, hardy and time-tested Italian heirloom corn. 🌽

*For more great ideas for cooking and baking with delicious Floriani corn, go to [www.MotherEarthNews.com/Floriani-Recipes](http://www.MotherEarthNews.com/Floriani-Recipes).*

—MOTHER

William Rubel, a cook and author specializing in traditional cooking, met the Florianis and was introduced to their wonderful homegrown corn while in Italy researching wild mushrooms.





After fruit was thinned to 8 inches apart, this 5-year-old tree still produced 84 large apples.

# Prune for Small-Space FRUIT TREES

This revolutionary pruning method will enable you to grow any type and variety of fruit in small spaces. Never settle for an apple you don't adore or a peach you can't reach.

By Ann Ralph

Many fruit trees—including semidwarf varieties—can easily grow to 15 feet and taller. Anyone who has tried to manage one of these large trees in a backyard will instantly appreciate the value of small fruit trees: They require less space, are easy to care for, and produce fruit in manageable quantities. Growing compact trees allows you to tuck more varieties of fruit into corners of your property or a small orchard, and means you can choose those varieties by flavor and climate adaptability rather than by tree size. Nearly any standard and semidwarf

tree—from pears, peaches and plums to apples and apricots—can be trained to stay much more compact.

The pruning treatment outlined in this article will create an appreciably smaller fruit tree than what you're used to—as small as most dwarf trees (see “Why Not Choose a Dwarf Fruit Tree?” on Page 44). Here's the key to this little-known technique: Fruit trees' reaction to pruning is dependent on the season in which the cuts are made. The trees' response is determined by whether the tree is actively growing (spring), gathering nutrients (early summer), preparing for dormancy (late summer), or fully dormant (fall and winter). Keep this cycle in mind when wielding your shears.





A knee-high heading prune (1) when planting a dormant tree is critical for size management. For the optional second cut, choose the best scaffold (2) or simply remove any duplicate buds on the same node (3).



## Dormancy and the First Cut

The first step to growing a small fruit tree is to make a hard heading cut (a cut that removes the growing tip) when planting. While such a cut may seem extreme, your planting job will only be complete when you've lopped off the top two-thirds of your new tree. This pruning cut is critical because it will create a low scaffold (the primary limbs that make up the canopy of a tree), and making this cut during dormancy will give the tree strength and resilience, which is especially crucial for heavy stone fruits. Most importantly, it will help keep the canopy of the mature tree within arm's reach.

Here's how to handle the first cut. As winter comes to an end, and the ground is workable for planting, buy a dormant bareroot tree that's about as big around as your thumb. Plant the tree as soon as possible. Choose a bud at knee-height (about 18 inches from the ground), and make a clean, 45-degree cut that angles away from the bud (see Photo 1). Cut close enough to the bud so it can heal cleanly in a natural line, but not so close that you cut into the bud itself. Several buds should remain between the cut and the graft—the knobby place low on the trunk where the scion (the graft that determines fruit variety) meets the rootstock. A knee-high prune is reasonable for almost all fruit trees, but peaches and nec-

tarines will sprout more reliably if you cut just above a nurse limb (a branch left to absorb the tree's spring energy and encourage sprouting). A young tree will probably be a 5- to 6-foot whip at the nursery, so in most cases you'll remove more than you'll leave behind. Your beautiful sapling will now be a knee-high stick.

Granted, this cut sounds harsh. Do it anyway. The compact structure of the tree to come will begin to develop as a consequence. Heading your tree while it's still dormant will take advantage of nutrients stored in the roots, and vigorous growth and branching will occur in spring, when the plant directs its energy to the remaining buds—the perfect combination of conditions to get a small fruit tree off to a strong start. Your initial cut will awaken the buds below, and they will eventually develop into new limbs, each with a growing tip of its own. The resulting open-center tree will be shorter, stronger, easier to care for, and far more usefully fruitful.

## Spring: A Balanced Beginning

After the first buds start to break in early spring, examine the spacing of the branches and decide if you like the arrangement of the top buds. If not, simply prune lower to a place where the





In summer, envision the future: Remove competing branches (4), head remaining scaffold limbs by about 50 percent, and prune for balance (5).

configuration of leafing buds suits you (see Photo 2). This place will eventually become the crotch of the tree. The lower the crotch, the easier it will be to keep the tree small. The earlier in the season you make this cut, the more vigorously new limbs will grow.

A young tree with a stem thicker than three-quarters of an inch may have a hard time pushing buds. In this case, make the first dormant cut where the caliper (width of the stem) is thumb-sized, then make a second cut lower as soon as buds begin to develop. After the sprouts get going, you can cut the scaffold as low as you prefer.

Revisit the tree once more in early spring just as sprouts reach 1 or 2 inches long, before woody branches begin to form. Gently pinch off all but one bud where multiple sprouts grow on a single node (see Photo 3).

## Summer: Build Your Scaffold

In spring and early summer, deciduous fruit trees aggressively expend their energy reserves as they bloom and leaf out. This is when trees are in the mood to grow, and grow they will, often at an alarming rate.

By the time of the solstice in late June, a tree's resources will have migrated from the roots and trunk to be stored primarily in the

foliage. Solstice pruning will remove some of those resources and reduce late season root growth. In other words, summer pruning will slow a tree down, a desirable result for compact fruit trees. While peaches, plums and apricots pruned in fall and winter—the traditional pruning season—can grow as much as 8 feet the following spring, the same pruning cuts made in summer will yield

growth of only 1 foot or so. Cuts made while a tree is actively growing will heal quickly, too.

In a perfect world, a young tree would have three or four branches evenly spaced around its trunk. In the real world, branches grow anywhere and anyhow they please. The key to pruning is to envision the future: Consider the placement of the fully grown limbs in relation to one another. You may have too many options. You may have an open area with no

branching. You may be tempted to let nature take its course, but leaving too many branches will prevent sunlight from penetrating the interior of the tree. Remove competing branches to create space (see Photo 4). An ideal branch angles upward at 45 degrees. If you want to keep a vertical branch, consider a heading cut to encourage horizontal growth, or hang weights on the branch to direct its growth downward.

## A Summary of the First Year

- Prune a dormant, thumb-thick sapling about knee-high, or 18 inches from the ground, when you plant in late winter.
- After buds begin to break the first spring, choose your scaffold. Pinch off all extraneous buds or prune a little lower to a height where the configuration of leafing buds suits you.
- Near the summer solstice, prune to slow growth and begin to shape your scaffold. Remove any redundant branches and make heading cuts.
- In winter, prune to open the interior of the tree and form a well-balanced shape. Remove dead or diseased material.





Compact trees produce nicely sized fruits in manageable abundance.

After removing extraneous branches, cut remaining scaffold branches back by at least half (see Photo 5), to a bud that faces the direction you want the branch to grow. In the case of aggressive growers, such as apricot and plum trees, feel free to prune by two-thirds. Remove any suckers growing from the lowest part of the trunk or the base of the tree.

The earlier in summer you prune, the greater your size-control effects. By late summer, nutrients collected by the leaves will have already begun to move into the trunk and roots. A tree begins the shift into dormancy as early as July.

## Winter: Architecture

Winter will be the best time to make structural and aesthetic decisions because your tree will be bare. The dormant season will also be a good time to remove any limbs that just don't look quite right—those that are too horizontal, grow into a fence, or branch

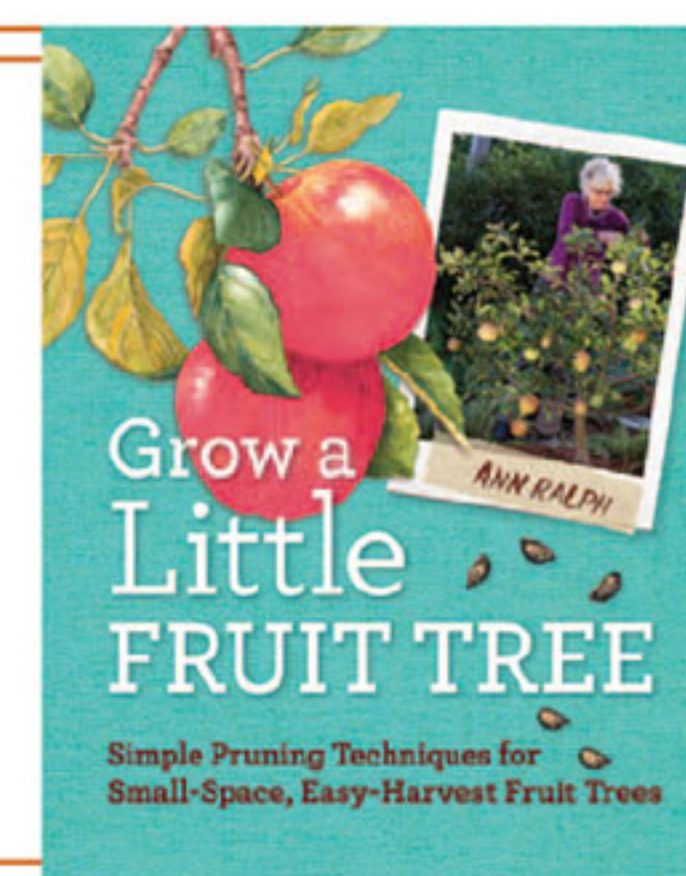
out over a path. You'll want to remove what Portland, Oregon, pruner John Iott calls "The Three Ds"—the dead, the diseased and the disoriented. Open up the interior with a few well-considered cuts. Observe the growth pattern of the tree, and prune to enhance its natural grace.

Make heading cuts in winter only if you want an enthusiastic response—when you're trying to develop the first low scaffold branches, or when you're trying to rejuvenate an older tree. Prune heavily in winter only if a tree has stalled, if pruning has been neglected and needs correction, or if you were too timid last time and want to generate some better choices this time around. The tree will outgrow the pruning with the full force of its reserves.

In subsequent years, just keep pruning: Make architectural decisions in winter and take height down around the summer solstice. When fruit is about the size of the end of your thumb, thin clusters down to a single fruit. Depending on the variety, you may harvest a few fruits by the third year and a few dozen fruits by the fourth.

How should you choose what to keep and what to prune? Ask yourself what seems best, listen to your instincts, and cut something out. The tree will create new choices and you can always make adjustments next season. 🌳

This article was adapted with the permission of Storey Publishing from *Grow a Little Fruit Tree* by Ann Ralph (available at [www.MotherEarthNews.com/Store](http://www.MotherEarthNews.com/Store)). Ralph, a fruit tree specialist with 20 years of nursery experience, gives pruning classes in the San Francisco Bay Area.



## Why Not Choose a Dwarf Fruit Tree?

**Genetic dwarf** fruit trees have their short stature bred into their genetic makeup. Genetic dwarfs aren't grafted; they grow on their own roots. On average, they stay between 6 and 8 feet tall, but are known to be less vigorous and have a shorter lifespan. When a fruit tree is bred for one quality, such as size, then other traits, such as fruit flavor, climate adaptability and overall vitality, become necessarily secondary. By selecting for size, you will miss out on the tastiest varieties.

Some fruit trees are available grafted on **ultra-dwarfing rootstocks**. These trees stay quite small, a petite 4 to 6 feet, but because of their extremely small root systems, ultra-dwarfing rootstocks present many of the same problems genetic dwarfs do in terms of short lifespan and overall plant health.

Most nurseries offer fruit trees grafted onto **semidwarfing rootstocks**. People seek these out with reasonable expectations of smallish trees, but semidwarf only means "smaller than standard." If a full-sized fruit tree is 30 feet tall, then a semi-dwarf might grow to be as tall as 25 feet.

If you want a broad variety of choices, opt for a standard or semidwarf variety. The regular and strategic pruning described in this article is the best way to limit the size of a fruit tree.



You don't need to buy special rootstock to keep a tree small: Strategic pruning, like that used to manage this espalier apple tree, is enough.



# GARDENER'S FIRST AID

## *What Works and Why*

Follow these simple, safe and effective remedies for soothing sunburns, blisters, bug bites and other minor maladies.

By Linda B. White, M.D.

**H**auling compost, digging garden beds and wrangling ornery livestock are just a few of the farm and garden tasks that can be hard on your body. Even the healthiest homesteaders are susceptible to bee stings and sun-

burns. Fortunately, your home is probably already stocked with simple cures for minor woes. The following remedies are adapted from *500 Time-Tested Home Remedies and the Science Behind Them* co-authored by Barbara Seeber, Barbara Brownell Grogan and me (available at [www.MotherEarthNews.com/Store](http://www.MotherEarthNews.com/Store)), and

they'll soothe everything from bug bites and bumped shins to blisters, burns and back pain.

### Poisonous Plants: Ivy, Oak and Sumac

**Prevention.** The best way to protect yourself from this itchy, blister-causing







Gel from aloe leaves (left) works wonders on burns, and the leaves of comfrey (middle) and plantain (right) help topical wounds heal quickly.

trio is to wear protective clothing, including pants, long sleeves and gloves, whenever you work in areas where these plants may grow. Anytime you think your skin or clothing may have made contact with their leaves, immediately remove and wash your clothing in hot water and take a shower. If you know your hands or arms touched the leaves, wash these areas as soon as possible with a skin cleanser, such as Tecnu, which is designed to remove the blister-causing urushiol oil that these plants produce. Some people are severely allergic to these plants, while others are totally immune. If you know you're allergic, you may want to apply a preventive barrier cream, such as Ivy X Pre-Contact Skin Solution, before going outside.

**Treatment.** If you do develop a bad rash with blisters, an oatmeal bath or paste may relieve the itching. Oats (*Avena sativa*) have antioxidant and anti-inflammatory properties. Applied topically, oats moisturize the skin and decrease itching. To draw an oatmeal bath, pour 2 to 3 cups of rolled or colloidal oats into a sock, cloth, bag or bandana to contain the particles and help with cleanup. (You can make colloidal oats in your food processor by blending oats to a powder.) Place the sock in a tub full of warm water. Climb in and soak for at least 15 minutes. Avoid using soap, which will only dry and further irritate your skin.

To make an oatmeal paste, combine 1 tablespoon of colloidal oats with 1 teaspoon of baking soda. Gradually add just enough water to form a paste and mix well. Apply to irritated areas. After it's dry, rinse the paste off with warm water.

## Bug Bites and Stings

**Treatment.** Lavender (*Lavandula angustifolia*) is anti-inflammatory, analgesic (pain-killing) and calming. Keep a frozen lavender-infused cloth or a simple lavender and baking soda paste on hand for the next time your path collides with a poisonous, panicky pollinator.

To make a lavender-infused frozen cloth, wet a washcloth with water and wring out the excess moisture. Squeeze 5 drops of lavender essential oil on the wet cloth, place it inside a resealable bag, and store it in the freezer. When you get stung, remove the cloth from the bag and apply it directly to the inflamed area. It will help reduce swelling and relieve pain.

Oats have antioxidant and anti-inflammatory properties that help soothe itchy skin.

You can also try a mixture of 3 drops of lavender essential oil and 1 teaspoon of baking soda, which is thought to help neutralize the acidic venom in bee and fire ant stings. Add enough water to the mixture to form a paste, and plaster the paste over the sting. Remove the paste after about 30 minutes or after it's dry. Reapply as needed.

Plantain (*Plantago major*) is a common weed—not to be confused with the banana-like fruit—that contains pain-relieving, astringent and mildly antibacterial substances, a trio of traits that are beneficial for healing insect stings and

minor abrasions. A 2012 study showed that skin tissue in mice healed faster when plantain was applied, compared with a control group.

The next time you get a bug bite or small wound, gather five to 10 plantain leaves and mash them with your fingers to release the beneficial tannins. Apply the juicy pulp to the affected area for about 30 seconds. Repeat as needed.

## Burn Relief


**Prevention.** For gardeners, the main causes of burns are ultraviolet radiation (sunburn) and friction (blisters). You can prevent the former by wearing protective clothing, a floppy hat and sunscreen.

Avoid the latter by wearing good gloves, using tools that fit you and the job at hand, and avoiding prolonged, repetitive movements. When preventive measures fail, however, these remedies help.

**Treatment.** Scientific studies show that honey, an ancient wound-healer, is antibacterial and speeds healing of burns better than conventional burn dressings containing silver sulfadiazine. Using a clean butter knife, spread organic, high-quality honey on a piece of sterile gauze large enough to cover the burn. Tape the edges of the gauze in place so the bandage is comfortable. After six hours, remove the dressing, gently rinse the skin, and reapply a fresh strip of the honey-coated gauze.

Tea (*Camellia sinensis*) compresses are a time-honored treatment for sunburns. Tea is anti-inflammatory, antioxidant, antibacterial and astringent. Compared with black tea, green tea has stronger an-





**Practice prevention: Avoid sunburns and heat exhaustion by wearing a thin, long-sleeved shirt and a floppy hat while working in the yard or garden.**

tioxidant and antibacterial effects. If you want to use an herbal tea, German chamomile is antioxidant, anti-inflammatory, antimicrobial and wound-healing.

To make a tea compress, bring a half-cup of water to a boil. Pour the boiling water into a mug and submerge the tea bag of your choice (green, black or chamomile). Let cool to room temperature. Dip a clean cloth into the tea and lay the cloth on your burn until pain subsides.

Aloe (*Aloe vera*) is anti-inflammatory, promotes circulation, and inhibits bacterial and fungal growth. Most studies show that aloe speeds healing of burns and wounds. Keep an aloe plant on your windowsill so you can squeeze the fresh gel from a leaf, or look for a product that's at least 90 percent pure aloe. Apply pure aloe gel to the burn, or blend 1 tablespoon of gel with 10 drops of lavender essential oil.

**Blisters—to pop or not?** The skin on top of a blister and the fluid underneath protects the fragile new skin below. The fluid absorbs into skin on its own, so the general rule is not to puncture. On the other hand, if the blister is large, irritating or painful, you may wish to drain it. To do so, wash your hands and sterilize a needle by heating it in a flame. After it cools, insert the needle into the blister and gently massage out the fluid. Do not remove the flap of skin. Apply an antibiotic cream or ointment, and cover with a bandage. Call your doctor if signs of infection develop, such as yellow discharge or red lines leading away from the blister.

## Cuts and Scrapes

**Treatment.** Comfrey (*Symphytum officinale*) leaves and roots contain allantoin, which helps the regeneration of new skin cells. Research has shown that abrasions heal faster with topical comfrey relative to a placebo.

To use, wash the site of your wound thoroughly. Harvest a comfrey leaf and rough it up with your fingers. Place this backyard bandage against the wound. Secure it with a clean, damp cloth. Leave it in place for an hour before removing.

Sanitizing wounds with soap and clean, cool water is sufficient for minor scrapes and cuts. Stronger solutions, such as hydrogen peroxide or iodine, can actually irritate a cut, harm tissue and slow the healing process.

## Sore Muscles

A 2012 clinical trial found that when virgin olive oil was applied topically to arthritic knees, it provided superior pain relief compared with an over-the-counter ointment containing the anti-inflammatory drug piroxicam.

Turmeric and ginger are traditional Indian analgesic and anti-inflammatory agents. Cayenne contains capsaicin, which acts as a counterirritant (it initially causes a mild burning sensation, but then silences local pain nerves). Studies have shown that topical capsaicin reduces pain from osteoarthritis, rheumatoid arthritis and back pain.

**Treatment.** For a pain-relieving poultice, blend 1 tablespoon each aloe gel and

unfiltered, extra-virgin olive oil, 2 teaspoons each ground turmeric and ground ginger, and 1 teaspoon ground cayenne pepper. Spread the paste over the painful area. Hold it in place with cloth or plastic wrap, and remove after 30 minutes.

Turmeric will stain clothing and temporarily tinge your skin. Wash your hands and avoid touching your eyes or other sensitive areas after handling cayenne powder.

## Heat-Related Ailments

**Prevention.** Working outside during summer months can heighten the risk of heat stroke and heat exhaustion.

Garden in the relative cool of morning and evening. Wear thin, loose, light-colored clothing, a wide-brimmed hat and gloves. Drink plenty of water. Keep an eye out for warning signs of heat exhaustion, such as dizziness, weakness, nausea and vomiting. Rather than looking flushed, your skin may be pale, warm and damp.

**Treatment.** At the onset of symptoms, the best strategy is to quit working, move to the shade or indoors, remove clothing, and drink fluids. Go easy on yourself, and remember: Tomorrow is another day. 🌳

Linda White, M.D., usually remembers to wear gardening gloves when plunging her hands in soil. She keeps a potted aloe plant and lavender essential oil on hand for minor injuries.





# Tips and Techniques for WATER-WISE GARDENING

Tap these efficient garden-watering systems to save on your water bill while still growing food despite drought and heat.

By Barbara Pleasant

**T**his gardening season, with climate change causing higher temperatures and desperate droughts in multiple regions, many of us will experience weeks or even months in which sparse

rainfall won't keep pace with the sun's hot rays. To keep your crops' thirst quenched, try some options outlined in this roundup of water-wise gardening strategies, from familiar irrigation methods—such as soaker and drip hoses—to a lesser-known system called “partial root-zone drying.”

The best watering methods will depend at least partly on planting arrangement and crop type. Planting leafy greens, onions and other shallow-rooted plants in blocks rather than rows will simplify watering, especially if you water by hand. With crops that occupy more time and space in the





garden, such as beans, peppers, sweet corn and tomatoes, better options include using soaker hoses, drip irrigation or carefully managed ditches. Even with regular rainfall, crops that require a relatively large amount of water to thrive, such as beans and sweet corn, will almost always need supplemental irrigation.

## Make Foes of Weeds and Friends With Mulch

A water-wise garden is no place for weeds. According to research from Michigan State University, a combo of good weed control and adequate mulch can conserve up to 1 inch of water per week during toasty summer months. Left uncontrolled, however, some weeds, such as crab grass and lamb's-quarters, will slurp up more than 80 gallons of water to produce just 1 pound of plant tissue.

Fundamental organic gardening practices that improve soil and limit weeds will set the stage for efficient garden-watering systems. If you add compost or rotted

manure to the soil each time you plant, as well as use biodegradable mulches that break down into organic matter, your soil will retain moisture better. In general, the more grass clippings, leaves, coffee grounds and other organic materials you add to your soil, the less likely your crops will be to suffer from moisture stress. Another reason to be mad for mulch: Even before it breaks down into organic matter, a thick layer of mulch applied around plants will help by cooling and shading the soil, thus keeping your garden from drying out quickly after a watering or rain shower.

## Soaker Hoses and Drip Systems

I have long been an advocate of the 25-foot soaker hose, which weeps water evenly along its length, as if it were sweating. Soaker hoses work especially well for closely spaced crops and intensively planted beds. You can make your own soaker hoses by collecting old or leaky garden hoses from your friends and drilling small

holes into them every few inches. Just cap or clamp off the male end of the hose.

Drip irrigation systems distribute water at regular intervals through a network of hoses or tapes with slits, pores, emitters or drippers. They work well for rows of crops spaced at varying intervals (you can set the emitters at wider spacing if you're watering a crop planted farther apart), and perform best on relatively level ground, because pressure changes caused by sloping ground would result in uneven watering. If you have a large garden, look for systems that use inexpensive drip tape (brands include Aqua-Traxx, Chapin and T-Tape). The tiny holes in some emitters and drippers can become clogged with soil particles rather easily, so at least one filter needs to be screwed into the water line between the faucet (or reservoir) and the distribution lines of most drip irrigation systems.

Typical soaker hoses require at least the level of pressure from a faucet, but some drip emitter systems can use gravity alone to gradually distribute water from high cisterns or raised rain barrels to thirsty plants. For example, growers at New Mexico State University had great success raising 50-gallon water barrels head-high on a frame or platform and attaching several drip lines that fed out to a large garden plot.

To achieve deep watering from soaker hoses or drip systems, let the water run for several hours, turn off the water for an hour or so to allow the moisture to penetrate, and then water some more. Especially in clay soil, water from soaker hoses or drip irrigation can be slow to move to the subsoil, so these systems are best used often so the soil never dries out. I recommend using a timer to keep track of when to turn your soaker hoses on and off. Another memory aid: Put a rubber band around your wrist. If you're getting ready for bed and you find the rubber band still there, it means you forgot to turn off the water.

## Buried Reservoirs

While drip systems work well for crops planted in rows, crops grown in wide beds may do better when planted around a buried reservoir designed to deliver water to the plants' root zones, about 4 to 8 inches below the soil's surface for many crops. Plus, gravity-fed systems and buried reservoirs





Ramp up watering efficiency by using drip tape in your garden beds. Drip irrigation works especially well for evenly spaced crops planted in long rows.

would free you of any worries about whether you remembered to turn the water off. One ancient technique is to bury porous terra cotta jugs, called *ollas*, leaving just the mouths of the jugs aboveground. Fill them up, and they'll then slowly seep water to plants' roots. Handmade *ollas* aren't widely available, but you can order them online at specialty stores (try [www.DrippingSpringsOllas.com](http://www.DrippingSpringsOllas.com) or shop. [GrowingAwarenessUrbanFarm.com/Ollas](http://GrowingAwarenessUrbanFarm.com/Ollas)).

After noticing that hard-shelled gourds often survive intact for more than a year in my compost pile, I plan to try using them as biodegradable *ollas* this summer. I'll drill some tiny holes, cut off their necks, fish out the seeds, and—*voilà!*—gourd *ollas*!

Try the humble plastic milk jug or kitty litter container for more immediate *olla* alternatives. Fill jugs two-thirds full of water and freeze them. When frozen solid, take them outside and make lots of little holes in them using a drill or nail, covering all sides with holes up to the jugs' shoulders. (Freezing first will keep the sides stable for easy drilling.) Bury your jugs in early spring, before you plant crops. Place such reservoirs where a tipi of beans will go, or in the center of where you'll plant a trio of peppers, filling them as needed.

If you have some black plastic nursery pots, you can turn these into water reservoirs, too. Line the bottoms with a double layer of newspaper, fill the pots with small rocks or stones, and then sink

them into the soil up to their rims and fill with water as needed.

## Simple Irrigation Ditches

In extreme summer climates, where plants are screaming for water at the end of hot days with drying winds, old-fashioned irrigation ditches are quite practical when closely monitored. Your garden should be relatively level and laid out in rows for ditches to work efficiently. When crops are still small and you're hoeing to control weeds, cut shallow

The more organic matter in your soil, the less likely your crops will be to suffer from moisture stress.

trenches along at least one side of each row. Then, when plants need to wet their whistles, simply drop the hose in one end of the ditch, continue with other chores for a bit, and then remove the hose after the ditch has filled.

MOTHER's Editor-in-Chief Cheryl Long likes to use irrigation ditches for most of her crops. "I choose soaker hoses for my perennials, such as strawberries and asparagus, but for annuals, I find it's easier to use a hoe to shape irrigation ditches right after planting," she says. This

method won't require any extra equipment, and it will direct water to plants' root zones and keep you from watering paths and other unintended areas.

## What About Sprinklers?

Popular and affordable, sprinklers will save time when you need to keep newly planted seed beds constantly moist, and periodic use of sprinklers can help dissolve salts that accumulate at the soil's surface in some regions. Overhead irrigation via sprinklers may also be a good option if you have a large planting of crops with wide root zones, such as winter squash, the roots of which can reach up to 25 feet in diameter in just 11 weeks.

The main downside to sprinklers is that they can be wasteful—they water walkways and other unplanted areas, and a significant amount of water is lost to evaporation and wind. Plus, especially in humid conditions, leaves dampened by sprinklers may stay moist and become a hotbed for diseases. Watering sweet corn, staked tomatoes and other tall plants with a sprinkler can also prove challenging unless you elevate the sprinkler head to a height taller than the crops. In most situations, other garden-watering methods will be more efficient.

## Rainwater Storage

One way to store rainwater is to direct runoff from your roof out into your garden. Most soils can hold a great deal of water in the root zone, and roof runoff





Apply thick mulch to increase the water-holding capacity of your soil (left). Overhead irrigation benefits crops with wide root zones, such as squash (right).

can help you keep your soil's moisture levels high. We explain this approach in-depth in "A Better Rainwater-Harvesting System" (read it at <http://goo.gl/wwhDri>). Many gardeners capture roof runoff in rain barrels for use in the garden. Routing stored water from barrel to garden will be easy if the rain barrel sits more than a foot higher than your garden, because gravity or siphon action will move the water effortlessly to your crops.

But what if your house is lower than your garden? The highest beds in my terraced hillside garden are more than 10 feet above the nearest rain barrel. A garden at a higher elevation than its water source is not a rare situation. At an off-grid organic farm near me, farmers use a solar pump to carry water from a spring to the highest part of the farm, where it's stored in a tank or an aboveground cistern. From there, the water goes into gravity-fed drip irrigation lines—an elegantly simple system that can be replicated in a home garden by employing the kind of pump intended to move water in decorative fountains. On a sunny day, this type of inexpensive solar pump could easily be put to more practical use moving water uphill from your barrel to a waiting reservoir.

For an aboveground water-holding cistern, you can fill additional barrels, build a pond with a plastic liner, or find recycled, 275-gallon food-grade IBCs (Intermediate Bulk Containers), available online. A metal stock tank from a farm store would also fit the bill. Such a tank can perform mul-

multiple functions and will last for decades. In summer, the tank can be placed at the highest part of the garden as a water reservoir and produce-washing station. In spring and fall, use it for soaking shiitake mushroom logs, washing dogs, or other messy, wet tasks.

Sometimes, carrying water by hand is the only way to get it to where you need it, but water is heavy. Most watering cans hold 2 to 2½ gallons, which will weigh about 20 pounds when full (water weighs about 8 pounds per gallon). When I must carry water, I prefer hefting two partially filled watering cans rather than one that's brimming. I spill less this way, and this method is easier on my back. Better yet is

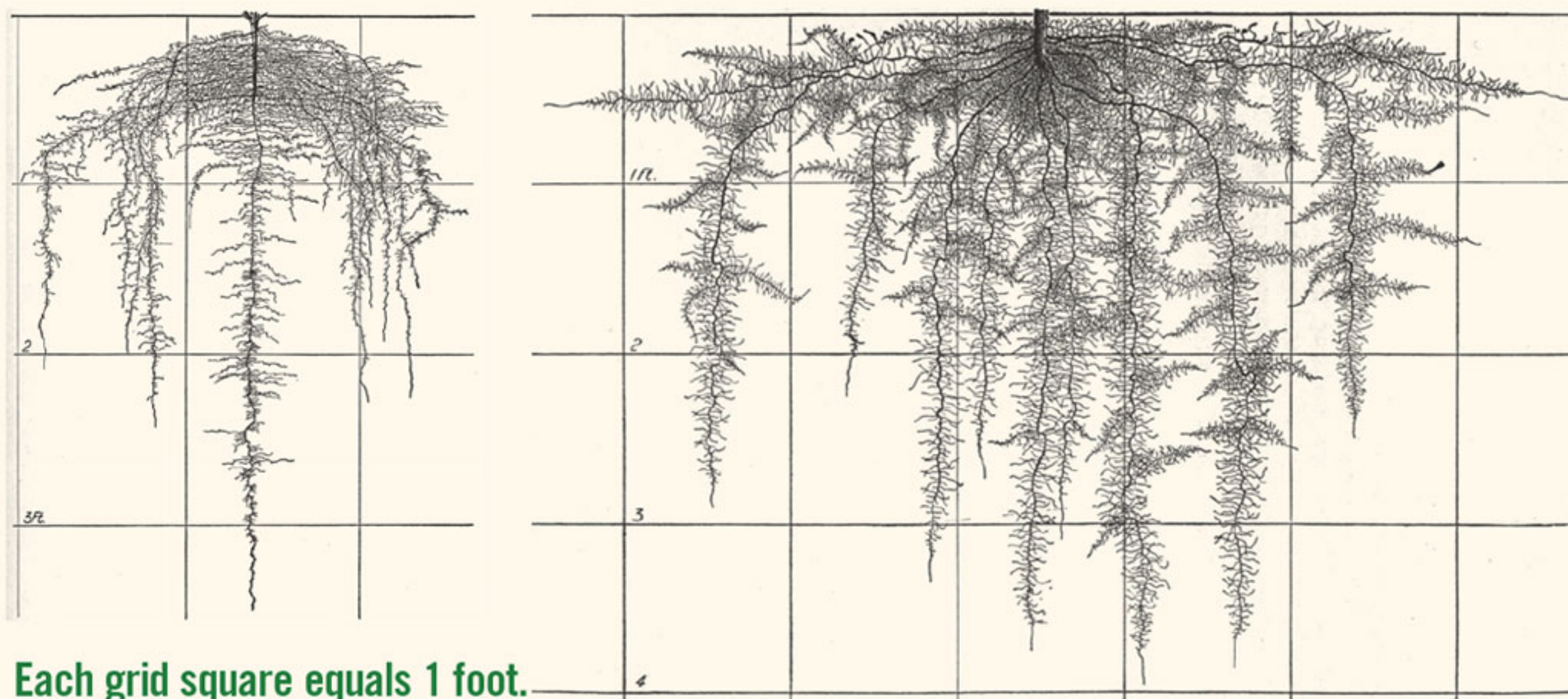
to use a carrying pole, also called a "yoke," that fits across your shoulders, making it possible to evenly balance two buckets using the strength of more body parts.

## Sunken Beds and Planting Pits

In chronically dry climates with poor soils, such as the Southwestern United States and Western Africa, vegetable yields skyrocket when crops are grown in sunken beds that capture and retain scant supplies of rainwater. The Zuni Pueblo tribe of New Mexico has long sculpted its gardens into a series of 2- to 3-foot-wide squares, with the excavated soil piled into ridges around each square to create a waffle-like

## Encourage Deep-Reaching Roots

Vegetable crops' roots can reach surprising depths. Here, a 10-week-old spinach plant (left) and a nearly mature pepper plant (right) have already hit 4 feet. Whichever watering systems you use, as your crops begin to mature, water deeply and less frequently so roots grow strong and reach down farther, rather than watering often but shallowly.



