# GRIT

COUNTRY SKILLS SERIES

INSIDE! ULTIMATE CHICKEN TRACTOR PLANS P. 54

# GUIDE TO HOMESTEAD DIY PROJECTS

## 33+ EASY DO-IT-YOURSELF PROJECTS

INCLUDING:

- Chicken Feeder and Waterer for Your Flock
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Vol. 10 Issue No. 4

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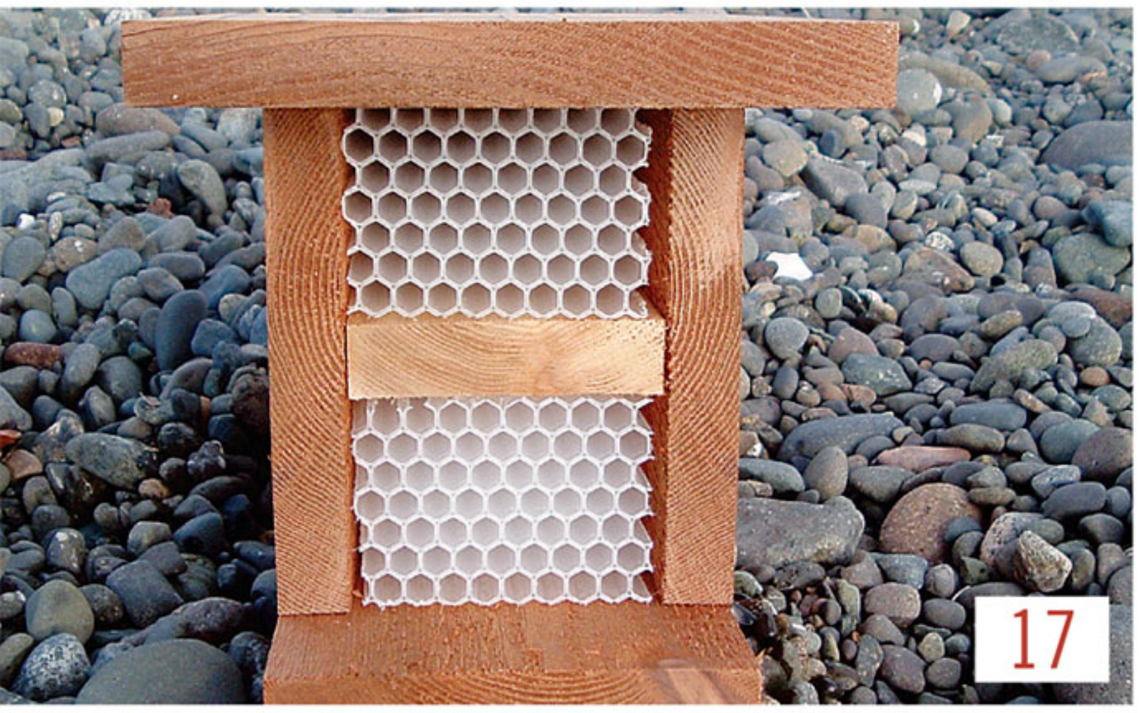




# GRIT


62


76


90

# Grit YouTube CHANNEL

## Splitting Firewood Efficiently

Splitting your own firewood can be good fun and good exercise, but a few tips will help ensure the process is safe and efficient. Grit Editor-in-Chief Caleb Regan discusses proper dress, footwear and hand protection to avoid injury and stay warm when working in the woodlot on a cold day. Watch the video at http://bit.ly/2dxoKMz for more expert advice.

## DIY Seed Starting Kits

Avoid spending too much money on pre-made seed starting kits and instead use materials that you have around your home. Learn how to make biodegradable seed starting kits out of newspaper in this how-to video by Mother Earth News Senior Editor Hannah Kincaid at http://bit.ly/2dxxLoA.

## When to Transfer Chicks from Brooder to Coop

Once your new chicks are ready for the coop, the biggest danger is not so much temperature as it is predators. See what else Ogden Publications Editorial Director Hank Will recommends at http://bit.ly/2dxpfGg.

## Home Blacksmithing

What can you do with a home blacksmith operation? Hank Will answers, "What can't you do with a home blacksmithing operation?" Blacksmithing is a versatile craft and can be applied to most any project around your farm and home. Head to http://bit.ly/1RFZdM9 for more ideas.

## How to Stack Firewood

Caleb Regan enjoys a toasty fire indoors on a cold winter day, and he knows well-seasoned firewood is the key to a clean-burning fire. To ensure your firewood is seasoned correctly and protected from the elements, it must be properly stacked and stored. Get tips for storing your firewood at http://bit.ly/2dxr7yP.

Visit YouTube.com/GritMagazine and Youtube.com/MotherEarthNewsMag to find other great videos on DIY projects and more. Be sure to subscribe to be updated on new additions to the channel.