Each grid square equals 1 foot.





Try new methods: Water into trenches dug alongside crops (left), or water into buried reservoirs, such as old milk jugs, with holes poked into them (right).

design. The ridges channel rain into the beds and provide a bit of shade and wind protection for the crops.

Popular in the small African country of Burkina Faso, the *Zai* pit method involves digging a series of holes—roughly 8 inches wide—and then refilling them partway with compost and manure. The excavated soil then gets piled into berms that shade and channel water to double rows of these permanent planting holes, which are refreshed with manure and compost each year. The *Zai* pit method at least tripled the productivity of millet in dry desert climates, and it has also worked miracles in the degraded soils of Ethiopia, increasing potato production five-fold, tripling the productivity of beans, and boosting overall water efficiency by 500 percent on average, according to a 2011 report published by *Cambridge University Press*.

## Throw Some Shade

In dire situations where hot sun and wind threaten to desiccate gardens, you can turn down the heat with shade covers or windbreaks placed alongside plants, or by planting shelter crops. For example, old window screens or pieces of lightweight cloth attached to stakes on the south side of your tomatoes can serve this purpose. In much of Texas, where drying winds necessitate water-wise gardening every season, green windbreaks of fall-planted grains, such as wheat, rye, sorghum or oats, shield winter onions and spring vegetables, and switchgrass, tall sunflowers

or corn serve as shelter crops in summer. Ideally, the shelter crop will be well-established along the garden's perimeter before regular garden crops go in.

Snow fencing makes a wonderful windbreak that's easy to install by attaching it to metal stakes. Growers in hot, dry climates use this technique to shade the root zones of tomatoes and peppers while leaving the plants' canopies open to the sun. Windbreaks can be quite small, too—place a wood shingle upright in the soil next to transplanted seedlings to block prevailing winds and harsh summer sun.

## Partial Root-Zone Drying

In studies of the novel irrigation method known as “partial root-zone drying,” completed in 2009 at the University of Copenhagen, scientists grew tomatoes in partitioned pots so that only half the roots could be watered at a time. When half the roots were allowed to dry out, the plants launched defensive maneuvers. Leaf stomata remained partially closed to reduce moisture loss, and roots foraged more efficiently for nitrogen. Meanwhile, new growth and fruit development continued, because the plants' watered sides received ample water and nutrients. Today, farmers are successfully using the partial root-zone drying irrigation method on corn, grapes, peppers, potatoes and other crops.

Here's how to put it to work in your garden: Grow crop plants normally for the first six weeks, or until they are well-established. After that, employ soaker

hoses, drip lines or irrigation trenches to provide water to one side of the plants at a time. When the plants need watering again, irrigate the opposite side. Partial root-zone drying will reduce yields slightly, but won't affect fruit quality, and that small loss will be offset monetarily by saved water. When combined with soaker hoses or drip irrigation, the partial root-zone drying method will significantly improve watering efficiency. 🌳

## DROUGHT TRACKERS

When a drought has you in its grip, you desperately want to know when it will end. Here are some tools to help you find out when it will be right as rain again.

**U.S. Drought Portal:** One of the best drought-monitoring tools available. Searchable by ZIP code, and includes early drought warnings. Go to [www.Drought.gov](http://www.Drought.gov).

**U.S. Drought Monitor:** Hosted by the University of Nebraska in collaboration with several federal agencies. Updated weekly with a written summary and reports from nine geographical regions. Go to [www.DroughtMonitor.unl.edu](http://www.DroughtMonitor.unl.edu).

**Climate Prediction Center:** Hosted by the National Weather Service, and provides daily updates on drought-related weather data and predictions. Go to [www.CPC.NCEP.NOAA.gov](http://www.CPC.NCEP.NOAA.gov).



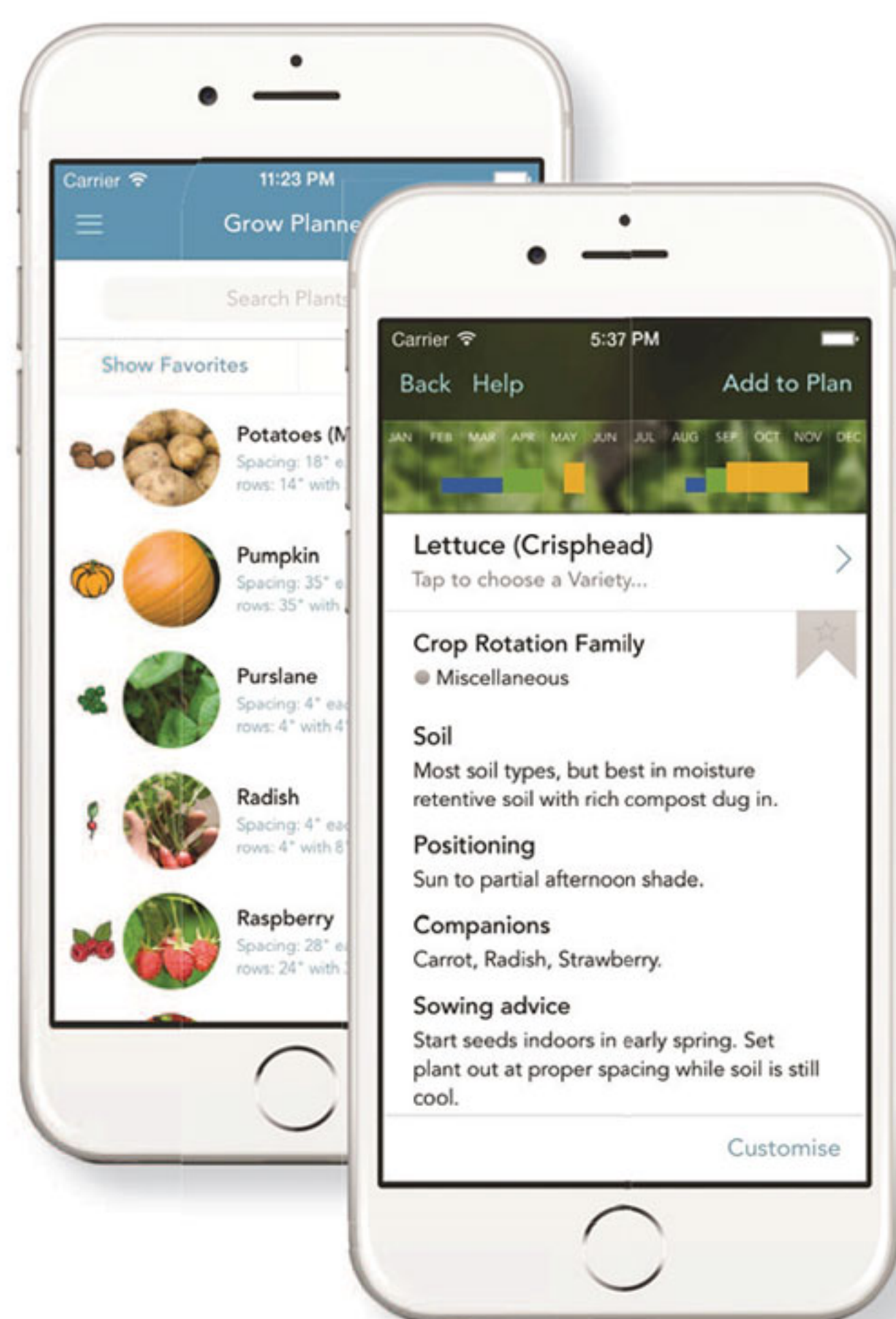
## WATER-WISE CROPS!

Some plants can take the heat better than others can. Choosing drought-tolerant crops and varieties is one savvy strategy of water-wise gardeners. Head to <http://goo.gl/Wshn6A> to browse a chart of our top recommendations.



# TOP-NOTCH GARDENING APPS!

*Get ready to have your most successful garden season yet with the help of these two apps.*



## ***Grow Planner***

Our popular desktop Vegetable Garden Planner is also a sleek app for either iPhone or iPad. The app version allows you to access and update your plans while in your garden, and your plans will conveniently sync across your devices. The app still provides the same outstanding garden-planning features, and includes growing guides for about 200 crops. (\$7.99)

## ***When to Plant***

Stop guessing about when to sow seeds or transplant seedlings into your garden. No matter the season, our *When to Plant* app uses your ZIP code and a database of almost 5,000 weather stations across North America to keep track of the best time to put your crops in the ground. Available for both Apple and Android devices. (\$1.99)




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Chili and cornbread, cooked together in a slow cooker, make a flavorful and simple stew (see recipe on Page 56).

# EASY ONE-POT MEALS

By Rebecca Martin

**B**usy cooks have a taste for one-dish meals, ranking them among their favorite recipes. When cooked together, individual foods blend flavors to produce a delectable dish that's better than the sum of its parts. These dinners also minimize prep time in the kitchen and reduce the number of dirty pans to clean after everyone has pushed away from the table.

Each of these meals comes together in a single pot, although you may need smaller bowls for mixing. Plan ahead to use leftover mashed potatoes in the Shepherd's Pie (Page 57). Use a pressure cooker to shorten the cooking time of Short Ribs With Root Vegetables (Page 56).

Order the cookbooks from which most of these recipes were taken on Page 63. Find a year's worth of dishes at [www.MotherEarthNews.com/Easy-Meals](http://www.MotherEarthNews.com/Easy-Meals).

## Spicy Eggs With Kale

Kale is the nutritious green at the heart of this recipe, but you can also substitute spinach, Swiss chard or collard greens. Cook the eggs lightly, keeping the yolks slightly runny to create a rich, creamy sauce for the greens.

Lightly adapted from *One Pot of the Day* by Kate McMillan. *Yield: 4 servings; cook time: 15 minutes.*

2 tbsp unsalted butter  
4 green onions, chopped  
2 cloves garlic, minced

2 bunches kale (or an equivalent amount of spinach, chard or collards), stems removed, roughly chopped  
1 cup chicken or vegetable broth  
Salt and pepper, to taste  
Zest and juice of 1 lemon  
4 eggs

Melt butter in a large skillet over medium-high heat. Add green onions and garlic. Cook, stirring, until fragrant, about 1 minute. Add half of the kale and sauté, stirring frequently until it begins to wilt, about 2 minutes. Stir in the

Want to serve up convenient, well-balanced dishes without making a mess of your kitchen? Now you're cookin'!





**Sautéed greens form an edible bed for lightly poached eggs when you rustle up Spicy Eggs With Kale.**

remaining kale and repeat. Add chicken broth, ½ teaspoon salt and ¼ teaspoon pepper. Stir in lemon zest and juice.

Simmer until the kale softens, about 6 minutes, stirring occasionally.

Using the back of a spoon, create 4 depressions in the bed of kale. Crack an egg into each depression. Reduce the heat to medium-low, and sprinkle the

eggs with salt and pepper. Cover the pan and cook until eggs are almost opaque, about 4 minutes. Turn off the heat and let the eggs rest, covered, until done to taste.

## Roasted Winter Vegetables and Sausages

Roasting makes cool-season veggies appealing even to picky eaters. Segregate the beets dur-

ing cooking so they don't turn the other vegetables pink. If you prefer meatless meals, you can substitute a cup of cooked beans for the sausages. Recipe by Rebecca Martin. *Yield: 4 servings; cook time: 30 minutes.*

*1 pound sweet potatoes, peeled and cut into ½-inch wedges*  
*¼ cup olive oil, divided*  
*1 medium onion, peeled and*

*sliced vertically into wedges*  
*2 medium beets, peeled and cut into ½-inch wedges*  
*4 bratwursts or Italian sausages, sweet or hot (about 1 pound)*  
*1 pound small Brussels sprouts, trimmed, stems scored*  
*1 tbsp fresh tarragon, chopped*  
*1 tbsp fresh thyme, chopped*  
*1 tsp fresh rosemary leaves, chopped*  
*Salt and pepper, to taste*  
*Spicy brown mustard*

Preheat oven to 400 degrees Fahrenheit. In a bowl, toss the sweet potatoes and onion wedges in half of the oil, and then spread them onto a heavy baking sheet, leaving one corner of the sheet empty. Toss beets in the same oil, and then drop them into the empty corner. Lightly salt and pepper the

## Chicken and Dumplings

Nothing beats homemade, slow-cooked chicken and dumplings for a stick-to-your-ribs meal. This one-pot classic comes from the files of our sister publication *Grit* magazine, and is lightly adapted from its *Comfort Food Cookbook*. *Yield: 6 servings; cook time: 2 hours.*

*1½ cups all-purpose flour*  
*¼ tsp baking powder*  
*Pinch salt*  
*1 tbsp lard or butter*  
*½ cup water*  
*1 whole chicken, cut into pieces (about 4 pounds)*  
*1 tbsp seasoning salt*  
*3½ quarts water*  
*½ small onion, finely chopped*  
*1 stalk celery, finely chopped*  
*1 carrot, finely chopped*  
*¼ cup butter*  
*Salt and pepper, to taste*  
*1 tsp poultry seasoning*

In a large bowl, sift flour, baking powder and salt. Cut in the lard until mixture resembles coarse crumbs. Stir in water until mixture forms a ball. Wrap the dough ball tightly and refrigerate for at least 2 hours or overnight.

Remove skin from chicken breasts, thighs and back; leave skin on legs and wings. Season chicken pieces with seasoning salt and place



**Tender chunks of chicken complement the hearty dumplings in this dish.**

in a large stockpot. Add water, onion, celery, carrot and butter. Bring to a boil; reduce heat to simmer. Cook for about 1½ hours, or until meat falls off the bone. Remove chicken, let cool slightly, then strip the meat from the bones. Return chicken meat to the pot.

Remove dough ball from refrigerator. Pull off pieces of dough and roll into rough balls about 1 inch in diameter. Drop into the simmering broth for about 15 minutes, or until dumplings are cooked through. Add more water if necessary. Season broth with salt, pepper and poultry seasoning while dumplings are cooking.





Sweet potatoes, beets and Brussels sprouts mix it up in Roasted Winter Vegetables and Sausages.

vegetables. Space the sausages around the sheet, avoiding the beets. Lay a piece of aluminum foil loosely over the pan and slide it into the oven.

Set the timer for 15 minutes, and trim the Brussels sprouts

while you wait. When the timer sounds, pull the sheet from the oven. Flip the vegetables and sausages with tongs or a spatula. Place sprouts in the spaces between the sausages and vegetables, again avoiding

the beets, and re-cover the sheet with the foil. Return the pan to the oven for 15 more minutes. Remove the pan and drizzle everything with the remaining oil. Sprinkle with fresh herbs and serve with spicy mustard.

## Chili With Cornbread

Chili is a hearty one-pot meal on its own, but this slow cooker recipe offers a bonus—cornbread made inside the same vessel. You can also easily adjust this recipe to make pressure-cooker chili: Spoon the cornbread batter into a heat-proof dish, cover the dish with aluminum foil, and lower it into the cooker using a foil sling (find easy instructions online at <http://goo.gl/YQnmRt>). Cook at high pressure for 30 minutes, followed by natural release. For a different chili flavor, try substituting a 12-ounce bottle of dark beer for 1 cup of the water, or adding 2 table-

## Short Ribs With Root Vegetables

After you drop the short ribs into the pot, you can leave the kitchen until this meal is ready to eat. Turn this into a pressure-cooker recipe by simply cooking the ingredients on high pressure for 1 hour. Encourage diners to mash the cooked root vegetables to absorb the sauce. Lightly adapted from *Simply Ming One-Pot Meals* by Ming Tsai and Arthur Boehm. *Yield: 4 servings; cook time: 3 to 4 hours.*

1 ½ cups all-purpose flour  
1 tbsp chili powder  
6 single-rib or 3 double-rib short ribs  
Kosher salt and freshly ground black pepper, to taste  
3 tbsp grapeseed or canola oil  
2 onions, cut in 1-inch dice  
2 tbsp minced garlic  
1 pound carrots, cut in 1-inch slices  
6 celery stalks, split lengthwise and halved  
1 medium celeriac (celery root), peeled and cut in 1-inch dice  
1 large sweet potato, cut in 1-inch dice  
1 large parsnip, cut in 1-inch dice  
2 tbsp soy sauce

Combine the flour and chili powder on a large plate. Season the ribs with salt and pepper, and dredge them in

the flour mixture. Heat a stockpot or another tall, wide pot over medium heat on the stove. Add 2 tablespoons of the oil and swirl to coat the bottom of the pot. After the oil is hot, shake the excess flour mixture from the ribs, add them to the pot and cook them, turning once, until browned, about 8 minutes. Set the ribs aside.

Add the remaining oil to the pot, and swirl to coat the bottom. When the oil is

hot, add the onions and garlic, and sauté, stirring, about 3 minutes. Add carrots, celery, celeriac, sweet potato and parsnip. Season with salt and pepper. Add the ribs, soy sauce and enough water to almost cover the ingredients. Taste and adjust the seasoning, if necessary. Cover and cook over medium heat until a knife passes through the meat easily, about 3 hours. Transfer the ribs and vegetables to a large bowl and serve.



You can braise fall-off-the-bone ribs slowly on the stovetop or quickly in a pressure cooker.

ANTONIS ACHILLEOS; TOP: HANNAH KINCAID



spoons of finely ground coffee with the spices. Lightly adapted from *50 Simple Soups for the Slow Cooker* by Lynn Alley. Yield: 6 to 8 servings; cook time: 7 to 9 hours.

#### Chili

2 cups dry beans, preferably black beans  
6 cups water  
6 allspice berries  
1 stick cinnamon  
1 tsp cumin seed  
1 tsp coriander seed  
¼ tsp aniseed  
3½ cups (28 ounces) crushed tomatoes, canned or frozen  
1 medium onion, diced  
3 cloves garlic, minced  
¼ cup red bell pepper, diced  
¼ cup green bell pepper, diced

1 tsp dried oregano  
1 to 2 tbsp chili powder  
¼ cup cocoa powder

#### Cornbread

1 cup cornmeal  
1 cup all-purpose flour  
¼ cup granulated sugar  
1½ tsp baking powder  
½ tsp baking soda  
½ tsp salt  
2 eggs  
2 tbsp vegetable oil  
1 cup buttermilk

#### Toppings (optional)

1 cup sour cream or yogurt  
¼ cup green onions, sliced  
½ cup black olives, sliced  
½ cup fresh cilantro, chopped  
½ cup grated cheddar cheese

**To make the chili:** Rinse the beans thoroughly and place them and the water into a 7-quart slow cooker. Grind the allspice, cinnamon, cumin, coriander and aniseed with a spice mill or a mortar and pestle. Add the spices to the beans, along with the tomatoes, onion, garlic, bell peppers, oregano, and chili and cocoa powders. Cover and cook on low until the beans are tender (6 to 8 hours), and then turn the slow cooker to high and prepare the cornbread.

**To make the cornbread:** Pulse the cornmeal, flour, sugar, baking powder, baking soda and salt in a food processor until thoroughly mixed. Add

the eggs, vegetable oil and buttermilk, and pulse until the liquid ingredients are thoroughly mixed in with the dry. Drop large spoonfuls of the cornbread mixture onto the surface of the chili, and continue cooking on high with the lid slightly ajar for 1 hour, or until a toothpick inserted into the cornbread comes out clean. Serve with toppings. 🌳

Managing Editor Rebecca Martin fires up a pressure cooker (she owns two) for a one-pot supper nearly every week.

## Shepherd's Pie

Shepherd's pie is traditionally a lamb dish, but you can substitute any cubed or ground meat for the lamb shoulder in this recipe. Lightly adapted from *One Pot of the Day* by Kate McMillan. Yield: 6 servings; cook time: 2 hours.

2 pounds boneless lamb shoulder, cut into 1-inch chunks  
Salt and pepper, to taste  
2 tbsp olive oil  
5 tbsp unsalted butter  
1 large yellow onion, chopped  
3 carrots, chopped  
3 celery ribs, chopped  
2 small cloves garlic, minced  
⅓ cup all-purpose flour  
3⅓ cups beef broth  
⅔ cup dry white wine  
2 tsp fresh rosemary, minced  
1 cup peas, fresh or frozen and thawed  
3 cups mashed potatoes, warmed

Preheat oven to 325 degrees Fahrenheit. Season the lamb with salt and pepper. In a 3-quart Dutch oven, heat the oil over medium-high heat on the stovetop. Working in a few batches, sear the lamb, turning chunks until browned on all sides, about 5 minutes. Transfer to a plate.

In the same pot, melt 4 tablespoons of the butter over medium heat. Add the onion, carrots, celery and garlic. Cover and cook, stirring occasionally, until the carrots are just tender, about 5

minutes. Uncover, sprinkle with the flour, and stir well. Gradually stir in the broth and wine. Add the rosemary. Bring to a boil over medium heat, stirring to scrape up any browned bits from the bottom of the pot. Return the lamb to the pot, cover and place in the oven. Cook for 1½ hours, until the lamb is tender.

Remove from the oven and season with salt and pepper. Stir in the peas. Spread the mashed potatoes evenly on top of the lamb mixture. Cut the remaining 1 tablespoon of butter into bits and dot the potatoes. Bake uncovered, until the potatoes are lightly browned, about 20 minutes. Remove from the oven and let stand 5 minutes before serving.



Enjoy yesterday's mashed potatoes as a topping on this Shepherd's Pie.



# Best Vegetables TO GROW IN THE SHADE

Even in shady conditions, you can bask in great garden harvests if you choose the right crops and make a few easy adjustments.

By Colleen Vanderlinden  
Illustrations by Frank Fretz

For many gardeners, the optimum conditions most vegetables prefer—eight to 10 hours of full sun—just aren't possible. Whether from trees or shadows from nearby buildings, shade is frequently a fact of gardening life. Luckily, shade doesn't have to stop you from growing food. If you start with the most shade-tolerant crops (see the chart on Page 60), take extra care to provide fertile soil and ample water, and consider using a reflective plastic mulch, you can establish a productive shade garden and harvest a respectable variety of veggies.

## How Much Shade Is Too Much?

All shade is not equal. Some shady conditions will yield much more produce than others will, while some areas are better left for hostas and moss. Gardeners should be familiar with the different types of shade, but should also keep in mind that measuring how much shade your garden gets isn't always easy.

For instance, nearby trees may cast **dappled shade** on your garden for some or all of the day. If the tree canopy is high enough and the branches aren't too dense, the conditions nearby can be shady but still fairly bright. Trimming any low-hanging branches can help let in more sunlight.

More challenging than dappled shade is **partial shade**, which can be quite variable, ranging from only a couple of sunny hours and many hours of shade to the opposite. Shade from buildings is more difficult to deal with than shade from trees, as it often plunges the garden into total shade for large parts of the day. As a general rule, if you have a few hours of full sun but dark shade for the rest of the day, you can grow some crops, but the yields won't be as high as if you had bright or dappled shade during the rest of the day.

Maybe your garden has a little of everything: some areas that get a couple of hours of sun, some that get dappled shade and some that are in complete shade—and the amounts of shade will change seasonally. With such a scenario, adding up the exact amount of sun your crops get can be difficult. Keep an open mind about what you may be able to grow in your conditions.





## Success in the Shade

- Remove low-hanging branches
- Use raised beds with liners to discourage tree roots from wicking water away from crops
- Use reflective mulches (illustrated at bottom right) to give plants more light





# Reflective Mulches and Surfaces

Reflective mulches, including metallic mulches, are a great tool for gardeners growing in shady conditions, and for some crops in some regions, the benefits can be huge. University studies have shown increased yields in crops such as peppers, tomatoes and strawberries.

Reflective mulches—such as the red plastic mulch some tomato growers are fond of—reflect light up onto the leaves of plants. Mathieu Ngouajio, professor of vegetable crops in Michigan State University’s Department of Horticulture, says that under partial shading, reflective mulches have been shown to provide the following advantages: increased amount of light in the plant canopy, increased air temperature in the plant canopy, increased photosynthesis, reduced incidence of certain insects (particularly aphids and thrips), and increased produce yield and quality. Ngouajio recommends metallized reflective mulches (which look like aluminum foil) because they reflect the entire light spectrum and will have the greatest impact on increasing photosynthesis and, therefore, growth.



When gardening without full sun, paint any nearby walls white to create as bright an area as possible.

Creating other bright, reflective surfaces near your garden will also benefit plants. If you’re growing near a wall, R.J. Ruppenthal, who shares his experiences with his small, Bay Area garden in his book *Fresh Food From Small Spaces*, recommends painting the wall white or another light color.

“A bright-painted wall that faces the sun for any period of the day, particularly south-facing, will reflect an enormous amount of light and heat,” Ruppenthal says. “This speeds up growth rates quite a bit, and can compensate for some other shade during the day.”

We encourage you to try reflective mulches (aluminum foil should also work nicely) and reflective surfaces in your own shady garden. If you do give them a try, send us a quick note at [letters@motherearthnews.com](mailto:letters@motherearthnews.com) to let us know how they work.

## Soil Considerations

If you’re going to push the envelope sun-wise, make sure your soil is well-prepared. Amend it with plenty of mature compost, and loosen the soil to at least a foot before planting your crops. The roots of nearby shade trees present a challenge all their own.

# Best Shade-Tolerant Vegetables

When considering which crops to grow in shady areas, think of them in terms of leaves and roots. Crops we grow for their leaves (kale, lettuce, spinach) and those we grow for their roots (beets, carrots, turnips) will do fairly well in partially shady conditions. (The crops we grow for their fruits—such as eggplants, peppers and tomatoes—really do need at least six hours of full sun per day.)

Crop	Shade Notes	Growing Tips
Arugula	At least three to four hours of sun per day.	Arugula welcomes shade, as this crop is prone to bolting as soon as the weather turns warm if in full sun.
Asian greens	At least two hours of sun per day.	Asian greens such as bok choy (also spelled “pac choy” and “pak choy”), komatsuna and tatsoi will grow wonderfully with a couple of hours of sun plus some bright shade or ambient light.
Chard	If you want to grow chard mainly for its crisp stalks, you will need at least five hours of sun per day. If you want to grow it mainly for the tender baby leaves, three to four hours of sun per day will be enough.	Expect chard grown in partial shade to be quite a bit smaller than that grown in full sun. Baby chard leaves are excellent cooked or served raw in salads.
Culinary herbs	At least three hours of sun per day.	While many culinary herbs need full sun, chives, cilantro, garlic chives, golden marjoram, lemon balm, mint, oregano and parsley will usually perform well in shadier gardens.
Kale	At least three to four hours of sun per day.	You’ll notice only a small reduction in growth if comparing kale grown in partial shade with kale grown in full sun.



The roots will wick moisture and nutrients away from your crops, causing them to need more frequent watering and fertilizing, and the roots will eventually invade your well-prepared soil. To overcome this, build raised beds or grow in containers filled with good-quality potting soil. If you're building a raised bed, try lining the bottom of the bed with discarded carpet to help keep tree roots at bay.

### Pests and Diseases in Shady Gardens

In any garden, the key to successful pest and disease management is to pay close attention to your plants and deal with problems right away. This is doubly important in shady gardens, where some disease problems can be exacerbated by the low light levels, and where pests such as slugs and snails—which thrive in damp, shady conditions—can decimate your lettuce crop in a flash.

Check your garden daily for the first signs of pests. Chewed leaves are most likely from slugs or snails. Handpick these pests whenever you see them. A reflective mulch brightening your garden will do double duty as a pest deterrent: The reflective surface will confuse many pests, and they'll tend to avoid the area.

### Trial and Error

Shade gardening experts tend to champion a trial-and-error approach to growing without full sun, all offering the same

REFLECTIVE MULCH SOURCES

**Harris Seeds:** 800-544-7938;  
[www.HarrisSeeds.com](http://www.HarrisSeeds.com)

**Johnny's Selected Seeds:** 877-564-6697;  
[www.JohnnySeeds.com](http://www.JohnnySeeds.com)

**Peaceful Valley Farm & Garden Supply:**  
888-784-1722; [www.GrowOrganic.com](http://www.GrowOrganic.com)

advice: Just try it and see! Some of the vegetables on the chart below will grow better in your conditions than others will. The quality of shade, your soil type and its level of fertility, ambient temperature and how much moisture the plants get all play a role in the success of the crops.

Regional conditions also play a part in how well your garden will handle shade. In the South and at high altitudes, some shade can be a good thing during summer to protect plants from the intense sunlight. In cooler, less-sunny areas, such as the Pacific Northwest, growing in shade is a bigger challenge. Orientation can have an effect on the garden, too: North-facing slopes are already cool and shady, but south-facing slopes tend to be hot and dry during summer. South-facing gardens benefit from a bit of shade to conserve moisture and regulate temperatures slightly.

Have a blast experimenting in your garden. Rather than feeling limited by less-than-perfect conditions, try to see shade as a fun challenge to overcome. We're betting you'll eventually be enjoying plenty of delicious, homegrown food! 🌳

Colleen Vanderlinden has been gardening organically for years, and has been in love with plants for as long as she can remember. She currently rests her garden clogs on a quarter-acre plot near Detroit.

Crop	Shade Notes	Growing Tips
Lettuce	At least three to four hours of sun per day.	Lettuce is perfect for shadier gardens because the shade protects it from the sun's heat, preventing it from bolting as quickly. Often, the shade can buy a few more weeks of harvesting time than you'd get from lettuce grown in full sun.
Mesclun	One of the best crops for shady gardens. Grows in as little as two hours of sun per day and handles dappled shade well.	The delicate leaves of this salad mix can be harvested in about four weeks, and as long as you leave the roots intact, you should be able to get at least three good harvests before you have to replant.
Mustard greens	At least three hours of sun per day for baby mustard greens.	Mustard grown for baby greens is best suited to shady gardens.
Peas and beans	At least four to five hours of sun per day.	If growing these crops in partial shade, getting a good harvest will take longer. Try bush and dwarf varieties rather than pole varieties.
Root vegetables	At least four to five hours of sun per day for decent production.	Beets, carrots, potatoes, radishes and turnips will do OK in partial shade, but you'll have to wait longer for a full crop. The more light you have, the faster they'll mature. Alternatively, you can harvest baby carrots or small new potatoes for a gourmet treat that would cost an arm and a leg at the grocery store.
Scallions	At least three hours of sun per day.	This crop does well in partial shade throughout the growing season.
Spinach	At least three to four hours of sun per day.	Spinach welcomes shade, as it bolts easily in full sun. If you grow it specifically to harvest as baby spinach, you'll be able to harvest for quite a while as long as you continue to pick the outermost leaves of each plant.

*These estimates are based on the experiences of the author and the experts mentioned in this article.*



# Best Tools for BIG GARDENS

Learn the pros and cons of the implements you need to successfully—and affordably—manage a large-scale food garden.

By Joel Dufour  
Illustrations by Keith Ward

Imagine you finally have some land and you're going to start gardening in earnest. I'm talking serious food production here: growing a significant portion of your own food, and possibly even selling surplus produce at the local farmers' market. After your garden grows to a certain size, however, your generic hardware-store tools will become woefully inadequate. These tools will wear out too quickly and they're poorly designed, so they'll wear you out quickly, too. For big gardens, you need serious tools!

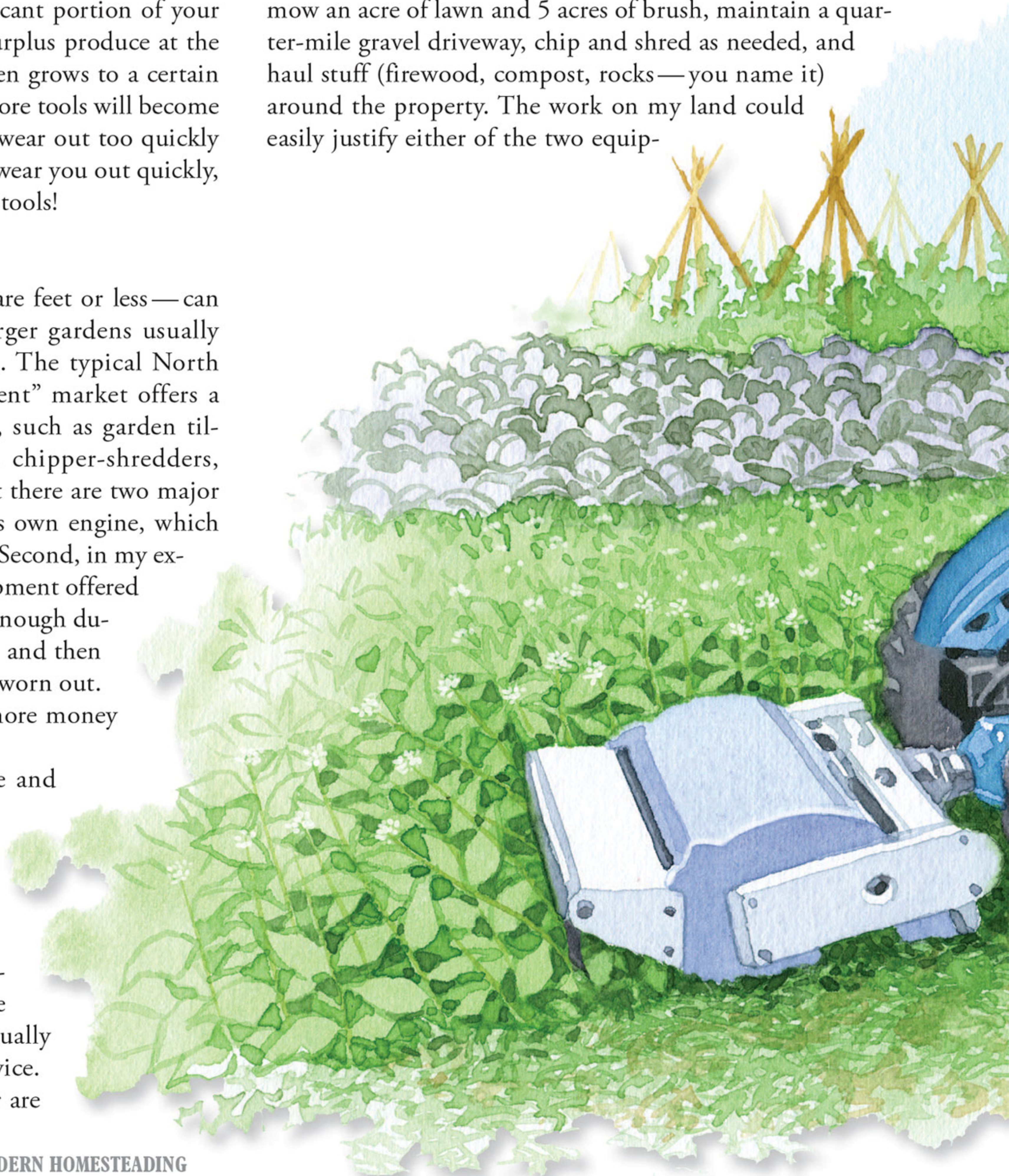
## Mechanized Equipment

While smaller gardens—5,000 square feet or less—can be managed by hand tools alone, larger gardens usually require some level of mechanical aid. The typical North American “lawn and garden equipment” market offers a plethora of single-purpose machines, such as garden tillers, walk-behind or riding mowers, chipper-shredders, and so on. This equipment works, but there are two major drawbacks. First, each machine has its own engine, which increases costs and maintenance work. Second, in my experience, most “consumer-grade” equipment offered at big-box stores is designed with just enough durability to outlast the warranty period, and then it needs major service or is completely worn out. You'll do better if you spend a little more money for “professional-grade” models.

Another option is to go for broke and jump into a four-wheel tractor with a power take-off (PTO) and a host of implements. This option overcomes the problem of needing a different small engine for each task, and, if you purchase equipment of a reputable brand, durability won't be an issue because any tractor with a PTO is usually built well enough for agricultural service. The downsides of a four-wheel tractor are

greater upfront costs, less maneuverability, and even lack of exercise for the user. These downsides can be justified if you have enough land on which to cultivate.

My own homestead is a good example of this quandary. In addition to managing a quarter-acre organic garden, we mow an acre of lawn and 5 acres of brush, maintain a quarter-mile gravel driveway, chip and shred as needed, and haul stuff (firewood, compost, rocks—you name it) around the property. The work on my land could easily justify either of the two equip-





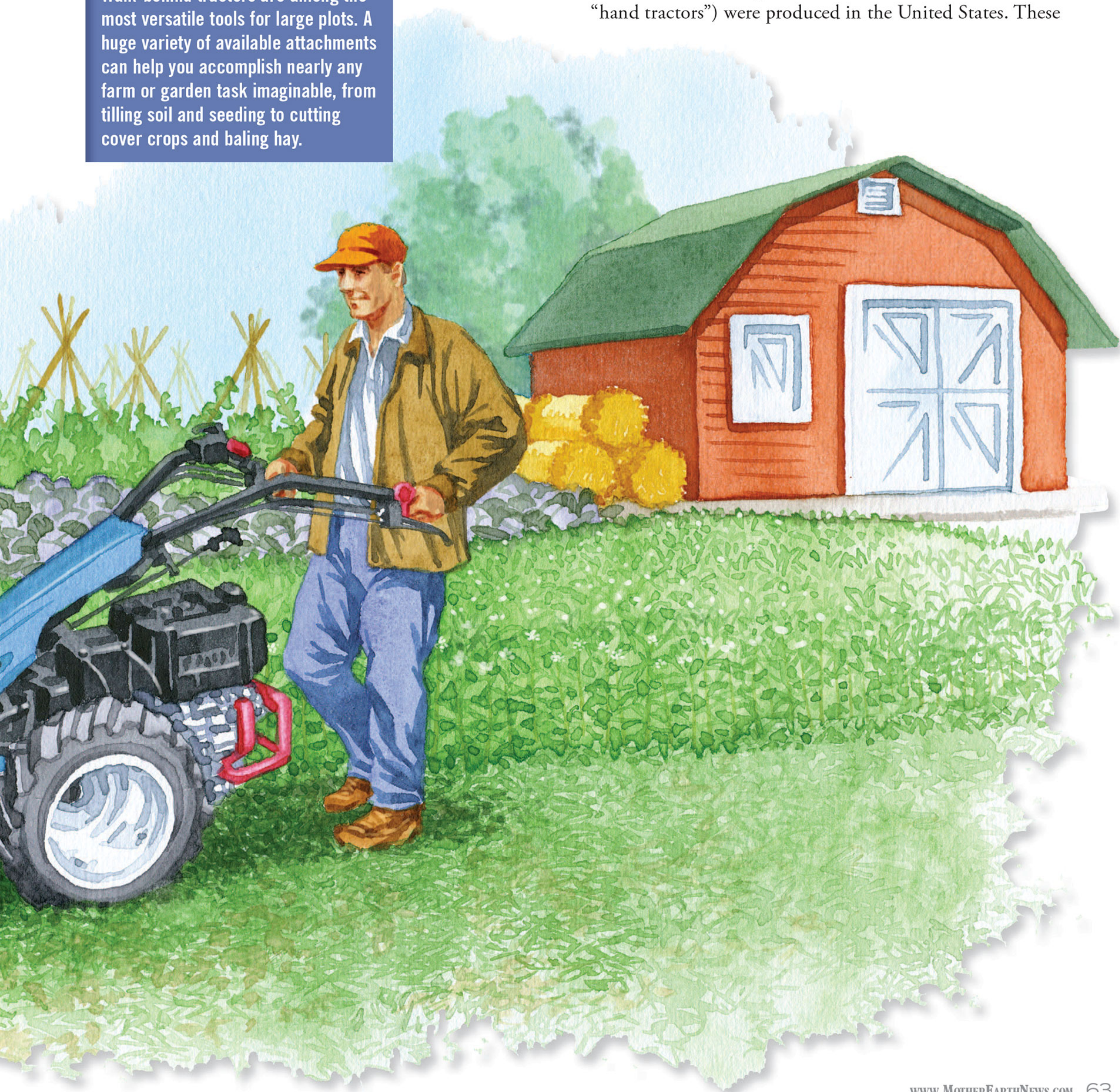
ment scenarios previously mentioned. I don't have enough acreage to condone the cost of a four-wheel tractor, nor am I willing to sacrifice maneuverability or exercise. I also tired many years ago of repairing and replacing poorly made, single-purpose machines that were built to be "consumable." What other options do I—and many others in a similar situation—have?

Walk-behind tractors are among the most versatile tools for large plots. A huge variety of available attachments can help you accomplish nearly any farm or garden task imaginable, from tilling soil and seeding to cutting cover crops and baling hay.

## Walk-Behind Tractors: The Best of Both Worlds

Unlike North America, many European countries have the tools to support large-scale gardening. These countries have a class of large-garden tools that effectively fills the void between four-wheel tractors and single-purpose machines: walk-behind agricultural equipment.

The idea of walk-behind farm equipment is not new to North America; it has just been largely forgotten. From the 1920s to the 1960s, scores of walk-behind tractors (also called "walking tractors," "two-wheel tractors" and "hand tractors") were produced in the United States. These





machines comprised an engine, two wheels, transmission and handlebars, plus a variety of attachable implements for garden or small-farm tasks.

While this equipment concept has dwindled in North America, Europeans have recognized that walk-behind agricultural equipment have the durability and versatility of a tractor, but in a walk-behind configuration that takes less space to maneuver and less money to purchase. European countries have continued to improve their walk-behind tractors (and accompanying attachments) over the past 70 years. One brilliant breakthrough was the design of a reversible handlebar system, so the implement mounting can change from the rear of the tractor to the front. Italy currently produces more walk-behind tractors than any other European country (16 brands) and available attachments include tillers, plows, a variety of mowers, chipper-shredders, snow-removal equipment, log splitters, cultivators, transport wagons, hay rakes, hay balers, seeders, power harrows and spaders. The list goes on, with more than 40 implement types available.

Asian countries have developed walk-behind farming equipment as well, but it tends to be less versatile than the European equipment and there are fewer implements available. Also, the Asian brands don't currently have any stocking importers established in North America, so even though a Chinese walk-behind tractor might cost less, spare parts and post-sale support do not currently exist in this country. Let the buyer beware!

## What's the Cost?

While walk-behind machines are roughly the same size as typical lawn and garden equipment, the difference in construction and durability is clear. Walk-behind tractors have commercial gas or diesel engines and all-gear powertrains. They can easily last as long as any full-sized agricultural tractor, meaning well into the next generation of family gardeners.

After your garden grows to a certain size, however, your generic hardware-tools will become woefully inadequate.

A walk-behind tractor with attachments for general lawn and garden tasks will run in the range of \$4,000 to \$7,000. This is a far cry from what you'd pay for the four-wheel equivalent, and not much more than you would spend on several single-purpose machines — actually less, when you take into account the longer life expectancy of a quality walk-behind model.

At a certain point, you may be working more acreage than is practical for a walk-behind tractor, and a four-wheel

farm tractor will become necessary. My family experimented with this limit on the farm I grew up on, and I'd say that if your garden is larger than 3 acres, it's time to look into buying four wheels.

## The Modern Wheel Hoe

A classic tool that straddles the gap between walk-behind, motorized tractors and hand tools is the wheel hoe. This human-powered, wheeled cultivator has made a reappearance in recent years. It's more versatile than ever because of an increased number of accessories now available (cultivators, sweeps, stirrup hoes, hilling plows and even a good seeder). Hoss Tools is the leading U.S. manufacturer; find more information at [www.HossTools.com](http://www.HossTools.com).

## Durable Hand Tools

Some may ask, "If I have excellent mechanized equipment, do I still need to fool with hand-held gardening tools?" As an organic gardener for more than 35 years, my answer is a resounding "yes!" I apply a lot of mulch in my garden to cut

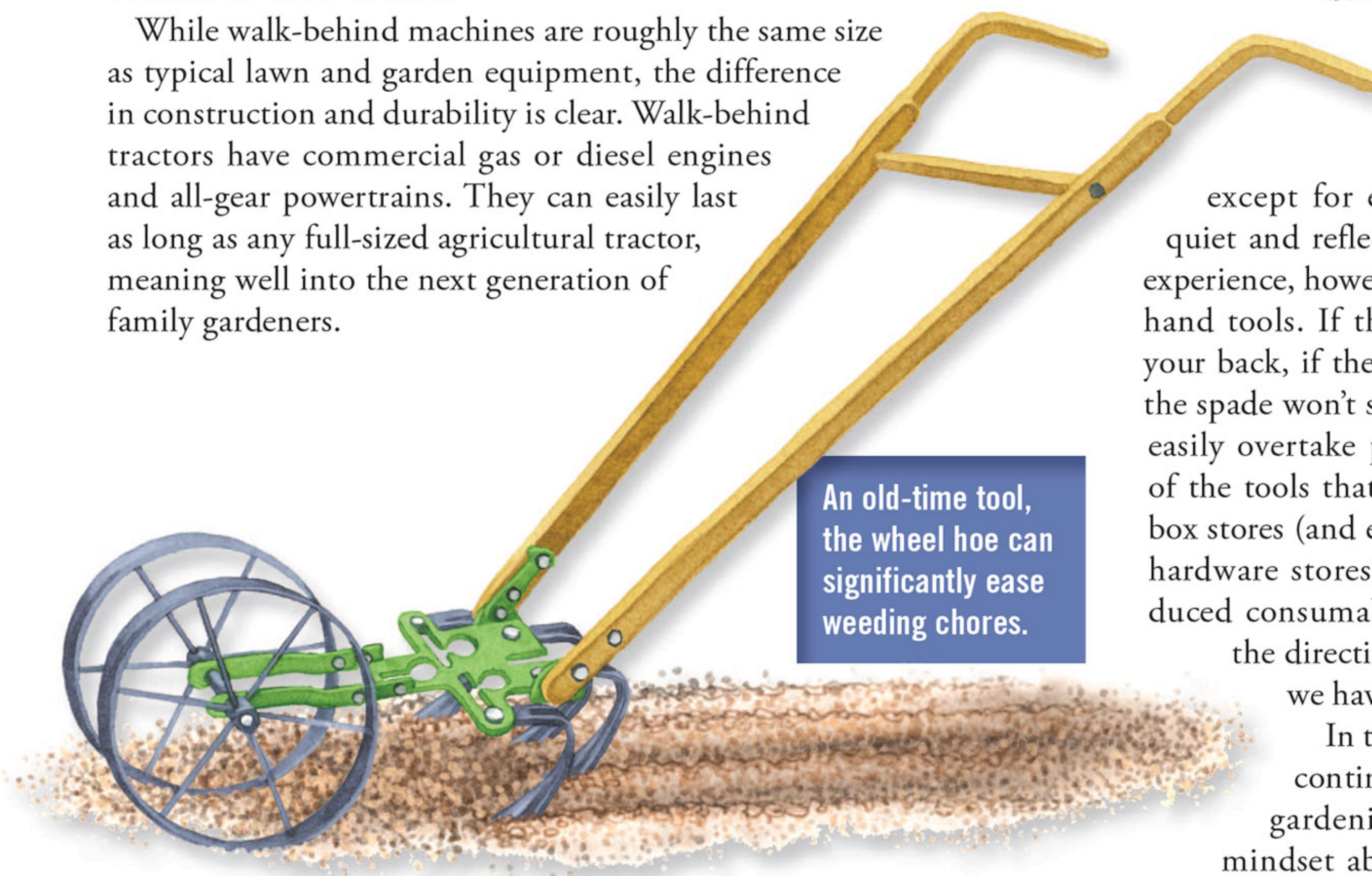
down on weeds, but still find plenty

to do with hand tools. In fact, cultivating and weeding with hand tools are my favorite parts of gardening,

except for eating the food. The work is quiet and reflective. To make it an enjoyable experience, however, you have to find top-notch hand tools. If the hoe you're wielding strains your back, if the garden fork keeps bending or the spade won't stay sharp, then frustration can easily overtake pleasure. Unfortunately, most of the tools that are typically available in big-box stores (and even, for the most part, smaller hardware stores) are poorly made, mass-produced consumables that don't even glance in the direction of ergonomics. Once again, we have to look at alternative sources.

In this genre as well, the Europeans continue to dominate the market. A gardening culture and an old-world mindset about durability have paired to

An old-time tool, the wheel hoe can significantly ease weeding chores.





produce some of the best hand tools available today.

Because European tools are made to last longer, producers usually put more thought into the ergonomics of tool design. If a hoe that will last 50 years is poorly designed, who would work with it? The only weeding hoes I've found with long enough handles to suit my tall height come from Holland, and the ergonomics of German chopping hoes (also called "eye hoes" or "grubbing hoes") are the best I've discovered.

## Solid Steel Designs

Steel tools are stronger and they stay sharp longer than tools made from other materials. Steel isn't just steel, of course, and Europeans have known this for the many generations they've been producing quality garden tools. Steel can be stamped, rolled, cast, forged or hardened, all with different durability results. The best tools are made of forged steel because it's denser and more resilient. Forging is an expensive process (some European manufacturers forge by hand), but the result is impressive.

I haven't found any North American manufacturers that are doing anything directly comparable to the forged tools from abroad, although some good manufacturers in the United States produce broadforks, ergonomic shovels, pruners/loppers, swan-neck hoes, and hoes made from recycled disk blades (called Rogue Hoes), which aren't quite as durable as forged, but are less expensive.

I have also found fine tools in Japan and Korea. Okatsune pruners, shears and loppers are top-notch, and Hida Tool in California carries excellent Japanese tools. To locate

The swan-neck weeding hoe is designed to be used like a broom.



these companies, see "Garden Tool Sources," below.

## Where to Look

The good news is that you don't have to take a trip to Europe to acquire this kind of equipment.

Several brands of Italian walk-behind tractors have been imported over the past 40 years, and while they are certainly not available in mainstream stores, select dealers will have them in stock. At least two brands—BCS and Grillo—currently have U.S.-based importers that stock a full supply of parts and offer customer support.

While you probably won't find the best wheel hoes or hand tools at your local hardware store, you can acquire them online. Top-notch, durable tools cost more,

but in my experience, the invest-

ment is well worth it.

Whether buying hand tools or motorized equipment, by investing in superior garden tools, you'll get more done, you'll feel better doing it—and you'll have more fun! 🌱

Joel Dufour has owned his garden-equipment business, Earth Tools ([www.EarthTools.com](http://www.EarthTools.com)), since 1993. He lives near Frankfort, Ky., with his wife and two daughters in an off-grid, 900-square-foot home they built by hand.

## GARDEN TOOL SOURCES

### BROADFORKS

**Gulland Forge Broadforks:** [www.GullandForge.com](http://www.GullandForge.com), 502-682-8529

**Meadow Creature:** [www.MeadowCreature.com](http://www.MeadowCreature.com), 360-329-2250

**Valley Oak Tool Co.:** [www.ValleyOakTool.com](http://www.ValleyOakTool.com), 530-342-6188

### PRUNERS/LOPPERS

**Barnet USA:** [www.Barnet.com](http://www.Barnet.com), 800-877-9907

**Hida Tool & Hardware Co.:** [www.HidaTool.com](http://www.HidaTool.com), 800-443-5512

### ROGUE HOES

**Rogue Hoe:** [www.RogueHoe.com](http://www.RogueHoe.com), 417-962-5091

### EUROPEAN HOES

**Earth Tools:** [www.EarthTools.com](http://www.EarthTools.com), 502-484-3988

### SHOVELS

**Green Heron Tools:** [www.GreenHeronTools.com](http://www.GreenHeronTools.com), 610-844-5232

**Spear Head Spade:** [www.SpearHeadSpade.com](http://www.SpearHeadSpade.com), 860-688-3280

### STAINLESS-STEEL TROWELS

**Wilcox All-Pro Heavy-Duty Digging Tools:** [www.WilcoxAllPro.com](http://www.WilcoxAllPro.com), 641-623-3138

### WALK-BEHIND TRACTORS

**BCS America:** [www.BCSAmerica.com](http://www.BCSAmerica.com), 800-543-1040

**Earth Tools:** [www.EarthTools.com](http://www.EarthTools.com), 502-484-3988

### WHEEL HOES AND SEEDERS

**Hoss:** [www.HossTools.com](http://www.HossTools.com), 888-672-5536

**Cole Planter Co.:** [www.ColePlanter.com](http://www.ColePlanter.com), 229-888-2032



# Easy Ways to Preserve FRESH FOOD

Pack your pantry with the help of this crop-by-crop guide to food storage.

By Barbara Pleasant

**C**an you name three crops that will keep easily for months in a cool closet? (Try garlic, sweet potatoes and winter squash.) How about a trio of vegetables that will stay fresh until well after the holidays if stashed in the refrigerator or even just a cooler in an unheated garage? (We suggest beets, carrots and potatoes.) Regardless of whether you purchase produce or grow your own, or whether you're new to preserving or are a veteran of the pursuit, this guide is brimming with invaluable ideas to assist you in preserving your fresh fare for better eating year-round.

Buying local produce and “putting it up” (or “putting it by,” depending on what part of the country you're from) is also a great way to support your area's farmers. Every bite you take—today or months from now—helps strengthen your local economy, supports more sustainable food production, and brings you a significant step closer to a more self-sufficient life. Another bonus: Buying local food in bulk and preserving it can save you money on your grocery expenses. And, as the examples



## RESOURCES

For additional information beyond what you'll find in this article, we recommend the following online resources.

- **Storing Vegetables at Home**  
University of Wisconsin-Extension  
<http://goo.gl/7t8wY>
- **Drying Fruits & Vegetables**  
Pacific Northwest Extension  
<http://goo.gl/zrmRh>
- **Preserving Food at Home**  
Blog at National Center for Home Food Preservation, <http://bit.ly/1PXSQWv>

in this article indicate, tapping such savings can be as easy as going to the farmers' market to stock up when your favorite fruits and veggies are in season, and then learning which techniques are best for storing each crop. Because most foods can be preserved in more than one way, you choose the preservation method that fits your cooking habits and time constraints.

To simplify home food storage, we've divided crops by preservation method, starting with those that require the least amount of time, effort and energy to preserve. Even when put through the process of canning or freezing, home-stored foods save huge amounts of energy in reduced

packaging, transportation and storage costs. Freezing is the most energy-intensive means of home food preservation, but you can still conserve energy through reduced use of transportation fuel by freezing food that was grown locally.





## Cool-Storage Superstars

These crops will keep for two to six months at cool room temperatures and require no processing, containers or refrigeration. Could things get any easier than slipping a few buttercup squash into the garage or finding a place in an unheated closet for some sweet potatoes? The rich flavors of those two crops actually improve under good storage conditions, so you're not settling for less by storing. If bringing winter

squash home from the farmers' market, cradle them in towels to avoid accidental nicks or bruises.

Garlic benefits from a cool environment, but most varieties will keep at room temperature for several months. Stow nuts out of the reach of hungry rodents, and freeze them after their protective shells have been removed.

Crop	Peak Season	Handling and Storage Tips
Garlic	Midsummer	Cure at 70 to 75 degrees Fahrenheit for 2 weeks. Optimum storage conditions are 60 to 65 degrees with moderate humidity. (May also be dried.)
Sweet potatoes	Late summer to fall	Cure at 80 degrees for 7 to 10 days. Optimum storage conditions are 55 to 60 degrees with high humidity. (May also be frozen.)
Unshelled nuts	Fall	Dry at 70 to 80 degrees for 4 to 10 days. Optimum storage conditions are 45 to 60 degrees with moderate humidity. (May also be frozen.)
Winter squash	Late summer to fall	Harvest with stub of stem attached and then wipe clean. Optimum storage conditions are 45 to 55 degrees with moderate humidity. (May also be frozen.)





## Underground Sleepers

These foods will keep for at least two months under cold, moist conditions—no processing required. A root cellar is ideal for such storage, but burying boxes or barrels of crops underground is a viable plan of action as well. (For information on building several styles of root cellars, go to [www.MotherEarthNews.com/Root-Cellars](http://www.MotherEarthNews.com/Root-Cellars).) If you live in a cold climate and don't want to dig, you can stash many of

these crops in an unheated garage or outbuilding. In warmer climates where the soil stays above 45 degrees Fahrenheit in winter, a second refrigerator may be your best option.

Running an extra fridge does take energy, but not nearly as much as would otherwise be needed to process, package and ship the crops you'd buy at the store.

Crop	Peak Season	Handling and Storage Tips
Apples	Late summer to fall	Late-maturing tart apples will store best. Ideal temperature range is 30 to 40 degrees with high humidity. Separate apples from root vegetables, as apples give off ethylene gas, which will cause vegetables to spoil. (May also be canned or dried.)
Beets	Summer to fall	With their tops removed, unwashed beets will keep for at least 3 months at 32 to 40 degrees with high humidity. (May also be canned.)
Brussels sprouts	Fall	Pull up plants, shake soil from roots, and hang upside down in a cool basement. Brussels sprouts will keep for 3 to 6 weeks at 40 degrees with high humidity. (May also be frozen.)
Cabbage	Late summer to fall	Plants dug, trimmed and replanted in large pots will keep for up to 7 months at 32 to 40 degrees with high humidity. Trimmed heads will keep for 3 months. (May also be canned.)
Carrots and parsnips	Late summer to fall	Topped roots with leaves snipped off just above the growing crown will keep for at least 3 months at 32 to 40 degrees with high humidity. Roots replanted in spring will produce seeds. (May also be frozen.)
Onions	Late summer to fall	Cured pungent onions will keep for at least 6 months at 32 to 40 degrees with moderate humidity. Sweet onions will store for 1 to 2 months.
Pears	Fall	Wipe clean, pack in loose paper, and store at 29 to 34 degrees with high humidity. Most varieties will store for less than 3 months. (May also be canned, dried or frozen.)
Potatoes	Summer to fall	Will store best at 40 to 45 degrees with high humidity. Some varieties will begin sprouting in 3 to 8 months.
Rutabagas	Fall	Will keep for 2 to 4 months at 32 to 40 degrees with high humidity.
Sunchokes	Fall, winter, spring	Will store for 2 to 5 months at 32 to 40 degrees with high humidity. Can be left in the ground in Zones 6 to 8.
Turnips	Fall	Stretch the fall season by using protective covers. Topped roots will store for at least 4 months at 32 to 40 degrees with high humidity.



## Water Bath Wonders

Pickles, acidic tomatoes, sweetened chutneys and fruit preserves have a pH level of 4.6 or lower, which delays bacterial growth, allowing them to be canned in a water bath canner. A water bath canner is nothing more than a large pot with a metal tray or rack to hold glass jars at least half an inch from the bottom. Canners aren't expensive to buy new, and you can often find used ones at thrift stores and yard sales. Canning jars will last for decades, so look for those secondhand, too. Each time you reuse a jar, you'll conserve the materials and energy needed to create a replacement. Jars sealed in a water bath canner need no refrigeration. (See "Learn to Can for Homegrown Flavor" at <http://goo.gl/jYrMk> for instructions on canning via both the water bath and pressure canning methods.) Closely follow recipes and the instructions that come with your canning equipment to steer clear of food contamina-



Crop	Peak Season	Handling and Storage Tips
Cucumbers, pickled	Summer	A salt and/or vinegar brine will turn cucumbers and other vegetables into pickles. Add sugar, fruits and additional veggies to make chutneys.
Fruits, whole or chopped	Summer to fall	Any well-washed fruit covered with sugar syrup can be canned this way. Use a pressure canner for sugar-free fruit canning. (May also be frozen.)
Fruit preserves, jams and jellies	Summer to fall	Jams and jellies concentrate the harvest into small containers, plus small jelly jars require only 10 minutes of processing time. (May also be frozen.)
Rhubarb	Early summer	Sweetened rhubarb pie filling is easy to can. Add strawberries if you have them. (May also be frozen.)
Tomatoes	Summer	Tomatoes with herbs and lemon juice or citric acid added can be canned in a water bath canner, but use a pressure canner if including okra, zucchini or other low-acid vegetables. (May also be dried or frozen.)

## Success Under Pressure

You'll need a pressure canner to preserve foods that have a pH level above 4.6, because higher temperatures are necessary to kill bacteria in non-acidic foods. Despite the heftier price tag of a pressure canner in comparison with the cost of a water bath canner, reusable jars and no refrigeration requirements for pressure-canned food still make this a practical method of food preservation. Some cities have community canning kitchens that maintain an inventory of canning equipment for residents' use.

Pressure canners require care and periodic testing, but perhaps the biggest challenge with pressure canning is the heat it creates. This is why rural homes used to have a place on the porch for a canning stove, or sometimes a canning kitchen in the corner of a shed. A propane cooker can help you move pressure canning to your deck or patio, though it's still best to prepare the food and jars in the kitchen.



Crop	Peak Season	Handling and Storage Tips
Fruits, unsweetened	Summer to fall	Process unsweetened fruits whole in a pressure canner and then purée into sauce or preserve as juice. (May also be dried or frozen.)
Green beans	Summer	A good vegetable for novice canners. Thick-fleshed Italian and heirloom varieties will stand up to processing better than delicate filet beans. (May also be dried or frozen.)
Tomatoes	Summer	Tomatoes with herbs and lemon juice or citric acid added can be canned in a water bath canner, but use a pressure canner if including okra, zucchini or other low-acid vegetables. (May also be dried or frozen.)
Vegetable mixtures	Summer to fall	Combine low-acid vegetables such as beans and corn with tomatoes and herbs for use in winter soups and stews. Processing time will vary by ingredients and equipment. (May also be dried.)





## Freezer Pleasers

Freezing is often the best means of capturing the flavors and textures of fresh, delicate vegetables, and small batches of vegetables can be blanched to stabilize their nutrients and texture, cooled to preserve their color, and then packaged in 30 minutes or less. Running a freezer no doubt consumes energy, but reduced packaging is where the home food preserver ultimately comes out on top here. For instance, pint-sized poly freezer bags or pouches require a

quarter less energy to produce than the freezer-proof boxes used for many commercial frozen vegetables.

To decrease your freezer's energy consumption, keep it in a cool basement or garage, and fill any vacant spaces inside of it with plastic bottles or freezer bags filled with water. Should the power go out, this extra ice will also slow the food's thawing process. Nest small containers inside larger snap-top plastic boxes so they won't get lost.

Crop	Peak Season	Handling and Storage Tips
Asparagus	Spring to early summer	Blanch in boiling water for 1 minute, cool on ice and then freeze.
Berries	Spring to fall	Rinse well, spin or pat dry, and freeze without blanching. (May also be dried.)
Broccoli, cauliflower	Late spring, fall	Blanch in boiling water for 1 minute, cool on ice and then freeze.
Cantaloupe	Mid- to late summer	Cut into bite-sized pieces or make balls. Freeze, and use within 2 months.
Chard	Summer to fall	Blanch to wilting point in the microwave or in boiling water. Cool on ice, drain and then freeze in small batches to add to other dishes.
Edamame	Mid- to late summer	Simmer pods in salted water for 5 minutes and then drain. When cool, remove beans from pods and freeze. Pods can also be frozen whole, after blanching.
Eggplant	Late summer to fall	Grill or broil slices that have been seasoned with herbs and salt. Freeze when cool.
Peas	Early summer	Blanch in boiling water for 30 seconds, cool on ice and then freeze.
Peppers	Late summer to fall	Grill or broil to remove skins before freezing, or leave skins on and blanch halved peppers in boiling water 1 minute, then freeze. (May also be dried.)
Snap beans	Summer	Blanch in boiling water for 30 seconds, cool on ice and then freeze. (May also be canned or dried.)
Spinach	Spring, fall	Blanch to wilting point in the microwave or in boiling water. Cool on ice, drain and then freeze.
Summer squash	Summer	Grill or broil slices that have been seasoned with herbs and salt. Freeze when cool. (May also be dried.)
Sweet corn	Mid- to late summer	Cut kernels from cob to save freezer space. Heat just to boiling, cool, then freeze.



## Dehydrating All-Stars

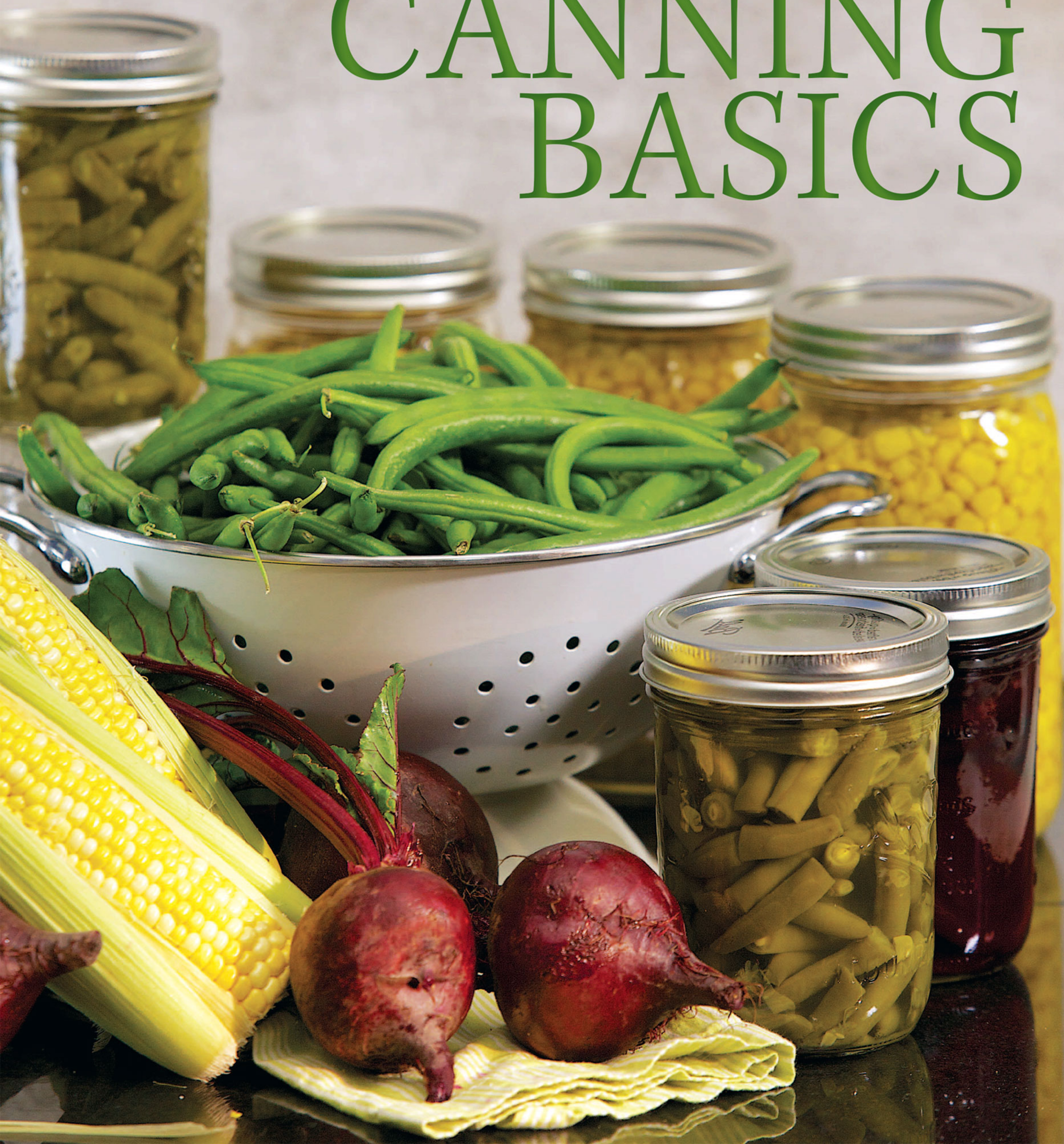
Some of the food crops listed here will need brief precooking or other special preparation before being dehydrated, but many can just be washed, peeled, pared and then popped into a dehydrator. You can also dry them in a solar dehydrator or simply by setting them in the sun. (Learn more about drying food at <http://goo.gl/RpsBzh>.) To even out the moisture levels between different-sized pieces, place your dried foods in an airtight container in the refrigerator for a few days after drying them. If the pieces soften, dry them a bit more before packing them away in storage. The drying process often intensifies flavors, and dried foods take up little space. For maximum energy savings, store dried food in reusable, airtight containers made of glass or plastic. Dried foods will keep for three to six months in a dark room or pantry at a cool temperature, or for up to a year in the freezer.