# Grit

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Celebrating Rural America 24 Hours a Day...

## FEATURED COMMENT

"I couldn't wait to try building your treadle feeder, but I really didn't want my hens (the ones who are the sneaky side feeders) to get whacked in the head while learning to use it. I knew that if I thought on it long enough, I would come up with a solution. When I built the feeder, I simply made the 'treadle' part 8 inches wider than the body of the feed box. In other words, the treadle sticks out 4 inches on either side, so those side feeders are also standing on the treadle. Now when the chicken in front steps off, the side feeders are also standing on the treadle. No more whacked heads!"

– Grace Hallett on "How to Build a Chicken Feeder." Read how to build the treadle feeder on Page 8.

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## SEND US YOUR PHOTOS

Do you have some cool projects you'd like to show off? Have some great shots of your recently completed hoop house? Send us your photographs and a few details about your DIY projects. Send them to *ktrimble@grit.com*, and it may be featured on our social media platforms or in a future issue of the magazine.

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**93** percent of GRIT readers consider themselves a do-it-yourselfer

**49** percent complete 76 to 100 percent of their own home/garden building needs

## JOIN THE CONVERSATION

On "Don't Blow Leaves, Mow!" by Lois Hoffman, via Facebook

Nicki L Garcia: Mulch makes great natural fertilizer if you just leave a pile in a corner of the yard somewhere all fall and winter. You can also create a natural shelter from twigs, some old branches, toss leaves in, and let it set. Maybe loosen the soil about 8 inches deep, and don't over water the pile. This may attract small native wasps, and salamanders will hide under limbs and boards on the ground until spring. Butterflies may take shelter on the underside of twigs and limbs and hide beneath some of the leaves.

Jerry Myers: I mow them, gather them, and immediately till them into the garden along with chicken litter.

Shellie McClish: We always mow over our leaves. It's wonderful for the ground. We also use them to pile around the strawberry plants, herbs, and grape vines.

## POPULAR ON GRIT.COM:

"Build Your Own Natural Swimming Hole"

"Although fairly common in Europe, natural swimming pools are in their infancy in the United States. Ask most American swimming-pool contractors to build a backyard pool and chances are they'll roll out a long list of goods, including rebar, sprayed concrete, fiberglass and a complex filtration system. But in recent years, a few builders and a growing number of homeowners have learned how to build pools that look more natural and blend nicely into the landscape."

Learn more about installing a beautiful pool on your homestead at http://bit.ly/2dCfExS.

## READER BLOGS

Grit is proud to offer blogs written by our readers from across North America. If you would like to become a Grit blogger, email *hfisher@ogdenpubs.com* for more details.

### The Great Chicken Coop Battle

by Candance Johnston

"My husband and I first started our little flock of chickens almost three years ago. We seriously had no idea what we were doing – and that is evident in the building of our first coop. I actually decided I was going to build it on my own using all upcycled materials and a plan I found online. As it turns out, I can read a lot of things really well, but building plans are not among them. I also have no idea about what type of wood should be used for what type of projects and I'm not as handy as I like to tell myself I am with power tools. Nathan ended up coming home after a long week of work on the road to a well-intentioned wife and a big, basically useless pile of wood in the backyard. He did the best he could with what he had and our lack of knowledge about coops and the girls have enjoyed a pretty sturdy home these last few years. I mean, really, they run the backyard all day and only go in to sleep and lay eggs, so it's not like they needed anything too fancy." – from "Johnston Backyard Farm" blog