Crop	Peak Season	Handling and Storage Tips
Apples	Dry apples that ripen early, in August or September	Dip quarter-inch-thick slices or rings in ascorbic acid solution (vitamin C) to prevent browning. Dry until leathery and almost crisp. (May also be canned, frozen or kept in cold storage.)
Berries	Spring to fall	Thoroughly rinse and pat dry. Cut large berries in half and dry until leathery. (May also be canned or frozen.)
Cherries	Summer	Slice in half or remove pits with a cherry pitter. Dry until leathery but still pliable. (May also be canned or frozen.)
Dry beans	Mid- to late summer	Harvest after pods have faded to tan. Remove beans from pods, then dry for 1 hour in an oven at 150 degrees Fahrenheit to kill any potential pests.
Fruit leathers	Summer to fall	Purée clean, washed fruits. Pour purée into a jelly roll pan lined with parchment or freezer paper. Dry until leathery but slightly tacky. (Add ascorbic acid to purée to prevent browning.)
Grapes	Late summer to fall	Use seedless varieties. Blanch in boiling water for 30 seconds to crack the skins, then cool on ice. Dry until leathery but still pliable. (May also be canned or frozen.)
Herbs	Summer	Hang bunches in a warm, well-ventilated room. Store dried leaves whole and crush just before using. (May also be frozen.)
Mushrooms	Spring and fall	Wipe clean with a damp cloth or paper towel, then dry at room temperature until crisp.
Parching corn	Mid- to late summer	Harvest mature ears after the husks have dried to tan. Break the ears in half before drying them to promote air circulation around the middle kernels. Finish drying indoors until you can twist the kernels from ears.
Peaches, plums	Summer	Dip quarters or slices in ascorbic acid solution (vitamin C) to prevent browning. Dry until leathery but still pliable. (May also be frozen.)
Peppers	Late summer to fall	Clean thoroughly, cut into quarter-inch-thick strips or rings, and dry until brittle. (May also be frozen.)
Snap beans	Summer	Blanch for 1 minute, cool and pat dry. Dry until almost brittle. (May also be canned or frozen.)
Summer squash	Summer	Clean thoroughly, cut into quarter-inch slices, and dry until leathery and brittle. (May also be frozen.)
Tomatoes	Summer	Dip in boiling water to remove skins. Cut large tomatoes into rings, and cut smaller ones in halves or quarters. Dry until nearly crisp. (May also be canned.)
Vegetable paste	Summer to fall	Purée clean, washed vegetables. Cook over low heat for 1 hour to evaporate water. Pour into a jelly roll pan lined with parchment paper. Dry to peanut butter consistency and store in the refrigerator. Use in place of vegetable bouillon.
Whole grains	Summer to fall	After threshing and screening, dry grains in a 150-degree oven for 30 minutes to reduce moisture content. Store in airtight, animal-proof containers. (May also be kept in cold storage.)



*Fearless Food Preservation*  
**PRESSURE  
CANNING  
BASICS**





# Learn how to use a pressure canner to safely preserve food, and you'll save money on groceries all year long. (It's not as scary as you may think.)

By Tabitha Alterman

Some of us were lucky to learn food preservation skills at home, on long, hot summer days that now exist as fond memories. Many of us weren't so lucky. Pressure canning in particular is a source of anxiety for new food preservers. The equipment may seem foreign, and if you aren't careful, you can end up with food that's unsafe to eat. Do respect food safety guidelines, but do not fear the useful technology that is pressure canning.

## The Two Main Types of Canning

The easiest way to can foods—and the best place to start—is with the simple **water bath canning**.

With this method, jars are processed at the boiling point—212 degrees Fahrenheit at sea level—which is hot enough to kill molds, yeasts and harmful bacteria, and to deactivate enzymes that lead to food spoilage. The boiling point is as high as you need to go to can foods that contain enough acid to prevent further microbial growth. These high-acid foods (pH 4.6 or lower) include most fruits, as well as other foods to which acid has been added.

Jams, jellies and vinegar pickles are good foods for beginners to can. Go to [www.MotherEarthNews.com/Canning](http://www.MotherEarthNews.com/Canning) to learn about the water bath method and to find recipes.

If you really want to save money and become more self-sufficient, eventually you'll graduate to **pressure canning**. With a pressure canner, you can preserve all kinds of low-acid

foods (pH higher than 4.6), from green beans, venison and tuna to chicken soup, chili and spaghetti sauce. Two readers reported that they even employ the pressure canner to put up chicken feet and homemade dog food.

A pressure canner raises water beyond the boiling point, which allows food to reach temperatures as high as 240 degrees. That temperature kills certain bacteria, including *Clostridium botulinum*, which causes botulism food poisoning.

The Centers for Disease Control and

## Canning Safety Tips

The pressure canners available today are much more reliable than they once were. According to the National Center for Home Food Preservation, home pressure canners were redesigned beginning in the 1970s. Today all have an automatic vent/cover lock, a steam vent and a safety valve.

Avoiding foodborne illness is simple. The purpose of canning is to heat the food to a high enough temperature to arrest enzymatic activity and kill yeasts, molds and bacteria. The organism that causes botulism poisoning, *Clostridium botulinum*, thrives in low-acid foods and can survive temperatures up to 240 degrees Fahrenheit. That's a potential problem because the temperature of boiling water never reaches more than 212 degrees.

Pressure canners trap the steam that escapes from boiling water, thereby increasing the pressure on the liquid. When the pressure is increased, it takes more energy for the liquid molecules to escape the surface, so the temperature at which the water will boil becomes higher. The boiling point in a pressure canner is approximately 250 degrees.

Mountain-dwellers: Adjust for your altitude. Here's the rule: More altitude = more time or more pressure. Instructions on how to adjust for altitude will come with your canner.

Finally, there's one very important rule in home canning: When in doubt, throw it out. Don't sniff or taste suspect jars. Boiling will not make tainted food safe for consumption. Better to be safe than sorry.



Prevention has been tracking botulism cases since 1973. Its 2013 report cited only two cases of canning-related botulism—with one death—so the risk of this type of food poisoning is probably lower than you think. If you learn the basics and use tested pressure-canning recipes, you'll relax and instead be able to focus on enjoying great foods.

## The Benefits of Pressure Canning

Many of the benefits of canning are the same regardless of method. You'll save money on groceries. You can store foods without relying on electricity or monopolizing freezer space. You'll save time every day by shopping your own pantry. A few days spent canning can provide quick, heat-and-eat meals—the original fast food.

Canning may seem like a big time investment, but it's concentrated time that results in time saved later. MOTHER EARTH NEWS reader Katrina Lee says she devotes one weekend per month to food preservation, and that's enough to keep her family well-stocked with healthy food year-round.

You'll save the most money if you preserve food you grow yourself. The savings can be considerable with food you buy, too, if you purchase items in bulk when they are in season and abundant. For many canned goods, you don't need to start with the best-looking ingredients. Ask for cheaper, less-than-perfect "seconds" at farmers' markets. Your friends and family will never know you cut some bad spots off that big pile of ripe veggies last August when they're relishing your home-canned stew in January.

Pressure canning offers additional benefits beyond those you get with water bath canning. For example, you can extend the



grocery savings to other kinds of foods. Reader Shelly Kave saves money by pressure-canning stocks from all of the scrap bones that would otherwise be thrown out. “It’s easy to put it on while doing other things around the kitchen,” she says. “And it doesn’t take as long as you might think.”

Pressure canning allows you to make use of inexpensive cuts of meats that benefit from the tenderizing that high heat and prolonged cooking provide. As

Home-canned food is a gift  
you give your future self.

with produce, some meats are more available—and thus more affordable—in certain seasons.

Spring is a good time to find farmers’ market deals on free-range chicken and lamb, while fall is the best time to stock up on beef, pork, venison and fish.

## Know Your Equipment

There are two types of pressure canners. **Weighted-gauge** models show pressure in units of 5, 10 and 15 pounds per square inch (psi). **Dial gauges** show a range from 5 to 25 psi, which is useful if you live at a high altitude. (Pressure adjustments must be made in small increments at altitudes above 1,000 feet.) Since the 1970s, canners have been manufactured with standard safety features. You

## How to Use a Pressure Canner

Tested canning recipes (see “Canning Resources” on Page 75) will contain all of the information you need. Always read the entire recipe before beginning. Many of the steps for pressure canning are the same as those for water bath canning. Each year, check that your canner is in good working condition by taking it to your local extension office.

### What You’ll Need

Pressure canner  
Canning jars with rings and new lids (wide-mouth jars are easiest to fill)  
Canning funnel  
Jar-lifting tongs  
Pots, bowls, measuring cups and spoons  
Plastic knife or wooden chopstick for removing air bubbles (metal knives can scratch glass jars)

**Assemble equipment and ingredients.** Though many sources will tell you to sterilize everything, this step is unnecessary. Pressure canning will kill all potential pathogens. Just start with clean equipment and a clean work surface. Discard any jars with nicks in the glass.

**Prepare recipe.** Some recipes require you to pack raw food into the jars and then pour hot liquid over the food. With others, you’ll cook the food and then pack it hot.

**Fill jars.** Be sure to leave the proper amount of headspace (the amount of space between the top of the food and the jar’s lid). Recipes should indicate how much headspace is necessary.

**Seal jars.** Remove air bubbles by sliding a knife or chopstick around the inside of the jar. Wipe the jar’s rim clean (a bit of vinegar on a cloth can cut through grease), set the lid on the rim, and twist on the ring just until it resists. Don’t over-tighten.

**Prepare the canner.** Place jars on a rack in the canner and add 2 to 3 inches of water, unless otherwise specified. Secure the canner lid into its locked position. If using a weighted gauge, remove the weight. If using a dial gauge, open the petcock. Heat the canner over high heat until steam escapes. Allow steam to vent for 10 minutes. Attach the weight or close the petcock. Bring the canner to your recipe’s recommended pressure using the high heat setting.

**Set a timer.** Begin timing when the weighted gauge is jiggling steadily (about 2 to 3 times per minute) or when the dial gauge displays the recipe’s recommended pressure. Be vigilant, and adjust the heat often to maintain the lowest heat under the canner that will keep the appropriate pressure. Remove the canner from the heat after the required time has elapsed.

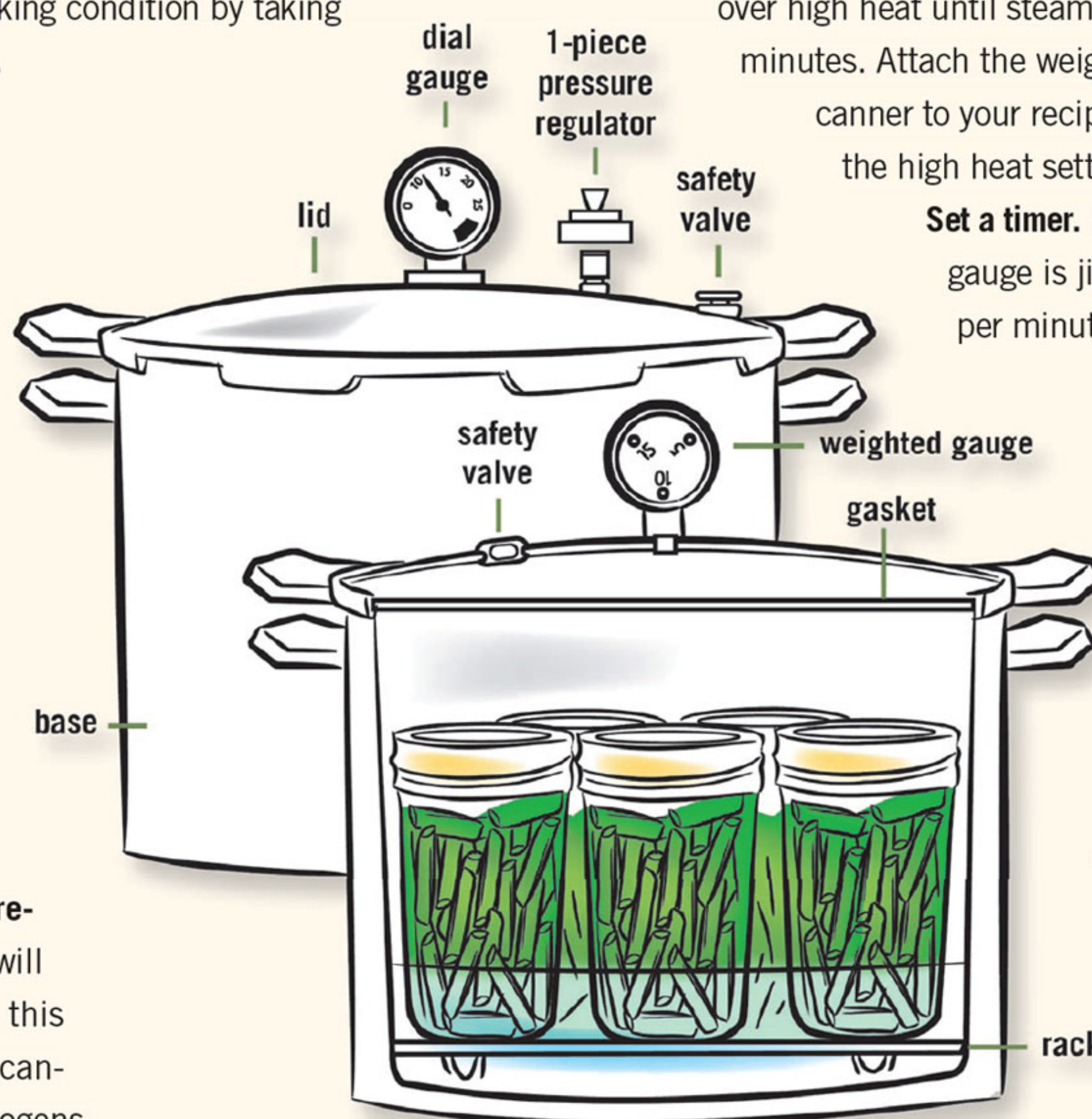
**Let the canner cool.** Leave the canner alone until the pressure has released naturally, about 30 minutes for pints and 45 minutes for quarts. Some models have a feature that will alert you when the pressure is normal.

**Remove the weight or open the petcock.** Let the canner sit undisturbed for a few minutes, then remove the lid. Lean back to avoid a steam burn. Let the open canner stand for 10 minutes.

**Let the jars cool.** Place a towel on the counter. Using a jar lifter, remove the jars to the towel, keeping them an inch apart to allow for air circulation. Let the jars cool for 12 to 24 hours, and then check the seals. The lids should not have any give when you press firmly on the center. If any jars didn’t seal, process them a second time.

**Fill your pantry.** Be sure to label jars with the date and contents. Remove the metal rings, as they can corrode during storage. Rings can be reused, but lids should not be.

**Eat up!** For best quality, consume within 12 months.





may be able to find good deals on used pressure canners on websites such as [www.Craigslist.org](http://www.Craigslist.org). The National Center for Home Food Preservation recommends purchasing a model that displays the Underwriter's Laboratory (UL) approval. Be sure to check gaskets for cracks if you're considering a used canner. Parts for most models are available online at [www.PressureCooker-Outlet.com](http://www.PressureCooker-Outlet.com).

New pressure canners range from about \$70 to several hundred dollars, depending on how well-made they are and the number of jars they hold. Some models have rubber gaskets that need to be replaced if they become cracked or stretched. Well-made models will last many years.

All American Canners, the only company manufacturing pressure canners in the United States, makes models that have easy-to-read dial gauges and metal-to-metal locking that eliminate the



**Left: Get dial gauges checked annually. Right: A 21.5-quart canner will process 19 stacked pints.**

need for replacement gaskets. Its most popular model (shown above, right) will process 19 pints (7 quarts) at one time and retails for about \$200. Always read the owner's manual, as different brands have different features.

Have your canner's gauge checked for accuracy at the beginning of each canning season. Contact a hardware store

or your local county extension agency for this service. Find your nearest cooperative extension office at [www.NIFA.USDA.gov/Extension](http://www.NIFA.USDA.gov/Extension). Before each canning session, make sure the lid locks securely, the gasket (if there is one) is sound, and the valves are clear of debris. Pull a string or pipe cleaner through the small holes to clean them. 🌳

## CANNING RESOURCES

### ONLINE

#### **MOTHER EARTH NEWS Home-Canning Guide**

[www.MotherEarthNews.com/Canning](http://www.MotherEarthNews.com/Canning)  
Find more in-depth instructions for water bath and pressure canning, tested recipes, favorite books, websites, and products on our canning page.

#### **MOTHER EARTH NEWS How to Can app**

<http://goo.gl/B8ymJ>

#### **National Center**

##### **for Home Food Preservation**

<http://NCHFP.UGA.edu>

#### **USDA's Complete Guide to Home Canning**

<http://goo.gl/pWRXD>

#### **Home Canning (Ball website)**

[www.HomeCanning.com](http://www.HomeCanning.com)

### BOOKS

Titles are available online at [www.MotherEarthNews.com/Store](http://www.MotherEarthNews.com/Store).

#### ***The Big Book of Preserving the Harvest***

by Carol W. Costenbader

#### ***Well-Preserved***

by Eugenia Bone

#### ***Ball Complete Book of Home Preserving***

by Judi Kingry and Lauren Devine

## Recipe for Homemade Chicken Stock

*Yield: About 8 pints (or 4 quarts).*

3 to 4 pounds chicken parts (wings, thighs, backs, necks or feet)  
4 quarts water  
2 stalks celery  
2 medium onions, quartered  
1 tbsp salt (optional)  
10 peppercorns  
2 bay leaves  
8 pint (4 quart) canning jars with lids and rings

1. Combine chicken and water in a large stockpot. Bring to a boil. Skim off foam. Add remaining ingredients. Return to a boil. Reduce heat and simmer 2 hours or until chicken is tender. Remove from heat, let cool.

2. Meanwhile, assemble pressure-canning equipment.

3. Remove chicken from stock, reserving meat for another use. Strain stock through a sieve or

several layers of cheesecloth. Allow stock to cool until fat solidifies. Skim off fat.

4. Heat stock to a boil.

5. Ladle hot stock into jars, leaving 1 inch of headspace. Wipe rims. Center lids on jars. Screw on rings.

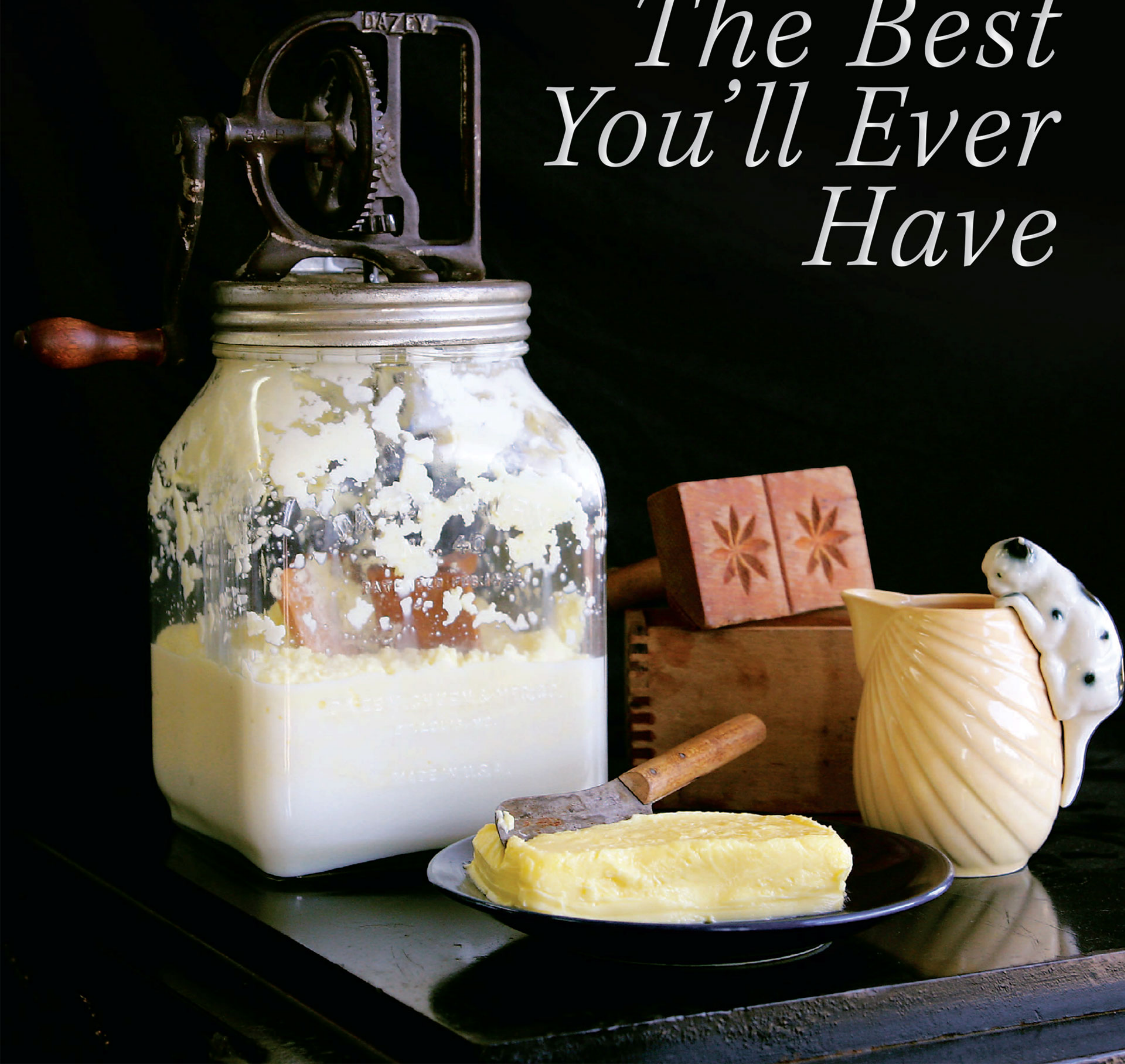
6. Process filled jars in a pressure canner at 10 pounds pressure for 20 minutes for pints (25 minutes for quarts). Let cool, then remove rings.





# HOMEMADE BUTTER

*The Best  
You'll Ever  
Have*





*It is sweet as early grass butter in April.*

— Herman Melville, *Moby-Dick*, 1851

By William Rubel

**O**f the sweet cream butter I'd made earlier in the day, my Italian visitor said, "It tasted heavenly." Sweet cream butter is churned from cream that has not been acidified by the conversion of milk sugar (lactose) into lactic acid by lactobacillus bacteria. Think of it as butter straight from the cow. The butter I served my friend was unsalted; so, in the slightly confusing language of butter, it was *sweet* sweet cream butter (neither salted nor acidified).

## Sweet Cream Butter

Sweet sweet cream butter is the purest butter—it most cleanly expresses the essence of the underlying cream.

It was April when I made dinner for my friend, so the cows were eating from spring pasture. Spring pasture butter is more delicately flavored than the rest of the year, and yellower because spring and early summer grasses are the most nutritionally complex, containing the highest levels of beta carotene. Indeed, the butter I made for my friend was sweet and bright yellow.

Prior to the industrialization of butter manufacturing in the late 19th century, butter sales were local, and butter customers were connoisseurs in a way that we are not. Early spring butter commanded a higher price than any other. Modern dairy practices ignore seasonal differences by feeding cows an unnatural diet of year-round grain. If you often make butter from good cream, you will notice changes as the seasons progress.

## Our Buttery Past

In the 7,000-year history of butter, sweet cream butter is comparatively new. In the few hundred years prior to the industrialization of butter-making, cream was cultured before it was churned. Culturing was the consequence of the universal practice of accumulating multiple milkings before churning. There was

no refrigeration, so the cream was simply stored in a cool room.

Because raw cream is naturally full of beneficial bacteria, raw cream ferments and sours on its own, without the addition of a bacterial culture. Fermentation by lactobacillus bacteria changes the chemistry of cream, making its flavors more complex. Among other changes, it produces lactic acid, making the cream less "sweet." Of even greater importance to butter-makers working hand churns, culturing helps make churned cream "break" faster into the two products of butter-making: butter and buttermilk.

When sweet cream butter was first introduced in the United States in the late 19th century, there was consumer resistance because, as described in one 20th-century text, "Flat flavor is noticeable in butter made from unripened cream." Now this flat-tasting butter is the standard butter in the United States, Canada and England. In comparison to cultured butters, sweet cream butter will always taste flat. But it has special qualities of its own. Fresh sweet cream butter is the taste of the cream unmediated by the butter-maker. It often has a lovely, milky taste.

## Difference You Can Taste

Whenever the taste of butter as a condiment is important—such as when spread on bread or melted over vegetables—homemade butter will make a difference you will taste. Where butter is a significant ingredient—such as in bread and pastries—you'll find an astonishing difference in both the ease of making the pastry and in the texture of the finished product. That's because homemade butter is usually about 86 percent butterfat. Commercial butter is usually 80 percent butterfat—the U.S. government's *minimum* standard.

Once you start using homemade butter, you won't look back. It is *so* different from commodity butter—even premium "European-style" cultured butters—that they are almost two different foods. As a rule, use homemade butter within a week of making it. For baking, use it the same day you make it, before it is refrigerated. The buttermilk, that other product of butter-making, is also entirely different from cultured buttermilk. Try it in scones, soda bread, gingerbread, corn bread and pancake recipes.

## Culturing Butter

Sweet cream butter can be heavenly, but after you begin culturing butter, I predict you'll find that you like cultured butter even better. Culturing brings a depth of flavor to the butter, and lets you become



Spring and summer pastures yield the most delectable butter—if cows get to eat the grass!



imaginatively engaged with manipulating that flavor. With a tiny amount more effort than it takes to make sweet cream butter, you can routinely make butter that crosses the threshold between butter and cheese—butter that's so good you literally want to just sit down and eat it.

Commercial culturing is a superficial affair, so don't imagine any brand you have purchased as a model for cultured butter. Industrial butter is cultured in a

matter of hours. At home, you can do much better. Unlike factories, you don't need to consider the cost of waiting for cream to ripen. And that's the secret to making extraordinary butter.

Raw cream cultures naturally. Pasteurized cream requires inoculation with an appropriate culture because all the lactobacillus organisms that naturally ferment cream would have been killed in the pasteurization process.

Butter-making is an incredibly simple craft. Even a child can churn cream into butter, which is why doing so is a common activity in kindergartens. But as an adult, butter-making can be a lifetime project. Crafting butter is a culinary area that has barely been explored in our modern world. In addition to seeking top-quality cream to make the most heavenly sweet cream butter, and the open-ended possibilities with culturing, one can add

## How to Make Really Flavorful Butter

Equipment should be scrupulously clean. Before and after each use, scald any wooden equipment, including spoons and the inside of churns. Scald repeatedly, if necessary, until there is no butter smell left in the wood.

**To make sweet cream butter**, use fresh cream, skip the culturing instructions that follow, and go directly to Step 1.

**To make cultured butter from raw cream**, pour the cream into a bowl and cover with a double layer of cheesecloth or a clean towel. Leave out in a cool room. If your room is warmer than 60 degrees Fahrenheit, set the bowl of cream in cool water. Become familiar with what is happening to the cream as it ripens (sours, ferments) by tasting it every six to eight hours. Raw cream can be used at any stage from fresh or lightly fermented (e.g. eight hours) to heavily fermented (e.g. a week).

**To make cultured butter from pasteurized cream**, you have two options: You must inoculate the cream with either a mesophilic bacterial culture (from a specialty shop), or a store-bought cultured product—either buttermilk, sour cream or crème fraîche that contains live cultures. If you go the specialty route, purchase a culture for crème fraîche, sour cream or buttermilk, and follow the instructions. If the commercial culture also contains rennet, your cream will set up slightly, but otherwise will achieve the consistency of soft yogurt.

If using a grocery store product as the inoculant (starter), strengthen the starter by leaving it out at room temperature for approximately eight to 12 hours, and then add a tablespoon per cup of cream. If you are sure the inoculant is strong, just 1 teaspoon per cup should be sufficient. Leave the cream at cool room temperature for one to three days.

**With either method**, you can further develop flavor by leaving the cultured cream in the refrigerator for days, or even a week or two. The ripening cream should have a pleasant smell and develop a tangy taste,



**Butter-making is simple: Add culture (optional), whip, drain buttermilk, rinse, and you're done!**

sharpening with time. As the cream acidifies, it becomes hostile to toxic bacteria, but should the cream curdle, or smell or taste bad, discard it. The longer you ripen it, the more clear and distinctive the flavor of your finished butter will be. Butter churned from long-ripened cream is a butter of perfection, like a perfectly ripened fruit.

**1. Pour sweet or cultured cream into the churn**, leaving headroom for the cream to expand when whipped.

**2. Begin churning**, and as you churn, you'll see the cream go through three distinct phases. First, it becomes a snowy white whipped cream, then turns yellow and granular, and lastly "breaks" into clumps of butter swishing around in buttermilk. Churn a bit longer to be sure the butter has clumped, then stop. Observe what is happening throughout. Look, listen and feel what happens as the cream goes through these phases so you develop an intuitive feel for the butter-making process and your own equipment. Cream churns best between 50 and 60 degrees, but will break eventually even if it's warmer. Cultured cream breaks faster than sweet cream.

**3. Drain the buttermilk** to reserve for baking. Remove the butter from the churn to a steep-sided bowl. Hold the bowl at a steep angle, and gather the butter into a ball. Using the flat of your fingers or the back of a wooden spoon, spread and press it against the side of the bowl to squeeze out any remaining buttermilk. Still using the flat of your fingers or the spoon, fold the butter in half over itself, and press down again. Repeat until little or no buttermilk squeezes out. When done,



special flavors, such as savory rosemary or floral rose water.

## No, Really, Butter Is Good for You

After tasting a butter I'd made that he found utterly delicious, my killjoy friend said, "But William, no one should be eating butter." So I will address those of you who have concerns about the healthfulness of butter. In *Moby-Dick*, Ishmael ex-

claims, "Flask, alas! was a butterless man!" Flask was also an unhappy man. I will say no more on the correlation between happiness and eating delicious butter.

In truth, butter is not the enemy many people once feared. Researchers have upset the old-fashioned "lipid hypothesis" that blamed heart disease on animal fats. Plus, a multitude of studies are showing us how incredibly healthy foods from pastured animals can be. Butter from

grass-fed cows is higher in many nutrients, including vitamins E and A, beta carotene, and essential fatty acids. (To learn more, read "The Fats You Need for a Healthy Diet" online at .)

If you can find cream from pastured cows, your butter will also be more luscious and spreadable than you can get using cream from grain-fed cows.

So, how do you make butter so good that those who taste it always want more?



It's fun and practical to use small hand churns, but food processors make great butter, too. You can also use a mold to make fancy pats (below).

remove the butter to a plate and drain the buttermilk into your buttermilk container. Rinse the bowl, return the butter to the bowl, and cover with cool water.

**4. Wash the butter** covered in cool water using the flat part of your fingers or the back of a spoon. Repeatedly press, fold and turn to wash the butter free of buttermilk. Change water as needed, until it remains clear. Another option is to replace the last change of water with a flavored water—rose water for butter to be used in sugar cookies or shortbread, or salted water in which a sprig of rosemary was boiled, for an unusual savory butter circa 1615. Remove the butter to a plate, wash your hands, and drain the bowl. Note: If you are working with a large quantity of butter, an effective alternative to washing butter by hand is to return the butter to the churn, and then churn with repeated changes of cool water until it runs clear.

**5. To remove the rest of the water**, return the butter to the bowl and hold it at a steep angle. Use the back of a spoon to spread and re-spread the butter repeatedly against the side of the bowl to force out trapped water. When no further water can be pressed out of the butter, remove to a plate. Note: If seasoning butter with salt, sprinkle a small amount onto the butter at the beginning of this step. I suggest erring on the side of

undersalting and would not exceed 1 percent salt, which is a scant one-quarter teaspoon per 4 ounces of butter.

**6. Eat up**—the butter is ready to use. It will be soft and supple. Always wrap butter before refrigerating (parchment paper makes a nice wrapping). Try to use the butter within a week. Homemade butter is rarely washed free of buttermilk as effectively as commercial butter, and thus seldom stores well. Homemade butter freezes well, but the point of making butter is to enjoy it when it's fresh!





Up until recent times, people—mostly mothers—had been expert butter-makers. The break in this tradition is exceedingly recent. So let's teach ourselves this ancient and elegant craft. The following are general guidelines for those of you who don't have a mother or a friend to show you.

## The Crème de la Crème

Butter is made from cream. You get the greatest yield from cream with the highest fat content. In the United States, that's "heavy whipping cream," and the commercial grades "extra-heavy" or "manufacturer's" cream have even more butterfat. Plus, different cow breeds produce different percentages of milk fat. The most common U.S. dairy cow, the Holstein/Friesian, produces milk that has 31 percent less fat than Jersey cows. Jersey cream is widely regarded as the ideal cream for butter-making. If you are lucky, you can find a source nearby. (Search for one at [www.LocalHarvest.org](http://www.LocalHarvest.org).)

## Raw vs. Pasteurized

To savor the ancient taste of butter, you have to use raw cream. Raw cream is biologically active: It comes inoculated with beneficial local bacteria. When milk fresh from a cow sits for a while, the cream rises to the top. For thousands of years, all there was to separating cream from milk was spooning it off the top. Then it was allowed to sit and ferment.

But when it comes to pasteurized cream, even the most mass-produced stuff yields yummier butter than any butter you can buy. Let taste be your guide. If possible, make butter from two different dairies, and compare the results in blind tastings. This will help you develop your palate and focus on taste, rather than labels. If you can find and afford it, test cream from the smallest local dairy that offers cream from a single herd and pasteurizes at the minimum temperature. You will then have the best chance of tasting a butter "varietal," such as Jersey.



Fresh pasta tossed with richly flavored cultured butter and Parmesan cheese is a dish of elegant simplicity and memorable flavor.

Pasteurized cream must either be used for sweet cream butter or be purposefully cultured. You can't let pasteurized cream sour naturally, as you would raw cream. Pasteurization kills all bacteria, even the beneficial natives. So, if you were to let that cream sour naturally, you would be allowing a blank slate to absorb any ambient bacteria that might be lurking, without the natural defenses to control it.


## Culture the Cream

Butter cultures are "mesophilic," meaning the bacteria thrive in cool temperatures. ("Thermophilic" yogurt cultures require higher temperatures.)

You can buy mesophilic cultures from suppliers (try [www.Cheesemaking.com](http://www.Cheesemaking.com)), or you can culture cream effectively by inoculating it with a little store-bought sour cream, buttermilk or crème fraîche. (Just make sure the label says it contains live cultures.)

If you have a methodical mind, take notes on what you do and include a record of the flavors produced. If you're like me, just go with your gut. Either way, you'll consistently find that your homemade butter is far superior to commercial products, even premium imported butters.

## Choose Your Churn

A churn is anything that can agitate cream until the butterfat comes out of suspension, resulting in butter and buttermilk. It can be as simple as a jar (shake and pass around a circle of friends), or as easy as a food processor or electric mixer. Small hand churns are practical for home use, holding a pint to a quart of cream. The most common types are a paddle churn (a paddle in a jar, such as the Dazey glass jar butter churn shown on Page 76) or a plunger churn (a wooden plunger in a wooden cylinder). You can find a churn at [www.Lehmans.com](http://www.Lehmans.com), [www.eBay.com](http://www.eBay.com) or [www.Craigslist.org](http://www.Craigslist.org). 



Once you start using homemade butter, you won't look back.

William Rubel is an author and cook specializing in traditional cooking. He is the author of *The Magic of Fire*.





## *Easy, No-Knead*

# CRUSTY BREAD

Bake crispy, gorgeous loaves from scratch using this simple technique. All you need are a few ingredients and a blazing-hot Dutch oven for miraculous results.

Story and photos by Roger Doiron

**P**icture a bowl of soup or a salad without a slice of crusty bread to go with it. Worse still, imagine a deliciously tangy piece of Camembert cheese, served with a glass of red wine,

but no accompanying hunk of baguette. *Quelle horreur!* as the French would say.

Much has been written over the centuries about bread's importance in global cuisine. Legendary American chef and food writer James Beard called it the "most fundamentally satisfying of all

foods" and referred to bread served with fresh butter as the "greatest of feasts." True to form, the Italians are even more dramatic in describing bread's essential role. "*Senza il pane tutto diventa orfano*," they say, which means "Without bread, everyone's an orphan."

Several years ago, I felt orphaned myself. I had just returned from 10 years of living in Europe, where artisanal bread is so common you almost trip over the stuff in the streets. The same cannot be said of my native state of Maine, where Wonder Bread still leads wonderful





To watch a short video demonstration of the no-knead technique, check out the online version of this article at <http://goo.gl/2zgXg>. There, you can also learn more about the science of baking and why the Dutch oven technique works so well.



bread by a comfortable margin. If you trip over anything in the winter-worn streets of Maine, it's most likely to be a frost heave.

Bread had become so fundamental to my dining happiness that I realized upon returning to the United States that I needed to knead some of my own. After five years playing around with different recipes and techniques, I reluctantly came to terms with my limits as a home baker. I could produce excellent zucchini and banana breads, a decent sandwich loaf in both white and whole-wheat varieties, and a perfectly respectable focaccia. What I couldn't produce,

unfortunately, was the type of bread I craved the most—a hearty, round, rustic loaf with a moist, chewy crumb and a thick, crispy crust.

Fortunately, my return proved to be well-timed in that it coincided with an artisanal bread-making revival in Maine. I became a regular customer of Standard Baking Co., a Portland-based bakery that turns out breads and pastries that rival Europe's finest. What I couldn't bake myself was available just a few minutes and a few dollars away.

But for people like me who grow some of our own food and cook from scratch, close foods can never be quite close enough. I remained committed to being able to produce the loaf of my dreams in my own kitchen.

On a Saturday morning bread run to Standard, I asked one of the bakers her secret to a crusty loaf. She replied “qual-



Wonderful bread needs nothing more than flour, yeast, salt and water.





ity ingredients, time and a \$10,000 professional baking oven.” Ugh. That was *not* what I wanted to hear.

She went on to explain that the secret to a loaf that is soft and moist on the inside and crusty on the outside lies in the careful balance of heat and humidity. Professional baking ovens achieve this balance via high temperatures and blasts of steam during the cooking process.

Over the years, ingenious home bakers have tried to replicate the humid conditions of a commercial oven by placing a pan filled with water at the bottom of the oven, or by spritzing their loaves with water from time to time. My own experiments in moisture management, however, left me frustrated. The quality of my loaves just didn’t do justice to the amount of time and work that went into making them.

Just when I was ready to give up on crusty peasant loaves altogether, I came across an article in *The New York Times* that described baker Jim Lahey’s bread-making technique, the results of which sounded too easy and too good to be true. Dubbed “no-knead bread,” the method involves using wet dough, letting it rise over a long time in lieu of kneading it, and cooking it in a hot Dutch oven (heavy covered pot). While the recipe calls for a slow fermentation process, it proved to be an instant success. The recipe (at right) was shared by foodies the world over.

Excited at the prospect of finally creating a crusty loaf of my own, I couldn’t wait to try the technique.

I was also curious to see whether it really was possible to come up with something new in a field as old as bread-making. As if that weren’t enough, I’d indulged myself the year before with a \$120 cast-iron Dutch oven that hadn’t seen much action at that point.

I pictured myself cranking out one crusty loaf after the next, and I did some quick math to calculate how many loaves I’d need to make before I’d recoup my investment.

From the first attempt, my results—like those of others who’ve used the technique—have been nothing short of miraculous.

## No-Knead, Dutch Oven Bread

*¼ tsp active dry yeast*

*1½ cups warm water*

*3 cups all-purpose flour, plus more for dusting. You may use white, whole-wheat or a combination of the two.*

*1½ tsp salt*

*Cornmeal or wheat bran for dusting*

❶ In a large bowl, dissolve yeast in water. Add the flour and salt, stirring until blended. The dough will be shaggy and sticky. Cover bowl with plastic wrap. Let the dough rest at least 8 hours, preferably 12 to 18, at warm room temperature, about 70 degrees Fahrenheit.

❷ The dough is ready when its surface is dotted with bubbles. Lightly flour a work surface and place dough on it. Sprinkle it with a little more flour, and fold it over on itself once or twice. Cover loosely with plastic wrap and let it rest for about 15 minutes.

❸ Using just enough flour to keep the dough from sticking to the work surface or to your fingers, gently shape the dough into a ball. Generously coat a clean dish towel with flour, cornmeal or wheat bran. Put the seam side of the dough down on the towel, and dust with more flour, cornmeal or bran. Cover with another towel and let rise for about 1 to 2 hours. When it’s ready, the dough will have doubled in size and will not readily spring back if poked with a finger.

❹ At least 20 minutes before the dough is ready, heat oven to 475 degrees. Put a 6- to 8-quart heavy covered pot (cast iron, enamel, Pyrex or ceramic) in the oven as it heats. When the dough is ready, carefully remove the pot from the oven and lift off the lid. Slide your hand under the towel, and turn the dough over into the pot, seam side up. The dough will lose its shape a bit in the process, but that’s OK. Give the pan a firm shake or two to help distribute the dough evenly, but don’t worry if it’s not perfect; it will straighten out as it bakes.

❺ Cover and bake for 30 minutes. Remove the lid and bake another 15 to 20 minutes, until the loaf is beautifully browned. Remove the bread from the Dutch oven and let it cool on a rack for at least 1 hour before slicing.

*Yield: One 1½-pound loaf. Adapted from The New York Times.*

Not only are my loaves delicious, but they are drop-dead gorgeous—every bit as pretty as the ones I was tripping over in Europe. The long, knead-free fermentation process allows the dough to develop good flavor, while the Dutch oven creates the humid conditions needed for a crisp crust.

Those of you who have been foiled in your home-baking efforts in the past can find new hope in this technique, which is as forgiving as it is flexible.

Although I may still be a loaf or two shy of paying for my fancy-pants Dutch oven, I’m getting close, and I’m even

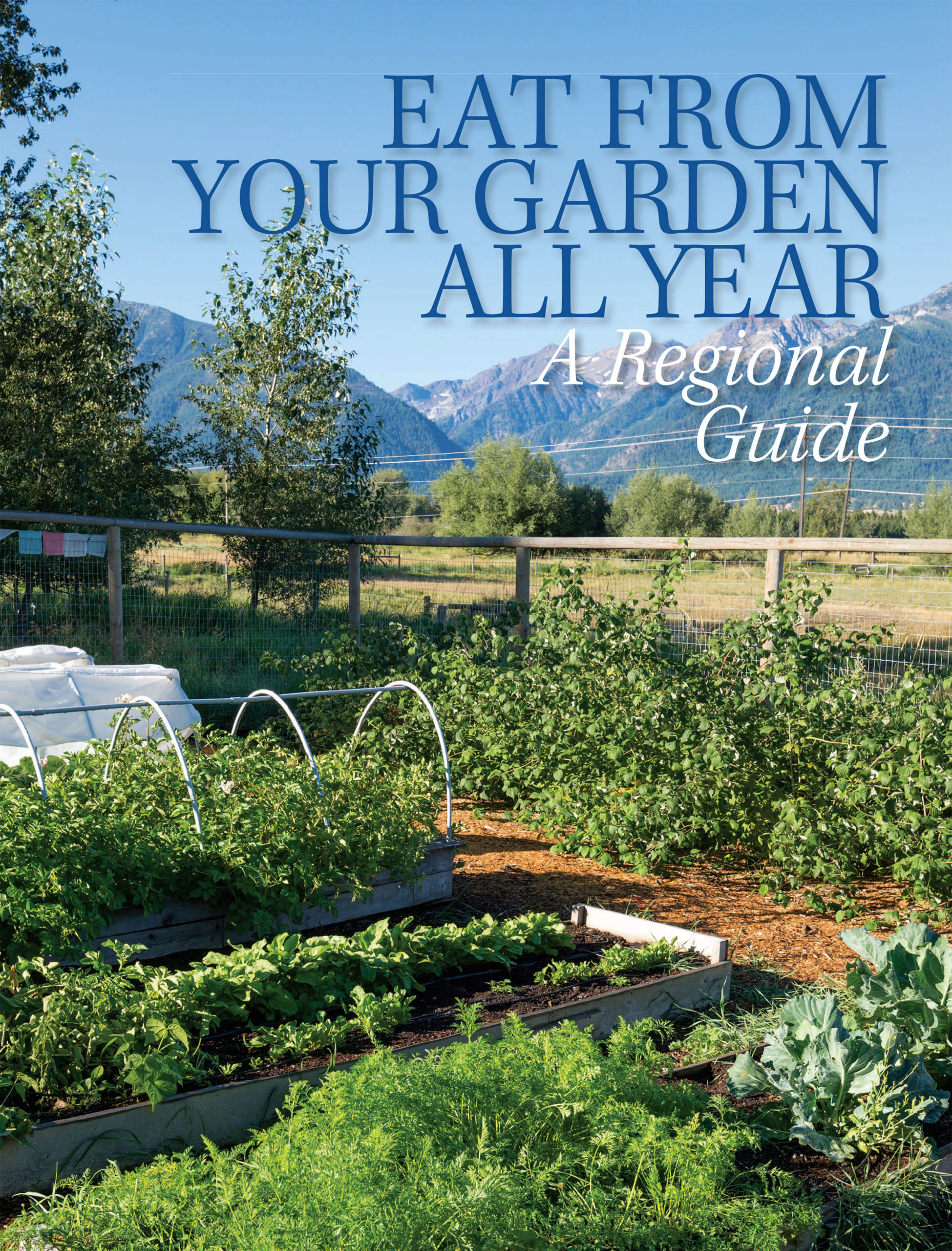
starting to think about new challenges. Next time I make a Saturday morning bakery run, I think I’ll ask the baker the secret to a buttery chocolate croissant. With my baking confidence at a new high, I just might be up to the task. 🌳

Roger Doiron lives on the southern coast of Maine, where he’s a sustainable agriculture consultant, passionate organic gardener and recreational clammer. He digs good food—literally—on land and at sea.



# EAT FROM YOUR GARDEN ALL YEAR

*A Regional  
Guide*





With these expert-recommended techniques and crop varieties, you, too, can break through seasonal barriers in your climate.

By Vicki Mattern

**F**all frost doesn't have to spell the end of garden-fresh eating. By choosing the right crops and varieties, as well as implementing some crop-protection strategies, you can push the seasonal envelope much further than you might have imagined. We talked with 11 of the most adventurous and successful gardeners we know from coast to coast (see map, Page 86) to learn their top tactics for stretching the growing season to its max. Try tips from in or near your Plant Hardiness Zone or region to embark on eating from the garden year-round!

## Pacific Coast

**1 Salt Spring Island, British Columbia (Zone 8).** Linda Gilkeson, entomologist and author of *Backyard Bounty*, overwinters frost-tolerant varieties of kale, carrots, beets, leeks, purple sprouting broccoli, cauliflower and Brussels sprouts, as well as many other healthful greens. "They're all still going full-tilt come March," she says.

From late February into May, cold-hardy cauliflower ('Aalsmeer,' 'Galleon' and 'Purple Cape') and broccoli ('Cardinal,' 'Red Spear' and 'White Star') produce crops from seed sown in late June to early July the previous year.

"Celeriac, grown for its flavorful roots, is a midwinter delight. Just leave it in the garden, well-mulched," Gilkeson advises. You can do the same with carrots and beets. For your leafy greens, keep a sheet of heavy plastic on hand, which you can prop aloft above your beds with stakes or low hoops to provide protection from Arctic blasts.

**2 Corvallis, Oregon (Zone 8).** Carol Deppe, plant breeder and author of *The Resilient Gardener* and *The Tao of Vegetable Gardening*, overwinters many crops, including kale, beets, purple sprouting broccoli and edible-podded peas. But her favorite way to eat from the garden year-round is to pack her pantry with reliable storage crops, such as homegrown grain corn, dried beans and winter squash.

For polenta and cornbread, Deppe likes 'Cascade Ruby-Gold' flint corn, an early maturing, cold-hardy variety she developed. She recommends 'Magic Manna' flour corn for cakes, pancakes, sweet breads and parching. A quality coffee grinder or blender can grind flour corns into a fine flour similar to wheat flour in texture. Deppe's favorite dry beans for her area are 'Gaucha' bush (an Argentine heirloom) and 'Black Coco.' She suggests timing the plantings so the pods can dry on the mature plants in late August, before fall rains.

Her favorite winter squash for the Northwest is 'Sweet Meat-Oregon Homestead,' which produces sweet, dry, flavorful fruits weighing up to 25 pounds. She also grows and stores 'Candystick Dessert Delicata,' 'Delicata Zeppelin' and 'Honey Boat' winter squash. All produce small, striped fruits with fine-grained, sweet, dry flesh, and will keep through late December. The fruits of 'Candystick Dessert Delicata' can weigh up to 3 pounds and have thick flesh with a flavor reminiscent of a Medjool date. Winter

squash generally bear large fruits that keep well and become more flavorful in storage. "Let them cure while you're eating up your fall veggies, and then eat your long-keeping *Cucurbita maxima* and even-longer-keeping *C. moschata* varieties," Deppe says.

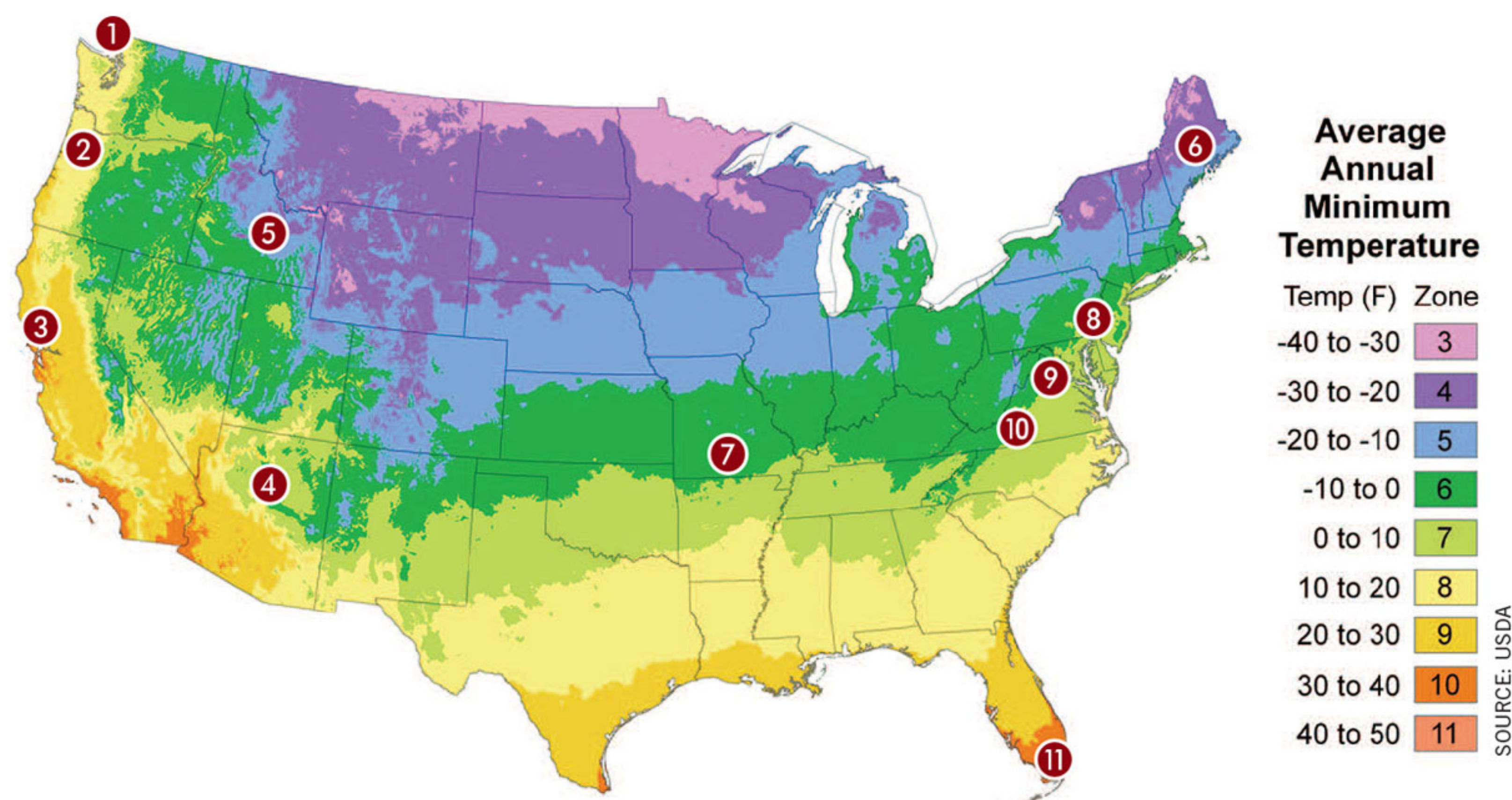
Just as some Native American tribes did, she slices and dries summer squash for winter use, too. Through extensive testing, she found 'Costata Romanesco' and any gold zucchini best for both eating fresh and drying. Just cut 3/8-inch slices of 1- to 3-pound fruits that have tender skins and small, immature seeds. Although she dries squash on a rack modeled on one that native tribes used, you can employ a food dehydrator set at 125 to 140 degrees Fahrenheit. The whole dried slices reconstitute in soup when cooked for about 45 minutes; chop up the dried slices first for faster cooking.

**3 Palo Alto, California (Zone 9).** In her coastal garden, Rosalind Creasy, author of *Edible Landscaping* and many other books, grows peas, scallions, onions, lettuce, kale, radishes, cauliflower, cabbage,



Winter haul: A Zone 8 gardener's New Year's harvest of leeks, cabbage, root crops and leafy greens.





From the cool Northwest to tropical Florida, gardeners in several USDA Plant Hardiness Zones offered tips for this article. Warming global temperatures have been pushing Zones farther north over time.

broccoli, Asian and mustard greens, chard, beets, parsnips, carrots, fava beans, and wheat through winter. Beets and chard planted in late October have the added advantage of avoiding the leaf miners that often plague these crops in summer. The cooler temperatures are also ideal for cilantro. “Most people try to plant cilantro in summer, but it bolts,” she says. “If you plant it in September, it will produce through winter and flower in March, attracting beneficial insects to the garden.”

She rarely needs cloches or row covers for frost protection. “To protect my frost-sensitive citrus trees, I hang old-fashioned white Christmas lights in the trees. They give off just enough heat to prevent the trees from freezing and look very pretty.”

Creasy preserves her garden’s summer flavors in her signature minestrone soup and her apple, tomato, marinara and ran-

chero sauces, which she freezes for winter use. Her frozen treasure trove also contains savory roasted tomatoes, herbs in olive oil, blackberries lightly dusted with sugar, chopped basil layered with Parmesan cheese, and lime juice cubes.

## Southwest

**4 Cornville, Arizona (Zone 8).** Native American corn and bean varieties are ideally suited to the hot, dry conditions of the Southwest, says Bill McDorman, founder of Seeds Trust, which began in Idaho but has been headquartered in Arizona since 2005. Many varieties McDorman grows and recommends have been selected over many generations for their ability to thrive in the region’s harsh environment. He harvests grain corn into November, and then stores it for use through winter and early spring. He recommends ‘Rio Grande

Blue,’ a flour corn that’s ideal for tortillas. “Dry the corn on the stalk before you pick it. If it isn’t completely dry, peel back the husks to let it finish drying,” he suggests. “Don’t shell the kernels from the cobs until you’re ready to use them. That’s the secret—it makes an altogether different food from what you’d get at the store.”

‘Candy Mountain,’ an early, open-pollinated variety with rich flavor, is his favorite sweet corn. Its strong emergence in cool soil and its early season vigor make it a standout for the Southwest and many other high-altitude locales. Among beans, McDorman favors what are now known as “Anasazi”—a type of bean believed to have originated from seed found in a clay pot among ancient ruins of ancestral Pueblo people. “The beans store for up to 10 years, cook relatively quickly, and have a creamy texture and rich flavor,” he says. He also considers tepary beans (*Phaseolus acutifolius*) a regional gem. Native groups in Arizona and northwestern Mexico grew and selected these beans to thrive there. Tepary beans need a short season (60 to 80 days) and are drought-tolerant.

McDorman harvests fresh Jerusalem artichokes, oregano and garlic through winter. Plus, he’s never without greens: “Wild mustard grows in the shade of mesquite trees everywhere around this part of the Southwest. So, I plant ‘Slow Bolt’ arugula, a relative of mustard, near mesquite. I get an unlimited supply of fresh greens for several years without replanting.”

## Northern Tier

**5 Ketchum, Idaho (Zone 5).** Bill McDorman is also well-acquainted with the extremely cold, short growing season of the North. He began his seed company, Seeds Trust, in Ketchum, Idaho, to help meet the needs of gardeners dealing with that region’s challenges. He suggests starting seeds indoors, and also taking advantage of warm microclimates, such as an area at the south side of a building with a concrete foundation. Try adding rocks to garden beds to increase thermal mass. “Or, site the garden on a south-facing slope,” he says. “The soil will start to warm about three weeks earlier in spring.”

Gardeners in this climate can grow kale and Brussels sprouts well into fall and



Can, freeze or ferment your summer harvests to stretch them into fall and winter meals.





Bend hoops over beds to easily add and remove row cover when needed.

early winter if snow cover is good, he says. 'Dwarf Siberian' kale, selected to stay low under the protection of snow, is a favorite. He also notes that many gardeners plant crops relatively late in the year and try to get them to mature as temps are dropping, which is rarely successful. Instead, focus on planting in time for crops to mature right before the first fall frost, and then use protection devices to keep them going.

To give corn a two- to three-week head start in spring, McDorman says, sow the seeds in the bottom of a 1-foot-deep trench, cover them with a couple of inches of soil, and then roll plastic over the top to trap the heat and moisture. When the corn reaches the plastic, around your last spring frost date, remove the plastic and fill in soil around the growing plants.

McDorman also urges gardeners in cold, short-season areas to grow Siberian tomatoes. In 1989, he collected seeds of 60 Siberian varieties that are now world-famous for their hardiness and flavor. "They were selected for the very best flavor by the gardeners who grew them and then traded the seeds," he says. All are cold-hardy, but many tolerate hot temperatures, too. 'Mikarda Sweet' and 'De Barrao' are good Roma types for stor-

age. And because all the Siberian tomato varieties are open-pollinated, you can save your own seeds and develop the best strains for your microclimate.

**6 Waterville, Maine (Zone 5).** Fedco Seeds horticulturist Roberta Bailey harvests brassicas, carrots, beets, cilantro and spinach well after her first frost, using high tunnels and row covers. 'White Russian' kale has held in an unheated greenhouse all the way down to zero degrees, and survived in the garden until January beneath insulating snow. Gardeners in the area can also grow 'Vates' collards, 'Green Lance' gai lan (a Chinese kale used like broccoli), and yokatta-na (an extra-hardy Asian green similar to bok choy) beneath row covers. "If snow cover is constant, 'Kolibri' kohlrabi, parsnips and horseradish will survive winter, too," Bailey says.

## Central

**7 Mansfield, Missouri (Zone 6).** The Midwestern area has a longer growing season than its northern neighbors, but frost-free dates can vary widely from year to year. The growers at Baker Creek Heirloom Seed Co. use row covers, cloches and cold frames to protect cabbage, lettuce and other greens from damage in

spring and fall. They recommend 'Wong Bok' Chinese cabbage, as well as the heading cabbages 'Early Jersey Wakefield,' 'Red Express,' 'Cour di Bue' and 'Late Flat Dutch.' Tatsoi, bok choy, collards, arugula and 'Giant Red Japanese' mustard also thrive.

"For storage, try 'Pusa Asita Black' and 'Atomic Red' carrots, and 'Chioggia' and 'Golden' beets," says spokesperson Kathy McFarland. "Also, 'Blue Hubbard,' 'Galeux d'Eysines,' 'Mini Red Turban' and 'Moranga' (also called 'Pink Pumpkin') squash will keep all winter long."

## Mid-Atlantic

**8 Devon, Pennsylvania (Zone 7).** Contributing Editor William Woys Weaver grows mustard, lettuce and celeriac beneath tunnels covered with greenhouse-grade plastic. He says the key to overwintering vegetables is to plant early enough for the crops to develop a good root system. If planted by early September, lettuces will develop sufficient roots so they can survive winter and, by early April, will be growing strong again.

Turnips, parsnips, winter radishes and 'Green Glaze' collards have proven exceptionally hardy, easily surviving winter



without protection. Weaver grows several less-familiar edibles in large tubs inside an unheated greenhouse in fall and winter. Oca, an Andean vegetable, produces a bumper crop of brightly colored, waxy tubers by mid-January. Yacon, a Jerusalem artichoke relative also native to the Andes, produces crunchy, sweet, nutritious tubers. Weaver also overwinters the South American litchi tomato in tubs inside his greenhouse, and then replants them in his garden when the weather warms in spring.

**9 Warrenton, Virginia (Zone 7).** Homesteader and author Harvey Ussery is wild about chicories for cold-weather salads: “There’s a huge diversity of types—escarole, endive, radicchio and sugar loaf—and they bear beautiful leaves of pink, rose, salmon, green and white. They’re better than a lettuce salad, to my taste.”

Most brassicas don’t appreciate the area’s hot, late summers, although ‘Vates’ kale, a few Asian greens, and turnips are dependable exceptions. Instead, Ussery focuses on growing fall and winter storage crops. Dense-fleshed root crops, such as carrots, turnips, rutabagas and beets, keep best (and stay sweetest) right where they grew, beneath a thick layer of clean straw or leaves. Just kick aside the snow and mulch to dig your crops.

A “clamp” is another easy winter storage method for rutabagas, turnips and cabbages, Ussery says. In fall, dig a hole below the frost line, put in your unwashed vegetables, and cover: “I make my clamp 2 feet deep. I cover it with 2-by-4s, a sheet of plastic, and a couple of straw bales.” This old-fashioned method maintains a high humidity level, so the veggies will stay crisp.

Indoors, Ussery stores winter squash, dried corn, peanuts, onions, garlic, potatoes and sweet potatoes. “The queens of storage squash are the *C. moschata*

varieties. I especially like ‘Seminole,’ which has an incredible ability to last, and resists squash vine borers.” He also highly recommends ‘Tennessee Red Valencia’ peanuts, which tolerate clay soil. After harvest, he cures the peanuts for about a month in an airy place, and then stores them through



**‘Atomic Red’ carrots, ‘Purple Cape’ winter cauliflower and ‘Chioggia’ beets stand up well to cold growing conditions.**

winter. “We roast small batches for about a half-hour, shell and eat—delicious.”

**10 Floyd, Virginia (Zone 6).** Author and expert organic gardener Barbara Pleasant grows spinach and parsley inside a glass-topped cold frame through winter,

and overwinters onions and ever-bearing strawberries beneath row cover supported by sturdy wire cages. To encourage strong germination of radishes, beets and carrots in cool spring soils, she lays row cover directly over a seeded bed at ground level, just until the crop germinates. She then installs the cover over hoops so the tiny seedlings don’t have to bear the weight of the cover.

For storage, Pleasant succeeds with dry beans, pumpkins, winter squash, potatoes and sweet potatoes. She especially likes ‘Dickinson’ pumpkins. Instead of growing storage onions, she says local gardeners should try shallots, which are often easier to grow and superior keepers.

## Tropical South

**11 Homestead, Florida (Zone 10).** “Don’t mistake this as the southern United States,” says Andres Mejides, gardening instructor and owner of Elfin Acres organic farm. “It’s the northern Caribbean!” Gardeners here can simply walk out their back doors and gather whatever happens to be ripe, year-round. “What it boils down to is the topsy-turvy nature of when to plant,” he says. “Winter is for crops that gardeners in other regions would grow in summer. We can start tomatoes and peppers in late summer, and then proceed through December with cool-weather crops, such as broccoli.”

Mejides notes that, without an extended cool season, getting a good crop of peas is difficult. He suggests growing perennial pigeon peas instead. He also advises waiting until the rainy season ends in mid-October to plant cucumbers and squash, to reduce the chance of foliar diseases. When the weather warms in spring, switch to crops common in the tropics, including chayote squash, okra, malanga (a starchy root vegetable), yuca root, boniato and tropical fruits. 🌴

**SEED SEARCH!** To locate any of the vegetable varieties recommended here, search the offerings of dozens of seed companies around the country via our Seed and Plant Finder at [www.MotherEarthNews.com/Custom-Seed-Search](http://www.MotherEarthNews.com/Custom-Seed-Search).



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# Build This COZY CABIN

Anyone with basic carpentry skills can construct this classic one-room cabin for just about \$6,000.





By Steve Maxwell  
Illustrations by Len Churchill

**R**ays of early-morning sunlight gently peek through the windows, easing you awake. Looking down from the sleeping loft, you see everything you need: a pine table, a box of split firewood, and a compact kitchen in the corner. This is the cabin dream.

On the following pages, I'll show you how to build a 14-foot-by-20-foot cabin with a sleeping loft over the porch, all for about \$6,050 (see Page 93 for the design). I'll alert you to the main challenges of framing a cabin and explain how to clear the most important hurdles. Even if you never build a cabin of your own, these instructions will be useful when building a garage, shed or other outbuilding.

I believe in building for the long haul. When it comes to cabins, this means working to the same standards of durability and beauty that you'd apply to a full-size house, even though the style, size and soul of a good cabin are entirely different.

I'm sold on durability because it takes such small amounts of extra care, materials and money to yield a huge increase in the project's longevity.

Although a cabin certainly can be framed less stoutly than the design I'll show you here, I'm convinced the wisest use of resources often means going beyond what's merely good enough.

## A Firm Foundation

Every well-built structure begins with the foundation. In regions where frost isn't an issue, site-poured 16-inch-by-16-inch-by-6-inch shallow-depth concrete pads work just fine. If this is similar to the approach used on new houses in your area, then it's OK for use under your cabin.

Cold climates are a different matter, and one of the best cabin foundations you can choose is established easily with minimal tools and time. Concrete piers extending below the frost line, poured within round cardboard tubes, are a time-proven approach to lightweight construction that offers a couple of advantages. Besides raising the structure off the ground and isolating it from the annual freeze/thaw movements of the soil, concrete piers pro-

vide good support around the perimeter of your cabin.

In this cabin design, you need one pier at each corner of the cabin, one in the middle of each long side, three piers spaced evenly on the front of the porch and one in the middle of the rear wall. In light soil, it's reasonable to dig the 10 holes you need for 8- to 12-inch-diameter pier forms using a long-handled shovel. Otherwise, call in a neighbor or contractor with a tractor-mounted auger. You can use 8-inch concrete piers, but the larger size is more forgiving if you don't get the alignment just right.

The best way to mark your foundation outline is with 12-inch spikes pushed into the soil and connected with nylon string. Regardless of the foundation design, the main construction challenge is the same: leveling the top of the foundation pads or piers. Try to borrow a laser level from a friend to successfully level the foundation.

When setting concrete pier forms in the ground, dig the holes large enough to allow room for side-to-side adjustment. The outside edges of the pier forms should extend a bit beyond the outer dimensions of your building. As inexpensive insurance against frost jacking of foundation piers (when the piers are pulled toward the surface by seasonal freezing, even though they extend below the frost line), wrap the outside of each pier tube with black polyethylene plastic before setting them into the holes and packing soil around them. While the concrete is wet, vertically embed  $\frac{5}{8}$ -inch L-shaped threaded metal rod anchors, extending at least 7 inches above the concrete, short end down. Later on, these will hold down the base of the floor frame.

## Building the Floor Frame

There are many ways to frame a cabin floor, but I favor the timber-rim approach. "Timber rim" refers to a load-bearing frame of timbers that defines the

## Cost Estimates for Your Cabin

The following includes the frame, rough floors and shingled roof, but not windows, doors and exterior siding. All costs are rounded up to account for miscellaneous expenses.

### TOTAL COST: \$6,050

#### Floor assembly: \$1,100

- Two 20' 6-by-6 rot-resistant beams (timber rim, length sides)
- Two 14' 6-by-6 rot-resistant beams (timber rim, width sides)
- Twenty-seven 14' 2-by-10 boards (blocking, joists and headers)
- Nine  $\frac{5}{8}$ " plywood tongue-and-groove subfloor panels

#### Walls and porch frame: \$1,300

- Fifty 8' 2-by-8 studs (walls)
- Fifteen 14' 2-by-6 boards (wall plates)
- Five 8' 6-by-6 rot-resistant wooden posts (porch)
- One 14' 6-by-6 rot-resistant beam (porch)
- Twenty-one  $\frac{7}{16}$ " oriented strand board wall siding panels (wall planks)
- Six 14' 2-by-6 fascia boards (exterior wall trim)

#### Roof: \$3,200

- Thirty-four 12' 2-by-8 boards (rafters)
- Two 12' 2-by-10 boards (ridge board)
- Seventeen 14' 2-by-6 boards (crossties)
- Four 8' 2-by-4 studs (rafter support)
- Two 20' 2-by-8 boards (blocking)
- Seventeen  $\frac{3}{4}$ " spruce plywood panels (roof planks)
- Wooden shakes for 550 square feet of roof surface; roof liner; gutter apron

#### Hardware: \$450

- Six 12" spikes (foundation markers)
- Ten 10" Sonotubes (pier forms)
- Ten  $\frac{5}{8}$ " threaded rod anchors (foundation)
- Eight  $\frac{1}{2}$ " x 6" carriage bolts (header anchors)
- 10 pounds of  $3\frac{1}{2}$ " Ardox (spiral-shanked) nails (wall studs, floor joists)
- 10 pounds of  $2\frac{1}{2}$ " Ardox nails (subfloor, roof planks)
- Eight  $\frac{1}{2}$ " x 8" lag bolts (post tops)
- 15 pounds of 1" roofing nails



I'm sold on durability  
because small steps yield  
huge increases in longevity.

perimeter of the floor area. It's better than a continuous foundation wall because it eliminates the need for lots of block work or a poured foundation, offers great stability, and is durable and simple for first-time cabin builders. For this project, it provides continuous support for a building that's held up at only 10 points around its perimeter.

Start by gathering rot-resistant 6-by-6 timbers for the outer rim. Timbers for the ends of the cabin and porch should be long enough to do the job in one piece. If you need to splice two timbers together for the 20-foot cabin sides, that's fine. Just locate the splices directly on top of your concrete pads or piers. (It is possible to get away with thinner pieces of wood here, but that would require adding more piers—an option that's probably less attractive than dealing with thicker timbers.) Be sure to make half-lap corner joints to connect the rim timbers (see illustration, Page 93).

Measure, mark and drill 1-inch-diameter holes in your 6-by-6s for the  $\frac{5}{8}$ -inch threaded rod anchors you embedded in your concrete piers, then settle the timbers in place over the rods. Before bolting down the timbers, double-check that the top surfaces of the 6-by-6s are level to within  $\frac{1}{8}$ -inch of each other. Pouring concrete is coarse work, and it's possible the foundation piers aren't exactly the same height after they've hardened. Now's the

time to correct any errors. Install shims underneath the uneven timbers to make them level; bolt them down tightly under 2-inch washers; then check one last time with a level. You now have a sturdy timber rim on which to begin building. As long as the bottom of the timber rim is at least several inches above the soil, natural ventilation should keep this structure strong for decades.

The timber rim supports floor joists and headers (the frame around the joists) that in turn form the cabin and porch floor. By running joists across the 14-foot width of the building, you'll have the stiffest possible floor for a given width of joist. As a general rule, 2-by-10s spaced on 16-inch centers across the span of this cabin will give you a good floor. But because the type of wood affects the total allowable span, double-check floor joist sizes with your local authority (building codes vary). Consider using 2-by-10 joists across the porch and 2-by-12s for the main floor (but if you do, remember to use a 12-inch-wide header for the main floor, or your joists will be taller than the floor frame). Using 2-by-12s raises the cabin floor slightly, creating a lip at the door that helps repel water and snow.

Regardless of the floor framing wood you choose, use four or five  $\frac{3}{2}$ -inch nails on each joint connecting the floor joists to the headers. Make sure the edges of your floor frame are straight. Use  $\frac{3}{2}$ -inch hot-dipped, galvanized nails driven at an angle to connect the floor frame to the timber rim. You also can use galvanized connector plates.

Next you'll apply a floor surface to your joists. If you want flooring that's easy to build, inexpensive and requires no maintenance for a cabin that won't see much cold weather, then  $\frac{3}{4}$ -inch softwood planks are the way to go. Even left completely unfinished, these form a fine, rustic floor that's easy to sweep clean. Over time, bare wood such as this also takes on a burnished beauty. If you want a better floor to keep out drafts and bugs, consider shiplapped floorboards. They're one step up from square-edged planks, offering all the same advantages as plain boards, while preventing board-to-board gaps. The best floor option is  $\frac{5}{8}$ - or  $\frac{3}{4}$ -inch plywood, though this makes sense only when you're planning to apply a finished floor material over the top. Plywood keeps drafts out and adds an element of rigidity that dimensional lumber can't match, but it also looks unattractive.

## Wall Framing

With your rough floor in place, now build the walls. Stud-frame construction

## Choose a Rock-Solid Start

Right from the beginning, you'll be faced with the challenge of creating an outline for your cabin that has truly square corners. To deliver accuracy, a carpenter's square just won't do it—you'll need to use geometry.

The overall width of the cabin is 168 inches, and the overall length (including porch) is 240 inches. According to the Pythagorean theorem (remember high school geometry class?), the diagonal line connecting these two is:

Length of diagonal = length of one side squared + length of the other side squared (then take the square root of this sum). It works out to be 293 inches for the length of the diagonal side of the Pythagorean triangle when the corner is square.

Start by laying out one side of your building, with a spike at both corners, and another spike at the porch corner—that's three spikes in a row, connected by a string. Next, grab two large tape measures and a couple of people to help hold the tape ends on the spike

heads: You're about to mark the other side of the building so the corners are perfectly square.

Hook one tape measure to each corner spike (you'll need some help holding them there), and then extend both tapes so the 168-inch mark on one tape intersects the 293-inch mark on the other. The spot at which this happens is the place where one corner of the remaining cabin side should be located. Sink a 12-inch spike there. Repeat the process for the other side, then double-check that the opposite sides are the same length.

If you're building on bedrock, lay out your cabin footprint and mark the corner points with a stout felt-tip marker, then rent a hammer drill. Boring holes in the rock is the best way to establish key anchor points for the strings to define the walls of your structure. Bore oversized holes, then tie a mason's line to half-inch-wide, 6-inch-long bolts and slip them in place. Bolt size isn't critical because they just drop into oversized holes bored into the rock.



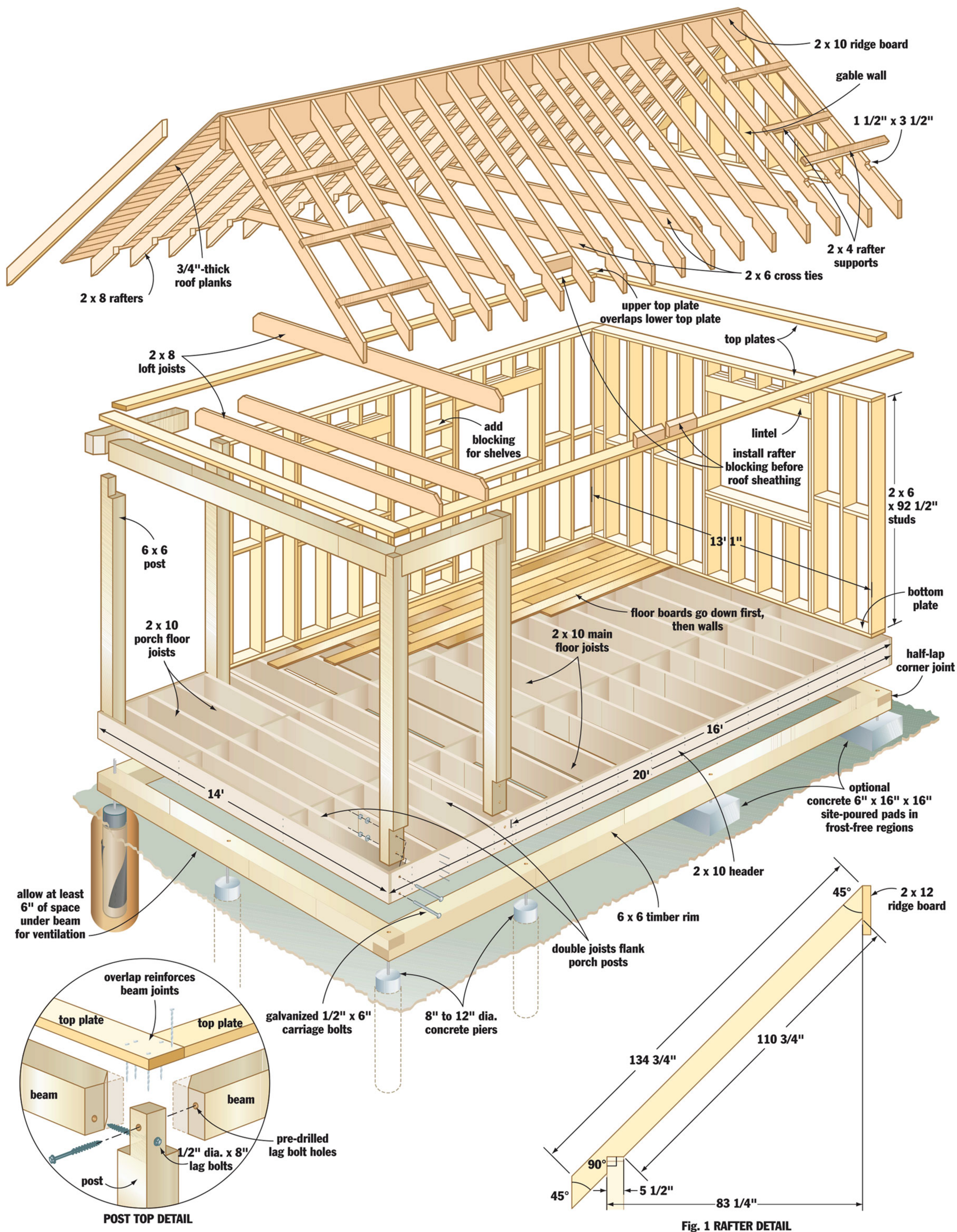


Fig. 1 RAFTER DETAIL





## Exterior Options

The exterior wall treatment you choose for your cabin matters a great deal because it sets the tone for how the place looks and how much maintenance you'll be saddled with over the years. The exterior of your cabin can be made of wooden shingles, boards and battens (right illustration), wooden panels or other materials. Research the pros and cons of each material before choosing one for your cabin, and choose a material that won't burden you with much maintenance.

Cedar shingles are a terrific option because they look great in a rural setting, last many decades and are lightweight. They always live up to their reputation on roofs. On walls, cedar shingles will satisfy those people who insist on wood siding. Hand-split cedar shingles

is still the most popular approach for residential projects, and it makes sense for cabins, too. Although you can save money by framing with 2-by-4s, I recommend 2-by-6s instead, even if you won't be insulating. The extra 2 inches of frame depth is stronger and looks better. The illustration on Page 93 shows how stud-frame walls have three main parts: the plates (horizontal members that form the top and bottom of the walls); studs (vertical frame members); and lintels (horizontal members that span doors and windows). Start by cutting one top and one bottom plate for the rear wall (the one opposite the door). Make these plates out of one 2-by-6 each, then temporarily screw them together so all sides are flush. Joining them together ensures the marks you make to show stud location are accurate. Make these plates 13 feet, 1 inch long. The completed front and back walls will measure 14 feet wide when flanked by the two long walls.

With the pair of plates on edge, use a carpenter's square to draw lines across the edges of the plates at the same spot. Each pencil line shows where one side of each stud should be located. An "X" marks the side of the line where the stud needs to sit. Studs measuring 92½ inches long should be spaced 16 inches apart from center point to center point, with extra studs where door and window openings will go. Before you frame openings for windows and doors, you need to know the sizes of the openings required for them. Make window openings 1 inch wider and 1 inch taller than the overall size of your window (1 inch wider and a half-inch taller for a prehung door, when you get that far).

Remove the screws that temporarily held the top and bottom plates together, separate these pieces about 8 feet apart (with the bottom plate near its final place on the wall), and then position your wall studs between them. Begin by nailing the plates to the ends of the full-length studs, then cut and add shorter studs to form the window opening. Use three 3½-inch nails per joint. If you're planning to build insulation into your floor, add a second

Softwood planks form a fine, rustic floor that takes on a burnished beauty.

bottom plate to the wall to raise it up. Now get ready to heave the wall upright and into position.

Raise the frame with helpers, then push, pull and pound it into alignment with the edge of the floor frame. Use your level to align the wall so it's perfectly vertical (plumb), then drive two nails into each space between the studs on the bottom plate, extending down into the floor boards and header. Now brace the wall with some long pieces of lumber extending to the ground (you'll take them off later, so use the good stuff), then repeat the wall framing process for the two neighboring side walls.

When you've framed and raised the last wall (the one with the door), check and adjust all walls so they're straight and plumb. Don't continue until you've carefully finished this detail. Use taut strings

to make sure the top edges of the walls are truly straight. When you're satisfied, get ready to cut and apply another layer of 2-by-6s over the existing top plate. You'll need to arrange these parts so they overlap the joints between wall segments, but there's another detail you need to address first. Page 93 shows you how two 6-by-6s or log posts should be installed extending from the top corners of the side walls to provide support for the porch roof. Begin by fastening two 6-by-6 vertical posts to the front corners, then rest three horizontal 6-by-6s on top, extending to the porch posts temporarily supported by props of lumber. When all this is in place, tie everything together with a second 2-by-6 top plate.

For siding, I recommend wall planks because they look so much better from the inside of your cabin. If you're looking for inexpensive siding, or you plan on insulating the wall's interior and adding interior siding (covering the 2-by-6s from the inside), you can use plywood or oriented-strand board (OSB).

## Roof Framing

There are many ways to frame a roof, but when you want to create usable loft space, you need to address a few design issues. The first is roof pitch. For both aesthetics and efficiency, the 12:12 pitch is best. This means the slope is 45 degrees from horizontal, with a 90-degree angle formed at the peak. The parts of your cabin that form the slope of your roof are called rafters, and cutting them accurately will be the most challenging part of building your cabin. But if you tackle the job with care, you'll succeed.



taken from your building site are ideal if you're lucky enough to have them, but commercially sawed cedar shingles also work well.

Are you planning to install stone or brick yourself? Buy all the time you need to get the job done by installing windlock asphalt shingles (left illustration) on walls. These interlock physically, allowing you to install them vertically without the usual flapping you'd get if you tried the same thing with regular shingles. They look pretty good on their own, even if you never get around to the masonry.

For a low-cost approach to exterior siding, use either board and batten or 4-by-8 wooden panels. These two options are easy to put up, and they look good for awhile. But in time they can look shabby unless you're diligent about refinishing.



The first step is to take another look at Page 93. Fig. 1 shows a side view of the rafters you need to build. You'll need 34 in all. This includes 30 that span the cabin itself, and two more pairs that extend to create the overhangs at the porch and the rear wall. You could use 2-by-6 rafters, but if you plan to insulate, you're better off using 2-by-8s spaced on 16-inch centers. Although it costs a bit more, the extra wood actually makes it easier to create the required notches and angles because there's more wood with which to work. As with the floor joists, check with local building authorities on exactly what size of wood is required where you live.

Start by marking rafter locations where they will sit on the top of the side walls, ideally atop wall studs. Use the same "line-and-X" marking scheme you used to lay out the top and bottom wall plates. Next, measure the width of your building across the top of the side walls. It should be 14 feet. Chances are good that your cabin width across the front and back walls will match this measurement, but maybe not across the middle. No problem. Take one or two spare planks, rest them across the top of the building and spike one end of each in place. Get some help wrestling the walls inward or outward (whichever is needed to get a 14-foot building width), then spike the second end of your brace planks down. These will come off later, when the rafters and crossies are added, so don't pound the nails all the way home. Also, make sure these temporary braces are well away from the rafter locations you marked earlier. You don't want them to get in the way of the rafters.

Follow the pattern on Page 93 (Fig. 1) and cut out a pair of rafters. Although they should fit nicely on your cabin, double-check your cuts with a tape measure. Tack a piece of 1½-inch-thick scrap wood to the top end of one rafter (to simulate the ridge board that will be part of the completed roof), then get some help temporarily hoisting the rafters up and leaning them against each other. You want a gap-free fit where the rafter meets the top of the walls, and where they come together at the peak.

When you're satisfied with your pair of test rafters (and have adjusted their size if necessary), make the entire batch of 34 rafters. Of these, you must add a special feature to 12 of them. Page 93 shows how you should cut 1½-by-3½-inch notches along the top edge of these 12 special rafters to accept 2-by-4 braces. These support the outer pair of rafters that create the overhang. The best way to cut these notches accurately and quickly is by temporarily clamping two sets of six rafters together, marking each set as a group, then

ridge board probably will have to be made in two lengths of 2-by-12s. Prepare these now, arranging the joint between them so it lands in one of the spaces between rafter pairs. Next, lay the ridge boards end-to-end on top of one wall plate and then transfer rafter locations onto these boards.

When it's time to raise the rafters and ridge boards, do one half of the cabin at a time. Raise one pair of rafters at the end of the cabin and another pair in the middle, near the place where the ridge board will end. Fill in the spaces along the wall with more rafters, angling screws so they penetrate the ridge board and sink into the ends of the rafters. Repeat the process for the second half of the roof. Add the 2-by-4 rafter supports, then the four rafters that form the front and back eaves.

Don't worry about a two-part ridge board. The roof sheathing will join these two halves together solidly. I recommend using solid-wood planks that are ¾-inch thick, not the more expedient option of plywood or OSB, unless you are building in a hurry. The underside of the roof plays a large visual role in this cabin, and sheet woods never enhance the natural backwoods aesthetic. Just remember to lap the roof planks across the area where the two ridge boards meet.

You're now well on your way to finishing your cabin. Add the ceiling joists that tie the cabin together at the top and form the floor of the sleeping loft. Shingle the roof, install doors and windows, and then apply your exterior wall treatment. When your cozy, affordable cabin has become part of your life, you'll realize that small really is beautiful! 🌲

Your cozy, affordable cabin will make you realize that small really is beautiful!

cutting the notches with multiple passes from a hand-held circular saw. Knock out the slivers of remaining wood with a hammer and chisel.

Total length of the cabin's ridge is 22 feet (20 feet across the building and porch plus 1 foot of overhang at each end), so the



# The Best-Ever DIY SOLAR FOOD DEHYDRATOR

Pull the plug on grid-dependent food preservation with this super-efficient unit.

By Dennis Scanlin

**F**or more than 30 years, I've led research teams as founder and coordinator of the Appropriate Technology Program at Appalachian State University. We've conducted many original experiments to produce a design for the best food dehydrator you're

likely to find anywhere. Yes, this dryer is supersized—about 6 feet tall and 7 feet long—but it's on wheels and thus moves easily. It can dry large amounts of food quickly and is a must-have for off-grid living. If you have a big garden or buy bulk produce, this solar dehydrator will help you keep up with food preservation all summer and into fall. If you live in a

cloudy or humid region, you can add heat from light bulbs to improve operation. Anyone with basic woodworking skills can tackle these plans.

## How It Works

Drying is an excellent way to preserve food, but exposing fruit and vegetables to direct light can cause vitamin loss. This design relies on indirect solar power, meaning the drying food is not exposed to the sun but instead to solar-heated air. Our dryer takes advantage of the natural process of rising hot air to operate efficiently without any electric fans.

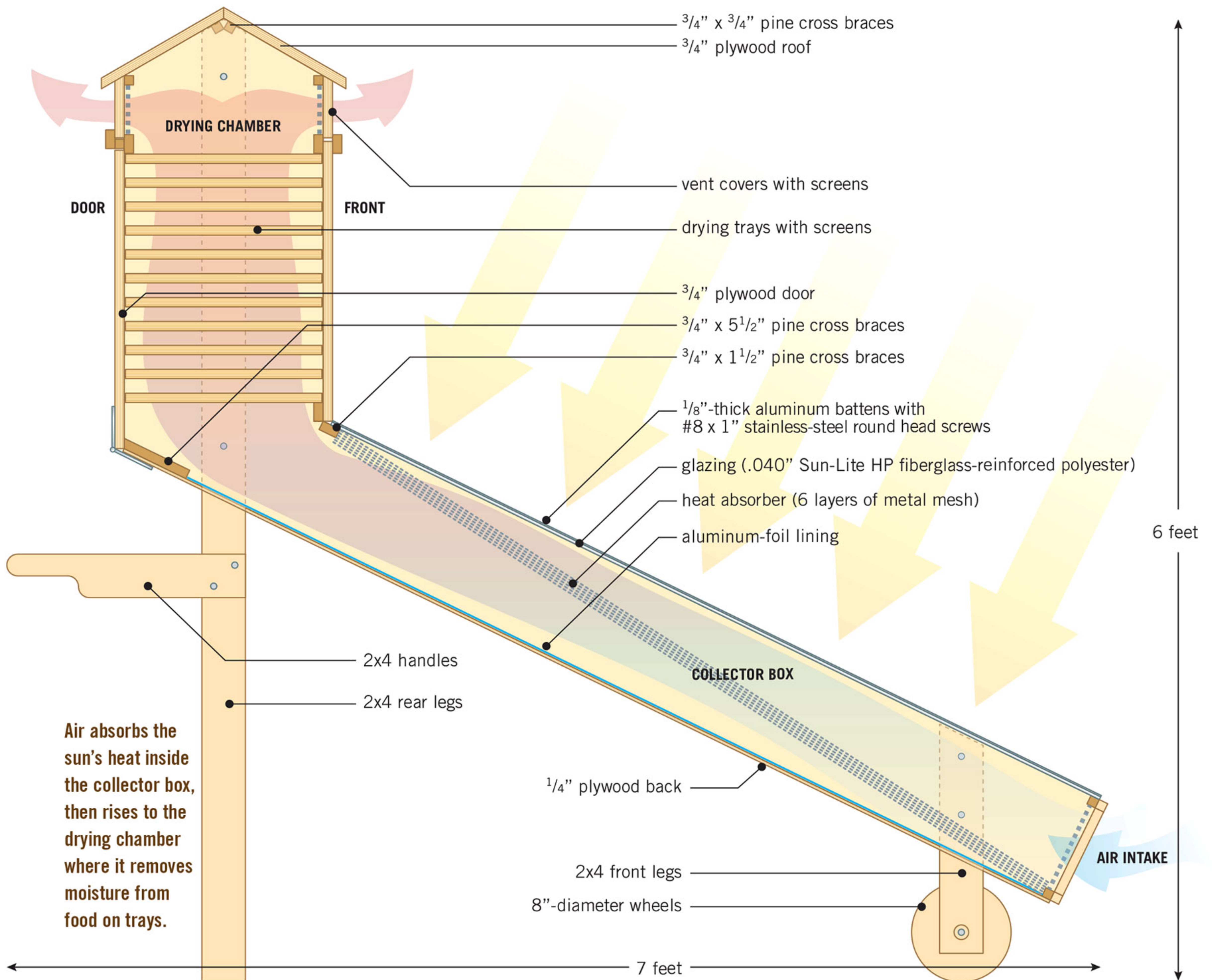
As you can see in the detailed drawing on Page 97, the design includes a long, angled wooden box covered with clear plastic glazing and an open bottom end for air intake. Inside, the box holds diagonal layers of black metal screen. The vertical drying chamber on top has a back door to access food-drying trays inside.

The sun's radiation passes through the plastic top of the collector box to the absorber screens, which retain heat. Air entering through the intake is warmed as it passes over the absorber screens, and then flows into the drying chamber. There, the heated air draws out the food's moisture before exiting through vents just below the roof. The rising warm air creates negative pressure at the bottom of the collector box, which draws in more outside air to replace the air that left through the top vents. Air will continue to heat and rise as long as the sun is shining or the dryer has access to another source of heat.



The author stands behind his solar dehydrator—a highly tested design that will dry 10 pounds of food in only two sunny days.





The drying chamber of this dehydrator supports 11 trays that hold up to a total of 10 pounds of thinly sliced food—about 35 to 40 medium-sized apples, for reference. It can dry this amount of food in two sunny days, or about half that amount in one sunny day because of better ventilation and reduced food mass. The temperature inside the chamber can easily soar to more than 140 degrees Fahrenheit. (The complete free plans for this food dryer are online at [www.MotherEarthNews.com/Food-Dehydrator-Plans](http://www.MotherEarthNews.com/Food-Dehydrator-Plans).)

## Why This Design Is the Best

I've built many solar dehydrators over the years and enlisted teams of students to study all the variables. We've made ad-

justments to improve the performance, simplify the construction, reduce the cost, and increase the durability and portability of food dehydrators.

Following are several of the most effective strategies our tests have established for producing the best dehydrator.

**Vents and airflow.** Temperature, airflow,

humidity and food density will all affect a dehydrator's performance. Ideally, you'll want high temperatures and heavy airflow, but because even slight changes in any one factor also affect all the others, the best food dryers must achieve a balance among all of these variables.

You can control the temperature

## First-Rate Features

Our tests found these dehydrator features to be the most effective and cost-efficient:

- **Long, sealed collector box** enhances airflow.
- **Dark drying chamber** preserves food's vitamin content.
- **Adjustable vent system** regulates airflow and temperature.
- **Aluminum-foil reflector** increases temperature inexpensively.
- **Single layer of glazing** is affordable and effective.
- **Six layers of metal lath screen** absorb and transfer solar energy.



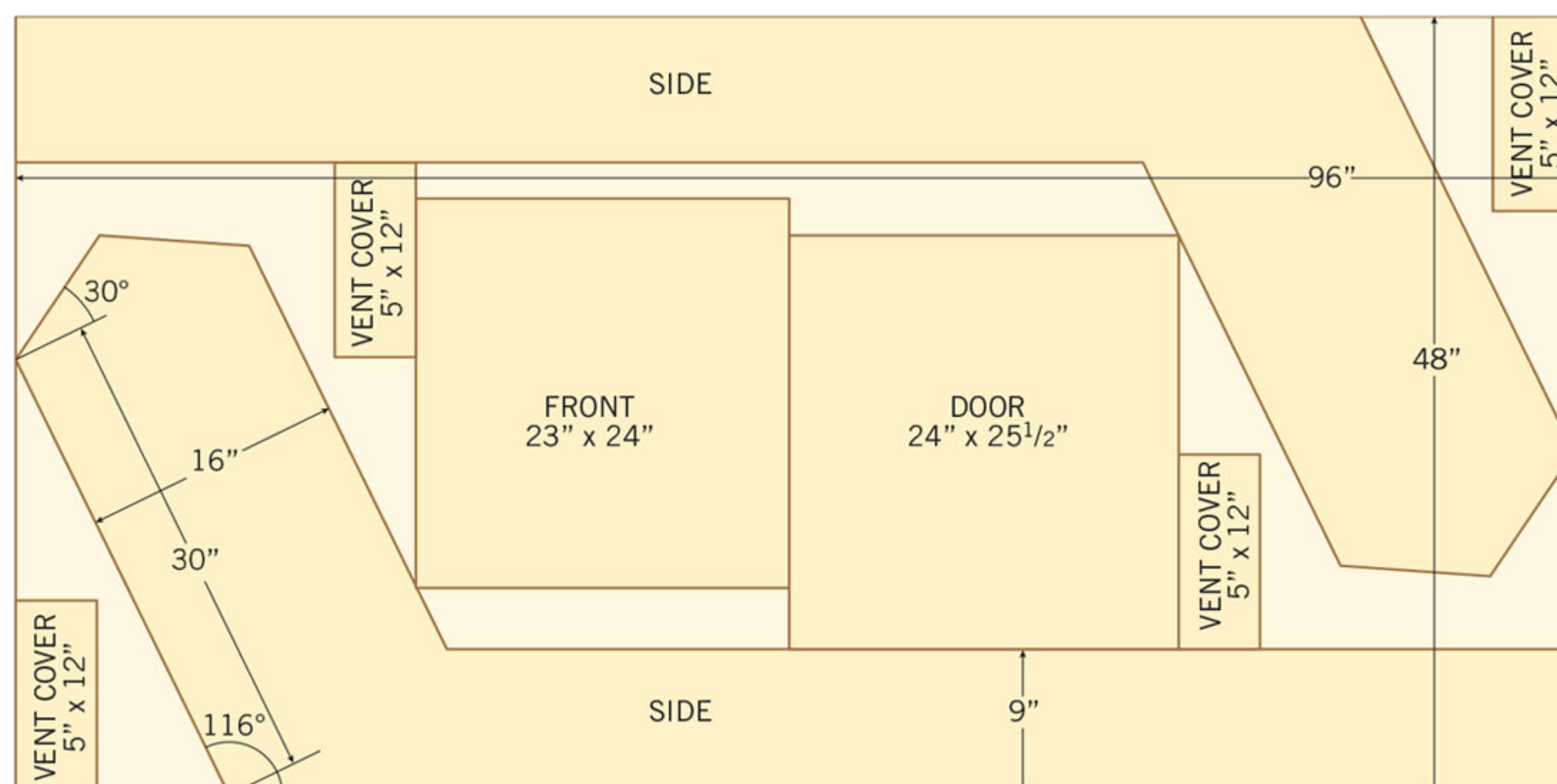
and humidity inside this food dryer by regulating the airflow with its adjustable vents. The vents are essential for effective operation: As air enters at the bottom and heats up in the collector box, the warmed air must rise into the drying chamber where it will absorb moisture from the food before exiting through the upper vents. When you close the vents, the air movement stops—and so does the fast, efficient drying of food.

Fully opened vents cause the airflow to increase and the temperature to decrease. Temperature is more significant than airflow in affecting the rate at which food dries, so we partially close the vents to increase the temperature. In general, more airflow (fully opened vents) is important during the early stages of food drying, while higher temperatures (partially closed vents) are more effective in the later stages of drying.

**Reflectors.** No official scientific standard determines the ideal drying temperature for food. The most common preferred range is between 110 and 140 degrees. Higher temperatures destroy harmful bacteria, enzymes, fungi, insect eggs and larvae, but food begins to cook at 180 degrees, and temperatures that are too high can cause vitamin C loss.

To bring the temperature into the ideal range, we tried adding external reflectors to cast more solar energy into the collector box. For the best performance, though, we discovered that the dryer with reflectors had to be relocated several times throughout the day, and its angle had to be adjusted as the sun moved across the sky. Based on our experiences, external reflectors usually aren't worth the trouble.

Installing a reflector inside the collector box is an easy way to boost the temperature without the hassle of an exterior reflector. Gluing aluminum foil to the bottom interior of the collector box (underneath the absorber screen) will increase the temperature inside by more than 20 degrees. With



Find this cutting diagram and more at [www.MotherEarthNews.com/Food-Dehydrator-Plans](http://www.MotherEarthNews.com/Food-Dehydrator-Plans).

its vents closed, our dryer with an interior reflector can surpass 200 degrees on sunny, 75-degree days. By opening the vents 1 to 2 inches, we can bring the range down to a more reasonable 120 to 155 degrees.

**Glazing.** The top of the collector box must be covered with glazing so the sun's energy can penetrate and be soaked up by the absorber screen inside. The best material is a fiberglass-reinforced polyester (FRP) known as Sun-Lite HP. This glazing is thick, durable and translucent, and is used in many solar technologies. You can purchase it in a variety of sizes from [www.Solar-Components.com](http://www.Solar-Components.com), and easily cut it to fit the top of your dehydrator.

We found that adding a second layer of glazing increases temperatures inside the dryer by approximately 10 degrees. But with the price of the glazing material—about \$2.50 per square foot—the extra layer doesn't improve performance enough to justify the added expense.

**Absorber.** This is a technical name for some simple materials installed beneath the glazing to absorb the sun's heat and transmit it to the surrounding air. Our trials show that the best absorber is made of either charcoal-colored aluminum window screen or the type of metal lath used in plaster work. Screen is cheaper and easier to work with, but some of our tests showed that lath produces significantly

higher temperatures, which justifies the added expense. At least 20 additional tests demonstrated that including six layers of steel lath, painted black and set on the diagonal, is ideal.

## Build It Yourself

You can construct this solar dehydrator using locally available materials—exterior-grade plywood, FRP glazing, metal screening or lath, and miscellaneous parts. New materials will cost about \$300, or you could recycle supplies already on hand. Most home workshops will already stock the necessary equipment. Find complete lists of materials, tools and step-by-step instructions at [www.MotherEarthNews.com/Food-Dehydrator-Plans](http://www.MotherEarthNews.com/Food-Dehydrator-Plans).

Expect construction time to take 20 to 40 hours, depending on your woodworking expertise.

My students and I have developed this solar food dehydrator design that works extremely well and isn't costly to build. I encourage you to build the dryer to our specifications and put it to work to stock your home larder with nutritious, sun-dried food. 🌱

Dennis Scanlin is a professor of technology and environmental design at Appalachian State University in Boone, N.C. For more than 30 years, he has coordinated the university's Appropriate Technology Program in which he and his students have built and tested countless renewable energy systems.

## ONLINE RESOURCES

**Preserving Food Using a Homemade Dehydrator:** <http://goo.gl/9JJtK8>

**Making Sun-Dried Tomatoes in a Solar Food Dehydrator:** <http://goo.gl/DU5VCF>

**Drying Herbs in a Solar Dehydrator:** <http://goo.gl/8FEkms>

**How to Preserve Food Using Sun Drying and Natural Methods:** <http://goo.gl/737LL5>





# DIY OUTDOOR COOKERS

You can build a fire pit or assemble a clay-pot smoker in just one weekend. Let's get cookin'!

By Spike Carlsen

Enjoy campfire cooking in the great outdoors without having to leave your own backyard by rustling up these two weekend projects: a homemade smoker and a DIY fire pit with a cooking grill. A backyard fire pit can be your family's favorite place for conversation, relaxation and cooking—and you won't have to limit the menu to marshmallows and hot dogs, because the pivoting, adjustable grate will expand your outdoor cooking options to include anything you'd try on a grill.

Or, if you'd prefer a simpler evening gathering spot, you can build only the fire pit ring without the cooking grate. You can also spend just a few weekend hours assembling this simple homemade clay-pot smoker.

## Fire Pit with Grill

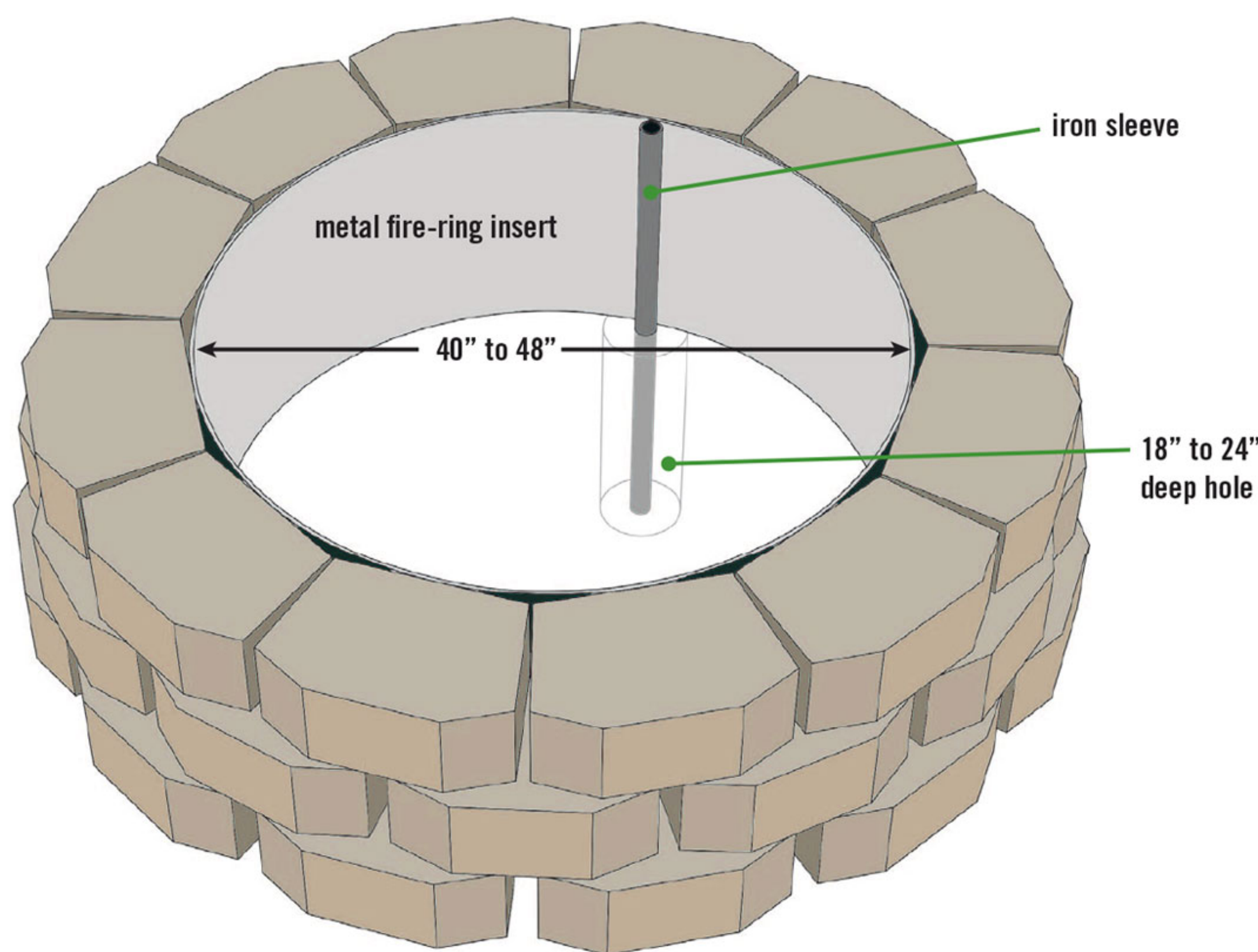
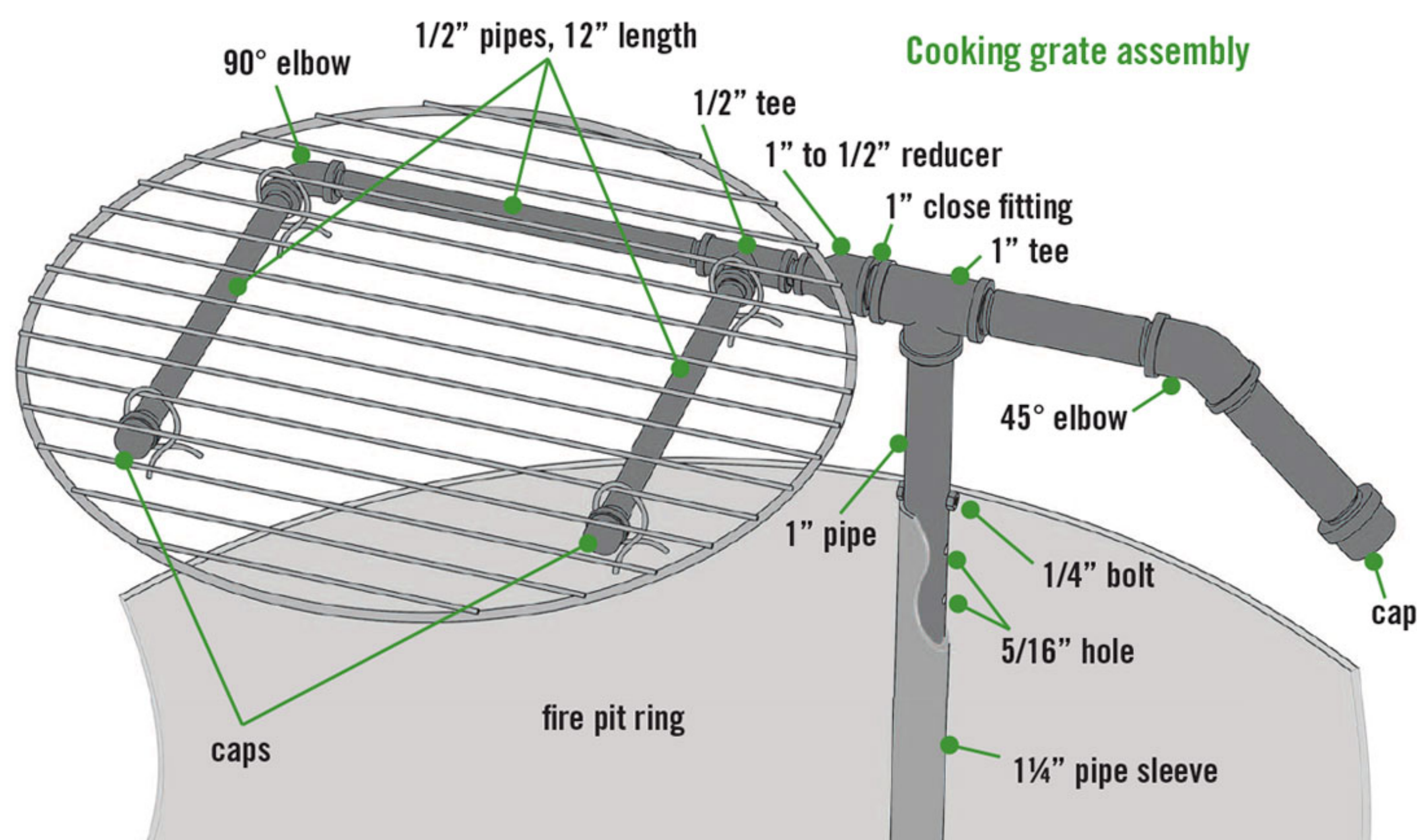
**1 Go shopping.** Find the items on the materials list (Page 100). Buy a metal fire-ring insert at a home center, farm supply store or garden center, or create your own by cutting down a culvert or a 55-gallon drum. Select trapezoid-shaped retaining-wall blocks for the surround. To make certain they'll create a tight circle around your fire-ring insert, check the manufacturer's literature or lay out some blocks in the store. If you're building the metal cooking grate assembly, note that fittings and pipe sections with pre-threaded ends are available in a range of sizes. Use the "black iron" variety, because galvanized pipe can emit harmful fumes when heated.

**2 Lay out the site.** First, determine the overall dimensions of the fire pit by adding the diameter of the fire-ring

insert and the width of the retaining-wall blocks. Pound a stake into the ground to indicate the center of the ring. Hook one end of a tape measure on a nail driven into the stake, and use it as a gigantic compass to scratch two circles into the ground: one to inscribe the circumference of the metal fire-ring insert, and the other to inscribe the outside circumference of the blocks. You can also mark the perimeters with stakes. The area between the circles is where you'll need to excavate in Step 3. If you prefer, you can dig out a much larger area to create a firebreak between your fire pit blocks and surrounding vegetation, and to give you space to create an easy-to-level gravel surface on which to set benches and chairs.

**3 Excavate the area between the circles to a depth of 6 inches.** Add 4 inches of gravel. Even out the gravel





## Fire Pit Materials

Retaining-wall blocks, 10 to 20 per course  
1 metal ring insert for a fire pit, 40" to 48" diameter  
Gravel  
Concrete block adhesive

### For cooking grate assembly

Black iron pipe and fittings—length and number will vary according to grate size  
Concrete mix  
1 cooking grate  
Wire  
1 bolt, 1/4" x 2"

a level to make sure the first course of blocks is level. Add a couple of inches of gravel along the outer perimeter of the first course to lock the fire pit's blocks in place and to bring the gravel fill up to ground level.

**8 Apply concrete block adhesive to the top of the first course of blocks.** Position the first block of the second course so it's centered over a joint between a pair of blocks below. Add the remaining blocks for the second course. Keep adding courses to reach your desired height; three or four courses are typical for backyard fire pits. Some retaining-wall systems include cap blocks to create a more finished look for the top course. Determine ahead of time whether you want to install cap blocks; if you do, then take them into account when calculating your fire pit's final height.

## Clay-Pot Smoker

**1 Purchase materials.** Follow the materials list on Page 101. Because you'll acquire parts to build this homemade smoker from a variety of sources, measure as you go and purchase the parts in the following order:

- **Electric hot plate.** The smaller, the better, but make sure it runs on at least 1,000 watts to maintain the temperature required for smoking meats.
- **Clay pot.** The bottom must be large enough to accommodate the hot plate and control knob, with a little room to spare.

using a level taped to a long, straight 2-by-4. If you don't intend to build a cooking grate, skip ahead to Step 7.

**4 Dig a hole.** Use a posthole digger to dig a 6- to 8-inch-diameter hole that's 18 to 24 inches deep for the iron pipe sleeve that will support the cooking grate assembly. The ideal position for the pipe sleeve is just kissing the inner surface of the metal fire-ring insert, as shown in the illustration above. Insert the pipe sleeve so it's level with the top of the metal fire ring (or slightly taller) and stands perfectly plumb. Mix and pour the concrete to fill the hole around the pipe; keep the top of the concrete just below the soil surface so it won't interfere with the metal fire ring and blocks when you install them.

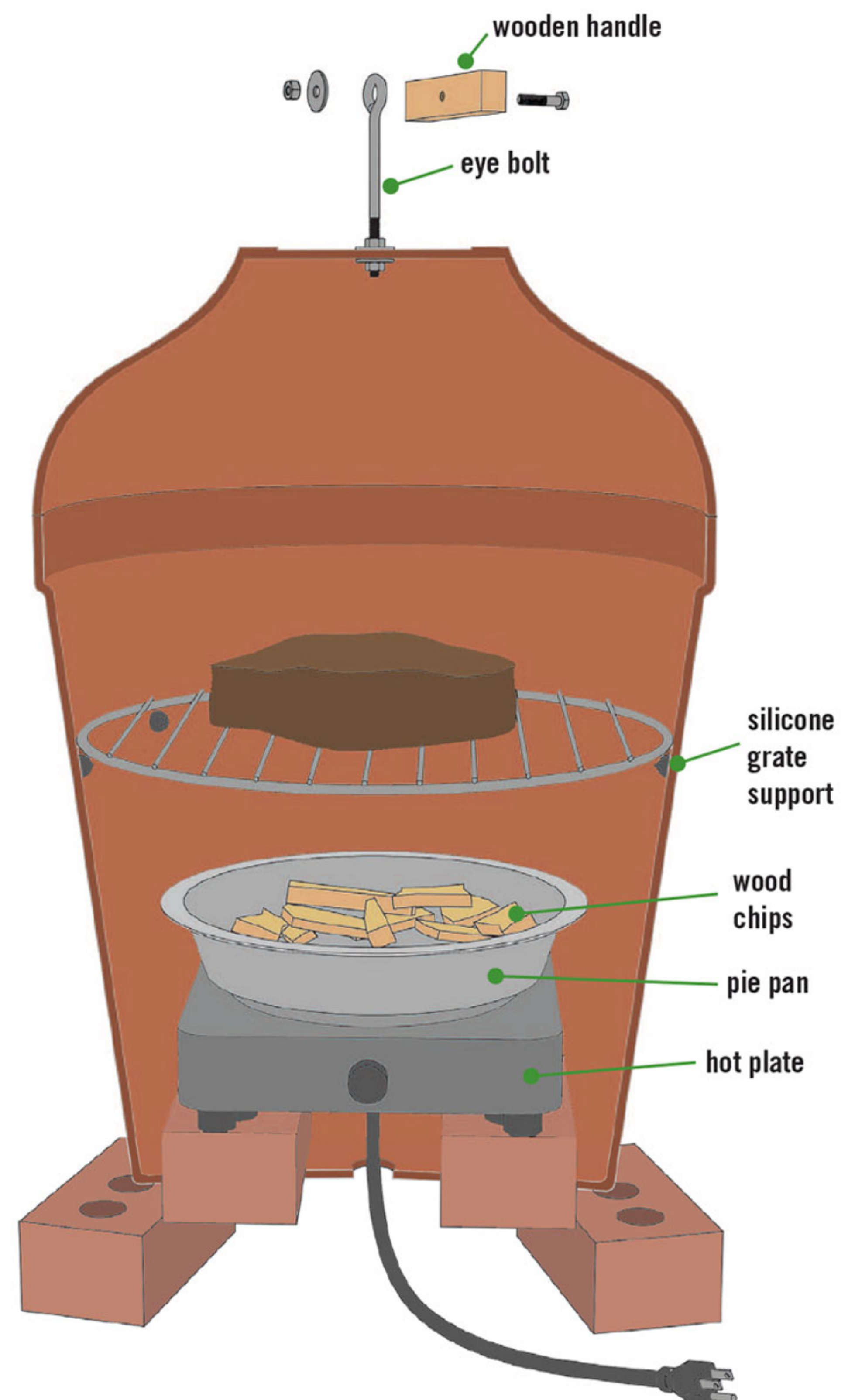
**5 Build the pivoting cooking grate assembly.** Use standard iron pipe and

fittings, as shown in the cooking grate assembly drawing above. Thread the parts together and tighten all the joints firmly with pipe wrenches. (You can fiddle with the size and design to match your site and cooking needs.)

**6 Install the grill.** I used a 22-inch replacement grill and wired it to the arms of the assembly in four places. Make the cooking grate's height adjustable by drilling a few 5/16-inch-diameter holes spaced 2 inches apart near the bottom of the pipe leg. Use a 1/4-inch bolt to peg the height you need.

**7 Position and level the metal fire-ring insert.** Set the first course of retaining-wall blocks around the perimeter of your fire pit. If the last block doesn't fit, pull each block an inch or so farther away from the metal insert and try again until the blocks form a full circle. Use





**Make a smokin' smoker:** Accessorize a clay pot with a grate, hot plate and a lid.

- **Grate.** You can find a grate at hardware stores or online. The one you choose must be of the right diameter to nestle inside your clay pot about  $\frac{1}{4}$  of the way down the sides.
- **Cover.** Find a pot tray or a clay pot that will fit over, inside of, or directly on top of the lip of the larger pot. The cover should create a decent seal and not be prone to sliding off the larger clay pot.
- **Handle.** Make sure the handle assembly hardware will work with the cover you chose.

**2 Drill a hole.** Use a masonry or glass-and-tile bit to drill a hole—or enlarge an existing hole—in the bottom of the large clay pot for the hot plate's electrical plug to pass through. To minimize the chance of damage as you drill the hole, cradle the pot on a bag of sand for support.

**3 Assemble a handle for the lid.** Use the eye bolt, bolt, washers, nuts, and a 6-inch length of wood or wood dowel. Drill a hole in the bottom of the clay cover for the handle assembly (see illustration above).

**4 Test-fit the parts.** Position a few 2-inch-thick brick or patio block scraps inside the pot to prop up the hot plate for air circulation. Place the pie pan for wood chips on top of the hot plate, insert the cooking grate, and then add the cover. When everything fits, you'll be ready to start smoking. Prop the pot on three bricks or patio blocks. If your cooking grate wobbles or tilts, create three support lips for the grate to rest on using dabs of silicone caulk on the inside of the larger pot.

**5 Get smokin'.** Position the smoker outdoors on a noncombustible surface in a sheltered area. On the trial run of my homemade smoker, a 5-pound brisket took  $4\frac{1}{2}$  hours to get to the recommended internal temperature of 180 degrees Fahrenheit. Some trial and error will be required to find the hot plate setting that will keep your DIY smoker within the desired temperature range—between 210 and 220 degrees. Use gloves to handle the hot components of your smoker, and keep curious children and pets away from the designated smoking area. 🌿

## Smoker Materials

*Electric hot plate, 1,000 watts or greater*

*Clay pot, 12" to 16" diameter*

*Smaller clay pot or tray for lid*

*Circular cooking grate, sized to pot interior*

*5 to 7 pieces of 2"-thick brick or patio block scraps*

*Metal pie pan*

*Oven thermometer with range up to 220 degrees Fahrenheit*

### For handle assembly

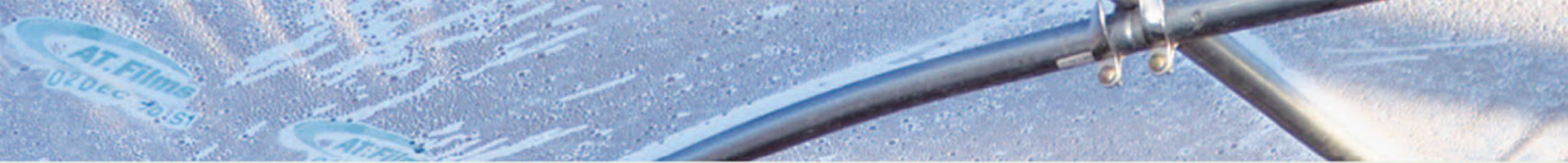
*1 eye bolt,  $\frac{3}{8}$ " or  $\frac{1}{2}$ " x 6", with 2 washers and 2 nuts*

*1 bolt,  $\frac{1}{4}$ " x 2", with washer and nut*

*1 wood dowel for handle, 6" long*

Spike Carlsen is a carpenter, editor and author who cooks up fun in Minnesota. These projects are from his excellent DIY book *The Backyard Homestead Book of Building Projects*.





# Grow More Food in a MOVABLE GREENHOUSE



Boost productivity in spring, summer, fall and winter with a do-it-yourself greenhouse you can transport around your plot.

By Barbara Damrosch  
and Eliot Coleman

Many gardeners use cold frames and quick hoops to extend the growing season, but just beyond these options is a step we think is simple and super-productive for the home gardener: a small, low-cost, portable greenhouse. At first, this may seem like a big step. We've found, however, that you can build a 10-by-12-foot greenhouse for less than you'd spend on a store-bought 4-by-4-foot cold frame. Our goals in designing this movable greenhouse were that it be inexpensive, simple to build with off-the-shelf parts, and easy to move and anchor.

Even gardeners in moderate or warm climates can benefit from a greenhouse, which gives you much more variety in your homegrown winter fare, and also makes the experience of growing it more pleasant. Like the cold frame and the quick hoop, the greenhouse furnishes a warm and sheltered spot for plants, but because you can stand up inside it, a greenhouse also shelters *you*. Just think about heading out to your plot, harvest



basket in hand, even while fresh snow is tumbling down.

Similar to a cold frame, a simple greenhouse captures the sun's heat and eliminates the drying, chilling effects of wind. Often a gardener's first thought regarding a greenhouse will be: "Wouldn't it be nice to grow warm-weather crops, such as tomatoes, during winter?" But that would mean providing some sort of artificial heat, and suddenly the simple greenhouse becomes a big expense. Here's the great part: You don't need to heat your greenhouse in winter if you plant hardy crops that are most content growing in cool weather. Come spring, you'll get in those early crops even sooner than normal, and you'll transplant your warm-weather tomatoes earlier in the year. Then, sit back and wait for extra-early ripening—all of this with no artificial heating required.

## The Greenhouse Structure

The frame of a non-glass greenhouse—the structural surface against which the plastic covering rests—can be made of a far wider range of materials than the frame of a glass greenhouse can be.

We've seen them made of bowed saplings from the woods or curved sections of concrete-reinforcing wire panels. We've seen greenhouses made with a few leaning poles holding the plastic sheet out from the south wall of a building. All of these simple structures shelter plants well and demonstrate the creativity gardeners employ to be able to grow food all year.

In the standard commercial greenhouse, bowed metal hoops forming a pipe frame support the plastic sheet. This is what the phrase "hoop house" describes, and it's the style on which we've modeled our greenhouse. But we've added a trick to make ours even more productive: It moves!

## A Movable Greenhouse

The ability to move a greenhouse from one place to another will ease the seasonal transition from winter to summer and back to winter for all of the crops covered by the greenhouse. You can leave it over summer crops, such as tomatoes, peppers and basil, to safeguard them from fall frosts and keep them producing longer. Then, you can move the greenhouse



This greenhouse design has door flaps that you can open for ventilation on sunny winter days.

to protect cold-hardy crops that you've planted nearby so you can enjoy them well into winter. Such crops don't mind early frosts—in fact, they prefer to grow in the increasingly cool days of fall.

If a greenhouse can be moved to where you want it, when you want it, a whole new world opens up. You get the positives of greenhouse growing—namely, cold protection—while eliminating the negatives, such as the pest and disease buildup that can occur in soil that's continuously enclosed. In addition, you increase the number of crops that can be sheltered by one greenhouse by covering plants only when they need protection.

All that's required to make a greenhouse mobile is a slight modification to

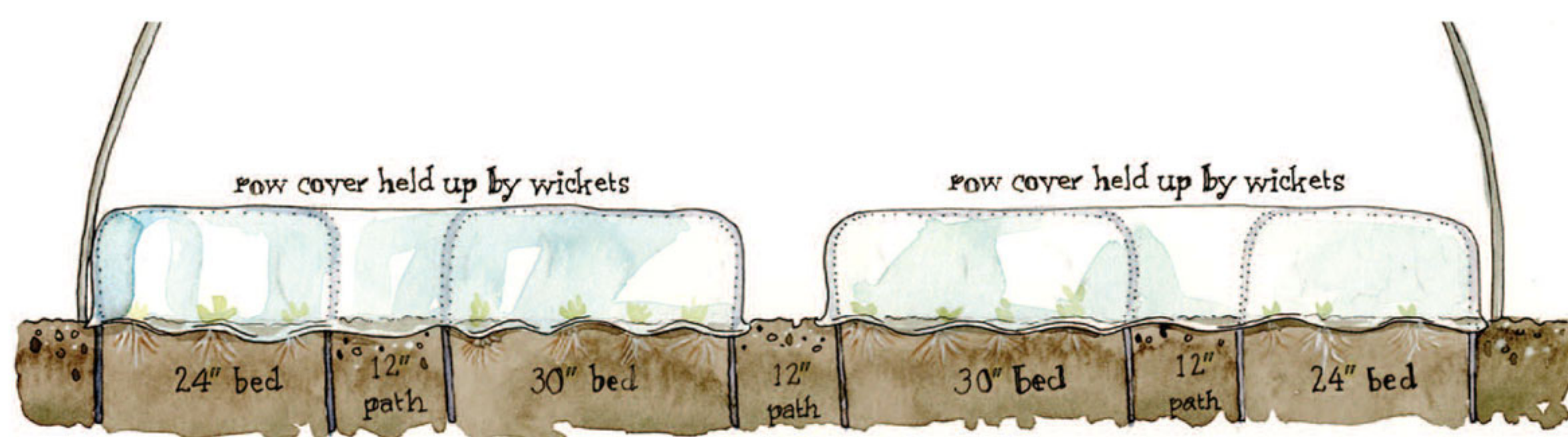
its construction. Normally, standard pipe-frame, plastic-covered greenhouses stand on a foundation of pipes driven into the ground. The far more expensive glass ones are usually erected on a concrete foundation. Ours is firmly attached to the ground when it's in place, but it can be detached for moving and then anchored again in a new location.

A greenhouse large enough to make a significant contribution to supplying your family with homegrown food year-round should be at least 10 by 12 feet. Our basic greenhouse is just that size, and builders can double or even triple the length by adding on modules of the same size. (For detailed building instructions, go to <http://goo.gl/S5XWeM>.) The frame



Get movin'! At 100 pounds total, the greenhouse can be picked up and relocated by two people.





Grow even more crops by using row covers as a second layer of protection inside your greenhouse.

consists of three half-circles of metal pipe attached to structural cross-pieces. A 10-foot length of pipe bends easily into a quarter-circle, and two of them form a half-circle hoop. We bend them the same way we bend our quick hoops, but we use a bender designed for high tunnels instead of low ones. (Find hoop-bending forms through Johnny's Selected Seeds; [www.JohnnySeeds.com](http://www.JohnnySeeds.com).) For pipe, we prefer the 10-foot-long and 1-inch-diameter pipes used for electrical conduit (called "1-inch EMT," which stands for electrical metallic tubing). They are available in the electrical department of home-improvement stores.

For the foundation of the greenhouse, instead of inserting the bottom end of the hoops into larger-diameter pipes driven into the ground, as is done with standard hoop houses, we attach the bottom of the hoops perpendicularly to a length of 1-inch EMT lying horizontally on the ground. With this setup, all parts of the 10-by-12-foot greenhouse module are connected as a single unit rather than

having each rib individually attached to its own ground post. The greenhouse is thus like a metal-pipe, plastic-covered bird cage that can be picked up and transported anywhere you want it.

After the greenhouse is in place, we attach it to anchors to hold it there (they're easily detached for moving). The corner anchors consist of four lengths of top-rail pipe, each 2½ feet long. One is driven into the ground at each corner of the greenhouse, and each is attached to a U-bolt that secures to the base connectors. We keep the plastic cover in place with form-fitting plastic clips that hold well, even in wind. All of this works smoothly and keeps the price low.

The weight of the pipes, the connecting parts and the plastic for this portable greenhouse add up to about 100 pounds. Thus the "pick up and move" part is doable for two reasonably fit and able-bodied gardeners. The two of us have moved this greenhouse many times with no problems, and because the structure isn't so heavy

that it has to be dragged into place, you can put it on any site, no matter how distant from the greenhouse's original position. If that seems beyond you, find some extra helpers on moving day.

## Ideas for Every Season

This greenhouse design accommodates plants grown directly in the ground—not plants cultivated on the waist-high benches some hobby greenhouses feature.

The winter inhabitants of your greenhouse will be cold-hardy crops. Plenty of vegetables can withstand cold weather, and some actually taste better because of it. A few frosts have a way of sweetening leaf crops and root crops. Over the years, we've experimented with some 30 different vegetables in our winter garden, including arugula, beet greens, carrots, chard, chicory, claytonia, collards, kale, kohlrabi, leeks, lettuce, mâche, mizuna, mustard greens, parsley, radicchio, radish, scallions, sorrel, spinach, tatsoi and turnips. (For specific variety recommendations for several of these crops, go to <http://goo.gl/ha7KZA>.) They've all been successful to some degree, and the favorites in our household are spinach, carrots, tatsoi, chard and kale.

In most of the country, these crops are harvestable through winter as long as they have the minimum amount of protection



Grow fall greens outdoors, and move the greenhouse over them when winter sets in.



from the outdoor weather that a single layer of plastic can give them. Here in Maine, we usually move the greenhouse over the winter crops about mid-October and plan to start eating those crops about mid-November.

In a cold climate such as ours, a second layer of protection inside the greenhouse will increase its value. We've kept temperature records for years, and here on the Maine coast, our portable greenhouse alone creates a winter climate akin to that of New Jersey, and the second inner layer magically transports the area under it to Georgia. When it's 15 below zero outside here, it's 18 degrees Fahrenheit beneath the greenhouse's inner layer, and the cold-hardy winter crops don't mind that at all.

Your greenhouse can also help you transition from winter to spring. After our winter spinach begins to go to seed in spring, for example, we can clear the bed, add more compost, and replant it with early tomatoes. Thus, tomatoes get going about six weeks before our last spring frost date, because the double-layer of protection will keep them from freezing.

Our summer crops will have an excellent head start, and in this temperate climate, they will keep producing all summer as long as the greenhouse is well-vented. The doors at either end—we call them “scissor doors”—are used for both access and ventilation, and they allow for complete airflow if tied in the fully open position. If you live where summers get quite hot—too hot for even a well-vented greenhouse—you have other options. For one, you can uncover the greenhouse by taking off the plastic after it has given the early crops a jump-start, but before the crops begin to bake in there. If you prefer to leave the greenhouse covered, you can add a layer of shade cloth over the plastic to decrease the heat buildup. A 40-percent shade cloth made of a reflective material is a good bet for the backyard greenhouse. Or, you can always move the greenhouse out of the garden for a few weeks until you're ready to put it to use again.

If you'd rather have more instant gratification in spring from salad-type vegetables as opposed to waiting for tomatoes, peppers and the like to mature, another winter-into-spring planting scheme could



The treasures a greenhouse can bring (clockwise from top left): early-ripening tomatoes, tender new potatoes in spring, and sweet, crisp root crops, such as carrots and parsnips.

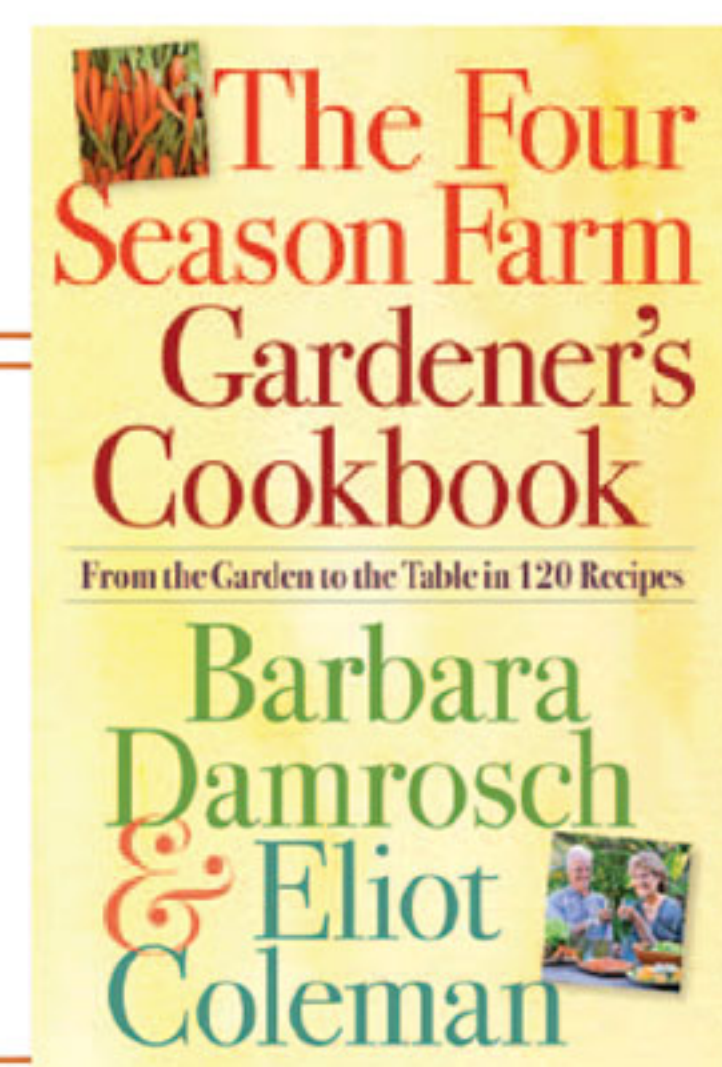
be the following: Plant patches of beets, carrots and spinach along with a bed of potatoes. Plant lettuce along with a few scallions at one end. The beets, carrots, lettuce, scallions and spinach can be planted anytime in spring, as soon as the space can be cleared from your winter crops. We plant our early potatoes on March 15; ‘Rose Gold’ is our favorite variety for early greenhouse production. Of course, you could have all of these in addition to early tomatoes, etc., if you build a second greenhouse. We're betting you probably will.

Another summer option for your greenhouse is to trap heat and use that heat to your advantage to prevent future weeds and pests in a process called “solarization.” To do so, clean out all of the early green-

house crops after the outdoor garden has started producing. Irrigate the greenhouse soil thoroughly, lay a sheet of clear plastic over the soil inside, and shut the doors. Those two layers of plastic (the greenhouse itself and the plastic over the soil) will trap enough of the summer sun's heat to kill weed seeds and plant disease organisms down to at least 4 inches deep in the soil.

To get step-by-step instructions for building this portable greenhouse, go to <http://goo.gl/S5XWeM>. We've been using these techniques for 30 years, but the thrill has never worn off. We're still as delighted as children by the wide range of crops we can harvest daily from our greenhouse garden. 🌱

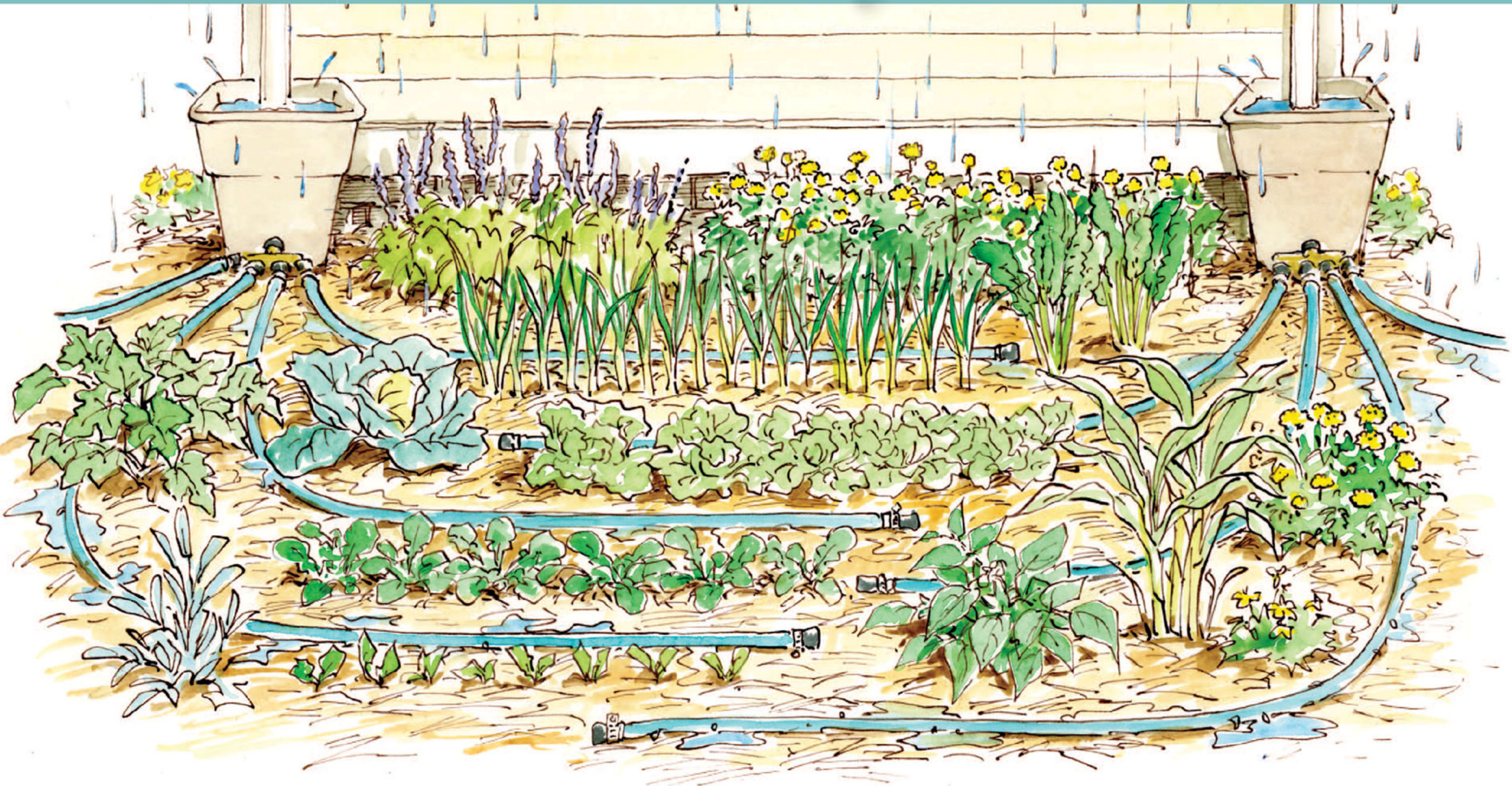
Barbara Damrosch and Eliot Coleman are two of the country's foremost authorities on organic gardening and winter growing. This article was adapted from their latest book, *The Four Season Farm Gardener's Cookbook*. Go to [www.MotherEarthNews.com/Store](http://www.MotherEarthNews.com/Store) to order this resource brimming with gardening advice and recipes.





# RAINWATER HARVESTING

## *A Better System*



Think beyond the rain barrel: This simpler, cheaper approach will help you harvest much more free water for your garden!

By Cheryl Long

Illustrations by Elayne Sears

**H**arvesting rainwater to use for growing vegetables makes a great deal of sense. Unfortunately, the most common method of collecting rainwater isn't the most effective. Typically, gardeners invest in a rain barrel—which holds only 50 or 60 gallons of water—and then dole out the captured water to plants

as needed, hopefully emptying the barrel before the next storm.

But 50 gallons is only a small fraction of the rainwater you could be harvesting. During a 1-inch shower, more than 900 gallons of free water flow off the roof of a 30-by-50-foot house or barn. Instead of catching just a little bit of it in a rain barrel, why not capture it all? You can do just that with a simple setup that diverts rain from your downspouts directly to your garden.

### How Soil Stores Water

Even many experienced gardeners have trouble comprehending just how much water soil can hold. Except in areas with consistently high rainfall, your garden soil's moisture level will seldom be at "field capacity" (the term scientists use to describe the maximum amount of water a soil can hold). When it rains or when we irrigate, gravity pulls the water down into the soil. After a heavy rain, some of the water may



move all the way down to the water table or the bedrock, but a large amount of it is held by capillary forces that cause water to coat each soil particle and partially fill the spaces between the soil particles. (An example of capillary action is the way a paper towel absorbs liquid.) That capillary action is what delivers water to your growing crops.

Each soil's field capacity varies depending on how much sand or clay is in it. One cubic inch of coarse sand may contain 125,000 particles, while the same amount of the finest silt could contain 15.6 trillion particles! A soil particle has an astonishing amount of surface area (the total size of all its faces). One cubic inch of an ordinary soil could have an overall surface area of 25 square feet.

What those numbers mean is that many soils can hold at least 2 to 3 inches of water in each foot of soil depth. Crop roots can reach down 4 to 8 feet to tap this capillary water.

To be sure crops get the water they need, gardeners would ideally want to keep their soil moisture near field capacity to a depth of at least 4 feet (which, on average, means the soil can hold 8 to 12 inches of rainwater in that space!). During peak growth, crop transpiration together with surface evaporation can draw as much as a half-inch of water per day.

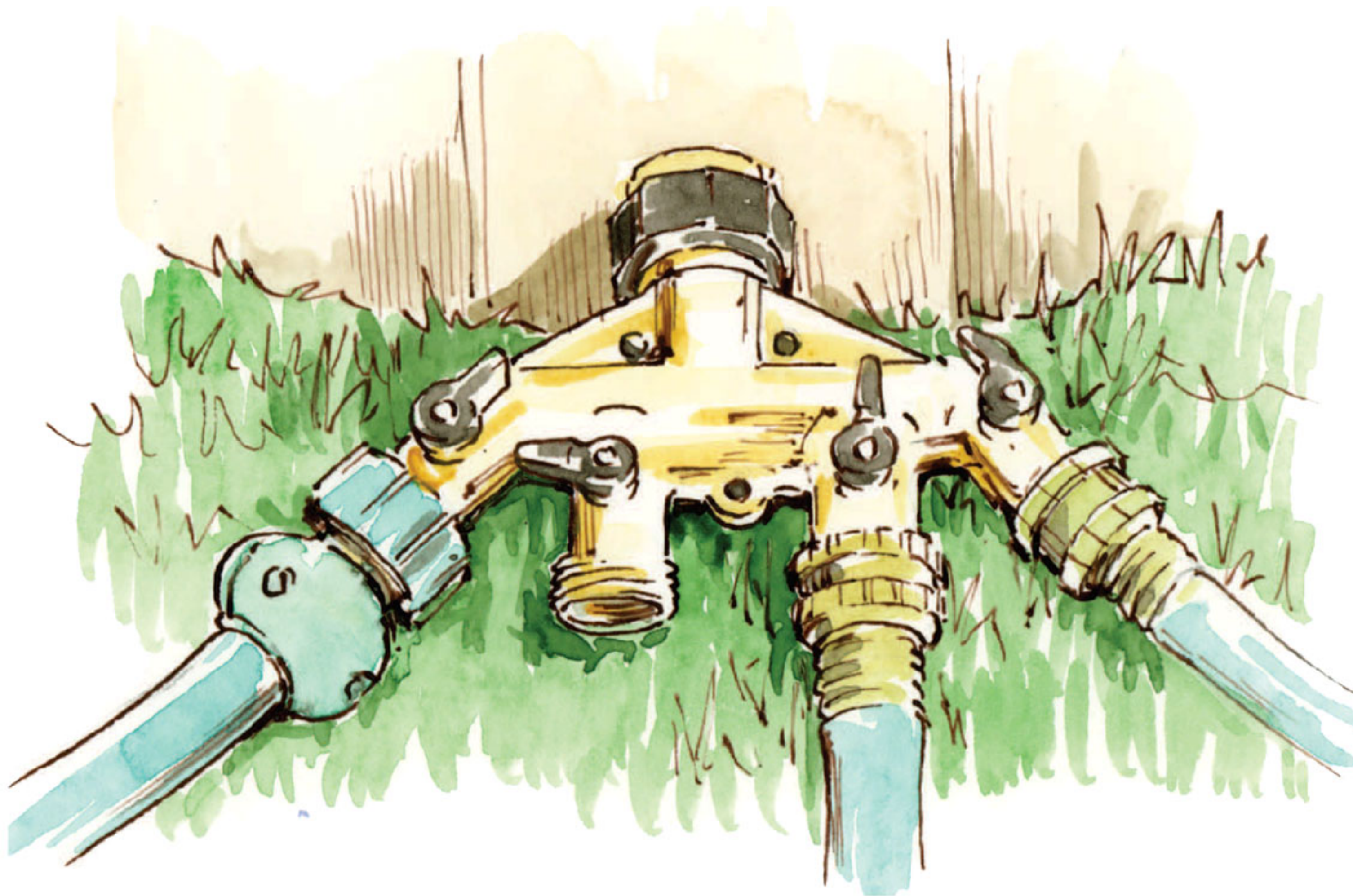
The more water you've stored in your soil, the less you will need to provide supplemental irrigation.

## Your Improved Setup

To store as much rainfall as possible in your garden soil, you can set up a rainwater irrigation system that diverts your roof runoff directly onto your garden beds.

This rainwater-harvesting system relies on gravity to carry rainwater from your downspouts out into your garden or lawn. For it to work, the area you choose to irrigate must be level with or below your downspout. If your garden is not near a downspout, you can attach a larger pipe to the downspout to carry the water out to a manifold and a set of perforated hoses in the garden.

**Step 1: Go shopping.** Study the illustrations in this article, and then head to a hardware store and buy one or more stand-



This distribution system will deliver rainwater to where it can be stored best—in your garden soil.

ard plastic trash cans. (If you already have a rain barrel, you can just use it.) Look for a hose manifold that will let you attach several hoses to it (see illustration, above). You'll need one manifold per trash can. Next, find a bulkhead fitting to attach the hose manifolds to your trash cans. Take this article along and show a clerk.

**Step 2: Install the bulkhead fitting and manifold.** Cut a hole near the bottom of the trash can, attach the bulkhead fitting to the can, and screw on the manifold.

**Step 3: Cut a hole in the trash can lid; install the can under a downspout near your garden.** If there will be leaves in the water coming off the roof, you may want to cut the downspout off above the trash can and install a screen over the entrance hole into the trash can. The screen will allow water from the downspout to enter but will prevent leaves from being washed into the can and clogging the manifold.

To stop mosquitoes from breeding, drill a few small holes in the bottom of the can so water can drain away completely after each storm.

**Step 4: Install perforated hoses.** Decide which areas you want to direct the rainwater to, then round up some old garden hoses. If you don't have any, ask around—many of us can seldom bring ourselves to throw out hoses even after they've aged and begun to leak. Cut them to the lengths you need, and then cap the ends or fold the ends back and secure with wire. Drill holes in the hoses every foot or so, and then attach them to the manifold. (Commercial *low*-pressure

soaker hoses will not work well with this setup.) If you use irrigation ditches between your crop rows, you can skip drilling holes in the hoses and just lay the hose ends in the ditches.

Each time it rains, roof water will flow into the trash can and out through the manifold to wherever you've directed the hoses. Check the system during a heavy downpour to confirm that the hoses are distributing the water where you want it. You may need to add more holes or possibly tape some holes closed.

Rainfall patterns vary greatly from region to region, but even if most of your rain comes in fall or winter, this system will let you store it right in your garden beds. (Be sure the manifold is fully drained during cold weather to prevent damage from freezing.) If you have periods during which your garden gets too much rain and the soil reaches field capacity, simply redirect your hoses away from the garden.

There's a bonus to using this DIY rainwater-harvesting system: If the rain doesn't come often enough and you need to irrigate using your household water supply, you can just aim your main hose into the trash can and turn on the water, and your network of hoses will distribute the water wherever you want it. 🌳

Cheryl Long has been testing innovative home gardening techniques for more than 30 years.



# The Multiple Benefits of GRASS-FED MEAT

Grazing ruminants play an important role in maintaining our health and protecting the environment. Give those animals grain in feedlots, however, and these health benefits become health risks.

By Richard Manning

**T**his story hinges on two numbers: 5.0 and 6.8.

At 5.0—the figure that dominates today’s industrial food chain—both you and the environment suffer. For humans, it means more obesity, more diabetes, more heart disease, more weakened immune systems, more feeble brains and dementia, maybe even more cancer. For the environment, it means more carbon in the atmosphere, more floods, more erosion, more dying streams and lakes, more cruelty. Push that number to 6.8, however, and we can reduce all of those problems.

## Ruminating on pH

These two numbers measure the health of an ecosystem that was the linchpin of human development through the hundreds of thousands of years of our evolution to our modern form. That ecosystem is still essential, because the fundamental facts of humanity have not changed: We are big-brained, upright mammals that thrive in grasslands.

Grass is  
useless to us  
directly, so  
we outsource  
its digestion  
to grazing  
animals.

Compared with other organs, the human brain is an energy hog, and because our brains are big, we need more calories and nutrients pound for pound than other animals do. Our upright posture places extraordinary constraints on our structure, especially our center, and dictates a small, muscular abdomen. No room for guts to process a lot of food at one time.

Grass is useless to us—directly. We can’t eat it. Its energy is locked up in cellulose, and we don’t have the intestinal fortitude (or magnitude) to break those calories loose. So here’s the deal evolution cut for us: We outsource grass digestion to the deer, gazelle, musk ox, elephant, caribou, elk, aurochs, goat, sheep and, now especially, cow.

All of those animals have in common a cavernous gut that is centered on a fermentation vat called the “rumen”—hence their name, “ruminants.” Like all fermentation vats, the rumen is an ecosystem. It works by harboring bacteria that have the unique ability to break down cellulose to more usable forms of carbohydrates. The bacteria depend on a friendly environment in the rumen, which, especially in cows, happens to be best measured by acidity: a near-neutral pH of 6.8.



## Subverting Evolution

In evolutionary terms, feeding ruminants grain instead of grass—the now near-universal habit of the industrial food chain—is a radical and arrogant experiment, tinkering with the basic function of a whole suborder of animals. The dense carbohydrate load of grain completely reworks the ecosystem of the rumen, creating an acidic pH of 5.0, which causes the condition called “acidosis.” A cow with this condition has an acid concentration in its rumen that’s 200 times greater than in the rumen of a healthy cow. Grain makes cows sick, and in this matter, organically grown grain makes no difference. The damage reverberates in human health.

The normal, grass-happy bacteria digest cellulose to yield a combination of carbohydrates and essential fatty acids, which are those fats our bodies must have but cannot manufacture. A healthy, grass-fed digestive system delivers a mix of fats weighted to healthful fatty acids, including omega-3s.

The sick, acidified rumen of a grain-fed animal supports different bacteria that yield a nutrient profile that will produce more omega-6 fatty acids. Research suggests that a diet high in omega-6s may create inflammation in humans, and a wide range of human health problems—from obesity to heart disease to dementia. (Our increased use of high omega-6 vegetable oils in recent decades has also shifted the balance of omega-6s to omega-3s.)

A healthy rumen is proof positive that a cow has been eating grass, shrubs and forbs—a wide variety of deep-rooted perennial plants. Ruminants range because they must eat an enormous volume of food. This diverse diet concentrates an array of minerals and micronutrients in their milk and meat. This phenomenon extends beyond ruminants to hogs and chickens. The latter two are omnivores rather than ruminants, but they still bioaccumulate minerals and micronutrients if they feed on perennial pasture. Perennial pasture plants are deep-rooted, and they deliver a whole string of key nutrients and trace minerals—such as copper, magnesium and iodine—that shallow-rooted annual grains cannot.

Much research bears this out. For instance, a 2010 review article that examined all available publications on the benefits of grass-fed meat confirmed the assertion that levels of essential omega-3 fatty acids are higher in grass-fed meat, eggs and dairy, compared with industrial products (see chart on Page 112). The review also confirmed increased levels of other key beneficial fats, and of nutrients, such as beta carotene,

vitamin E and cancer-fighting antioxidants, in grass-fed meat. Advocates for grass-fed systems (and the authors of some other studies) say these conclusions are actually overly conservative.

## The Problems With Feedlots

Eggs, milk and meat from grain-fed animals come mostly from confinement systems and feedlots, and many issues arise from this fact. To begin with, an acidic rumen makes cows sick, so industrial dairy cattle have a scandalously short life span of just three to five years. Because of acidosis, all feedlot animals have compromised immune systems that require a steady flow of antibiotics to prop up. The threat this poses to human health through antibiotic resistance is serious and well-documented.

Feedlots are manifestly cruel, yet their less-obvious spinoff effects are also egregious. For instance, much attention has justifiably been focused on the environmental threat of the mountains of manure generated in feedlots and confinement operations. But a recent study by the U. S. Geological Survey of an area of southern Idaho plagued with an explosion of feedlot dairies showed that the nitrogen pollution from the fields that grew the grain and silage for the feedlots was about twice as bad as the feedlot manure itself.

Looking at the larger footprint of feedlots yields an even more appalling picture. For example, the British National Trust, which manages more than 600,000 acres in the United Kingdom, conducted an exhaustive examination of the research on the full range



**Eating nutrient-dense meat from animals that grazed on perennial pastures helped humans evolve into big-brained, upright creatures.**





**The presence of grazing animals, such as these cattle in Blanco County, Texas, is required to keep pastures and prairies healthy.**

of environmental costs of feedlots and benefits of pasture in 2012. The report, which you can read online at <http://bit.ly/1ZgV5X7>, cites both the Trust's own studies as well as the available literature from the United States and Brazil—and ends in favor of pasture. Reducing global warming looms especially large in this study. A 2006 report from the Union of Concerned Scientists, which you can read at <http://goo.gl/KKX48A>, offers a similar conclusion, and includes qualifications that affirm the environmental costs of concentrated animal feeding operations.

## Straight Lines vs. the Circle of Life

An industrial farm field is linear: Fertilizer, seed and water go in, and grain for cattle and soybeans for Tofurky come out. It's easy enough to see that a farm field with a single crop, its nutrient cycling solely dependent on the nozzle that sprays anhydrous ammonia fertilizer, is not a healthy ecosystem.

Yet we can't create circular, sustainable ecosystems simply by replacing corn and soybeans with the two or three hundred species of plants normally resident in a native prairie. The system needs grazing animals and their rumens to digest and recycle cellulose. Without them, the grasses grow old and rank; nutrients remain locked in them, because animals disdain such mature grass.

An ecosystem is cyclical, with cycles of life and death capturing, storing and reinvesting energy. Death and decay recycle nutrients, so they are integral to an ecosystem's productive

capacity. Sustainable grassland ecosystems must include plants, microbes and grazing animals. Big animals with rumens drive the entire process, meaning these systems cannot be healthy without them.

## To Eschew Meat—or Not?

A consumer considering whether to eat animal products seems to have two ways to proceed.

One course is to disengage by eating no milk, meat or eggs, a decision seemingly supported by a long body of shortsighted research that traces human disease and environmental destruction to meat and milk. Virtually all of this research is based on the food products of animals kept in feedlots and fed on grain. The fatty acid profile of these animals' products, so high in omega-6s, by itself is enough to explain the deleterious effects on human health cited in those studies.

Avoiding meat and dairy deprives a body of nutrients, however. We're focusing here on the differences between grass-fed and grain-fed, but products of both systems have a lot in common. They both contain high concentrations of essential amino acids—proteins—difficult to obtain from plant sources, as well as vitamins A, B6, B12, D and E, and minerals, such as iron, zinc and selenium.

Good grazing practices ramp up beta carotene in animal products, meaning the fat, egg yolks, milk and butter show a deeper





**Choose grass-fed or wild animal products whenever you possibly can. The meat of grass-fed ruminants, such as sheep, goats and cattle; wild cold-water fish, such as salmon; and grazers, such as wild or farm-raised bison, gives you more nutrients than that of feedlot animals.**

yellow or orange color (think of beta-carotene-rich carrots). This color in dairy products and animal fats is a sign of good grazing.

This greater nutrient density in grass-fed products begins an argument for the other course—not disengaging, but rather following the path that supports healthy ecosystems. The magic of working ecosystems is that the whole is greater than the sum of the parts, which is why “reductionist” research, which looks at only a single detail, doesn’t describe the whole. Nonetheless, the pieces describing the benefits of grass-fed meat do make a compelling case:

**Nutrition.** By every indication, the benefits of grass-fed meat are numerous—especially in its fatty acid profile. This is not a small thing, and piecemeal evidence suggests additional nutritional benefits contribute to grass-fed products’ superiority.

**Environment.** Some research says that grass-based production systems increase carbon sequestration, which means grass-fed meat probably has a smaller carbon footprint than industrial animal production. Grass-based production certainly creates less erosion, uses less energy, and reduces the use of chemical fertilizers and pesticides.

**Social justice.** A close look at a set of counties in southern Idaho now dominated by feedlot dairies found that undocumented immigrants held 80 to 90 percent of the jobs in the industry, by the industry’s own admission. These are miserable jobs, and childhood poverty and low wages plague the area, while income and farm subsidies are concentrated among a few mega-farms. Meanwhile, in a 2006 University of Wisconsin survey of all varieties of farmers in the dairy state, in which nearly 25 percent of dairy production comes from pastured animals, farmers whose cows grazed perennial pastures reported the greatest life satisfaction.



**Economic viability.** All sectors of grass-fed production are growing, driven by profit, not subsidy. The public is beginning to understand and act upon the arguments I’m summarizing here.

## Pastured Products Done Right

In 2010, the journal *Agricultural Systems* published a paper titled “Comparative Life Cycle Environmental Impacts of Three Beef Production Strategies in the Upper Midwestern United States.” The paper concluded that feedlot beef production has less environmental impact than grass-fed does. It was the sort of thoughtful and reasoned accounting that might give us all pause in the rush to buy products from pastured animals. The paper was anchored in valid assumptions, and one of those was to base the calculations on existing grazing practices in Iowa—where farmers typically seed old corn ground to annual grass, fertilize it, and then turn the cattle in. There are large energy costs in seeding, renewing and fertilizing these “pastures” each year.

This is a devil in the details and it’s exactly why much of the nutritional and environmental evidence on grass-fed meat is highly variable and even contradictory. Grazing on an annual monocrop (usually wheat) is not the same as grazing on perennial pasture. Meat from animals on even poorly managed grazing can sport the U.S. Department of Agriculture’s grass-fed label, however, because that standard requires only that pasture was the animal’s sole source of nutrition. The animals may have the ideal rumen pH of 6.8, but the nutrition from those monocrop pastures doesn’t equal its perennial prairie counterpart of deep-



rooted plants pulling nutrients from deep in the soil.

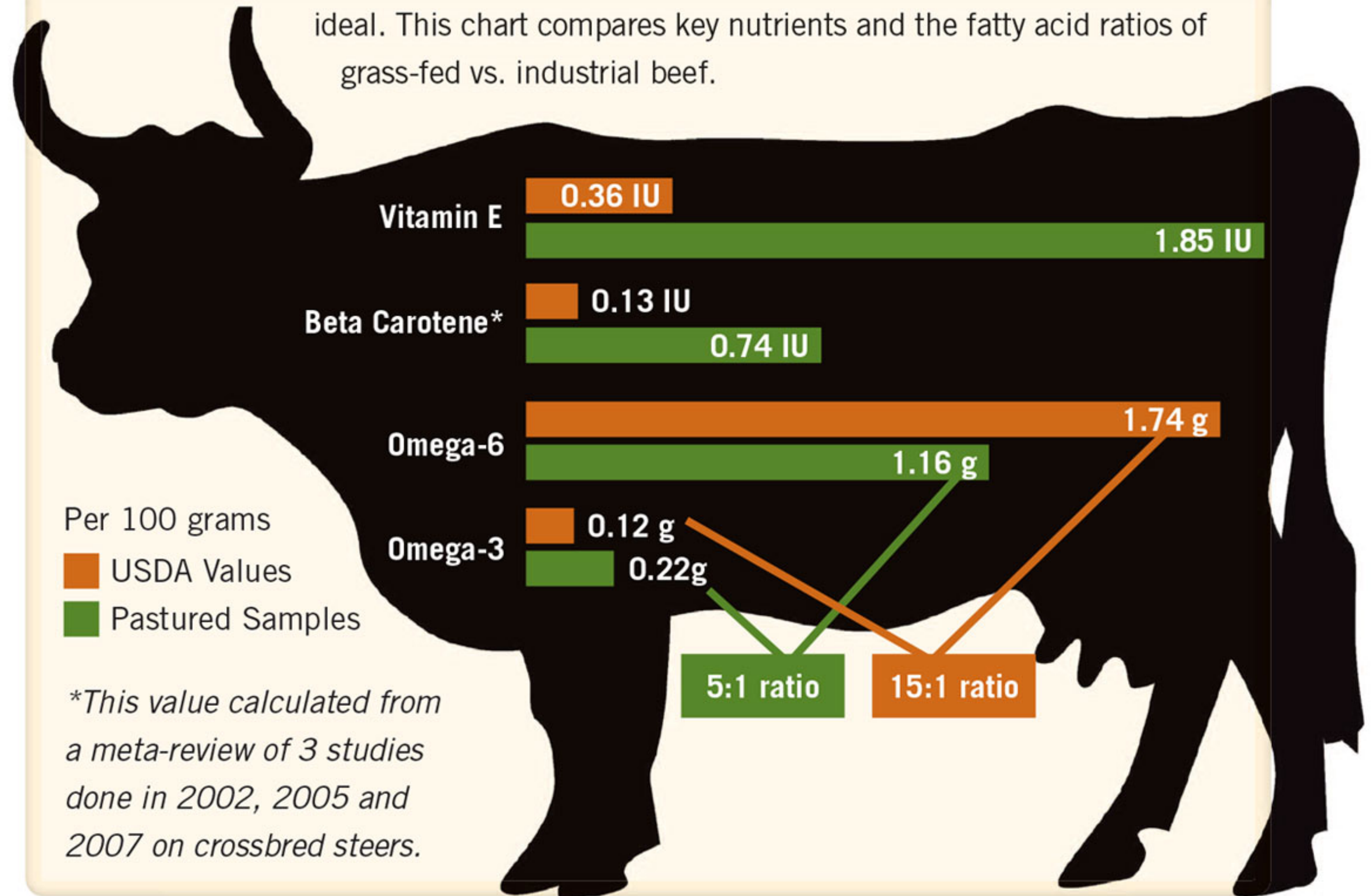
The USDA standard is not good enough. The grass-fed movement commits to a system usually labeled “managed intensive rotational grazing,” which mimics the effects of the wild ruminants, such as bison, that dominated the North American prairie for thousands of years.

Many of the benefits of grass-fed meat in general are greatly amped up under this perennial pasture regime. For instance, rotational grazing causes grass and other plants to slough off and regrow roots. The dead root matter is largely carbon, so this is the engine of carbon sequestration in the soil. Grazing, together with photosynthesis, stores carbon in the soil, and the soil thus becomes more fertile. Meanwhile, remaining roots drive deeper, giving the plants access to subsoil nutrients. Biodiversity increases, as a range of bugs, crawlers and microbes digest the dead matter in the soil. Legumes fix nitrogen as they do in a natural prairie—no seeding, fertilizer or renewal required. The goal is, in other words, permanence and sustainability through ecosystem restoration. If rotational grazing on perennial pasture is done right, the energy costs included in that Iowa cropland example cited earlier would never accrue, and suddenly the balance sheet looks much improved.

The 2011 report “Raising the Steaks” by the Union of Concerned Scientists gets at the crucial issue in all of this: The key is not just grazing, but how the grazing is done. The report, available at <http://goo.gl/YDfcPQ>, concludes that managed grazing offers gains, especially in terms of environmental impact and methane production. The amount of methane released decreases

## Grass-fed vs. Industrial Beef

The ratio of omega-6: omega-3 fatty acids is linked to good health. The standard Western diet has a ratio of 15:1 to 16.7:1, but the lower the ratio, the better—1:1 is ideal. This chart compares key nutrients and the fatty acid ratios of grass-fed vs. industrial beef.



when cows eat high-quality forage from a managed perennial pasture that works like a restored ecosystem, compared with cows grazed on annual grass. The Union of Concerned Scientists’ report confirms that the better the forage, the less methane.

Genetics also play a role in grass-based systems’ success. Modern cattle have been bred to function in feedlots, but old-line breeds, some now resurrected, fatten months faster and yield more usable meat when fed grass than breeds with feedlot genetics.

All of this is relevant to calculations of economic and environmental efficiency, but such calculations are almost nowhere considered in published research. Crossing that line from feedlot to even badly managed pasture heads us in the right direction.

Beyond that, we can drive the system further toward smart, environmentally sound grazing by insisting on a more demanding standard than the USDA’s current grass-fed label requires, by buying locally, by knowing producers, by education.

Advocates of grass-fed systems say there’s another indicator of good pasture rotation. Badly managed pasture makes beef tough and less tasty, milk and cheeses less flavorful. Well-managed, deep-rooted pasture creates products with fine flavor and healthful benefits. Simply, we can taste and see quality and nutrition, which is evolution’s way of making us take the trouble to find them.

Richard Manning hunts his wild meat near his home in Montana. He is the author, with John J. Ratey, M.D., of *Go Wild*, which we highly recommend for more on this topic.



Grass-fed meat is tender and tasty if pasture is managed correctly.



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