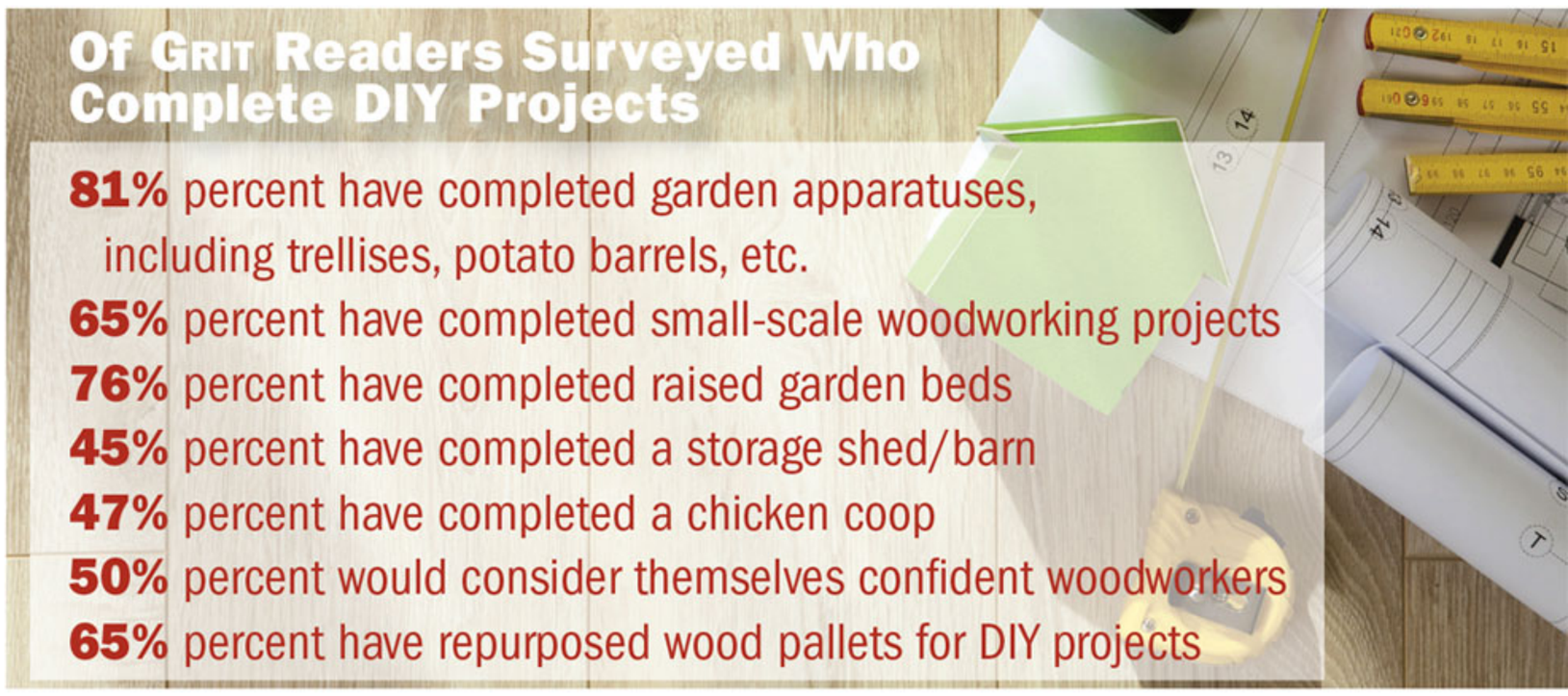
*Candance Johnston gardens and raises chickens in Krum, Texas. She enjoys writing about her adventures as she expands her garden and poultry flock and learns to preserve what she grows.*

### Bat Box for Babies

by Loretta Liefveld

"Now that we've evicted the bats from our home, we need to give them some new housing. We wanted to get it done before maternity season. But it's been triple digit heat for four weeks, so I could only work on it a couple of hours a day. There are many plans available online. I chose the Four-Chamber Nursery House from *The Bat House Builder's Handbook*. You can make two houses out of ½ sheet of ½-inch plywood, ½ sheet of ⅜-inch plywood, and 2 pieces of 1-by-6-by-8 pine or cedar. If you don't have the tools to cut the wood yourself, or you don't trust your ability, many lumberyards and big-box home improvement stores will make the cuts for you, for a small fee. I'm lucky to have a husband who does all that stuff, so I asked him to help." – from "Rural Adventures" blog

*Loretta Liefveld lives in a log home on 3RRL Ranch in Three Rivers, California. She writes about learning, living and loving the country life, growing and using herbs, and other herbal crafts.*

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CLOCKWISE FROM LEFT: FOTOLIA/ELENATHEWISE; CANDANCE JOHNSTON; LORETTA LIEFVELD; FOTOLIA/DRAGONSTOCK; COURTESY BIOTOP

# Tips for Saving on DIY PROJECTS

**With so many ideas and so little money, we offer nine ways to save money on that endless list of do-it-yourself projects.**

By ANDREA WOROCH

As the leaves start to fall and the temperatures drop, we start to think about the holidays and entertaining our family and friends. And, we realize there's some serious work to be done around the house. Fall is a great time to work on home-improvement projects, so if you're thinking about stocking up on supplies for your most pressing project, consider the ways you can save when you do-it-yourself:

## 1. Big box vs. small stores

For the frugal consumer, shopping smart is always a logical first step. When you're shopping at the big-box home improvement stores like Home Depot and Lowe's, there are always deals going down.

The two heavyweight retailers are highly competitive, and both stores offer price matching with an additional 10-percent discount on identical products advertised at a lower price at any competing store. Both stores also post weekly sales, discounts and rebates on their websites so you can be prepared before you hit the store. Not to mention, you can always find coupons for these home and garden giants.

On the other hand, locally owned home-supply stores, like Ace Hardware, often provide email sign-ups that allow you to receive special deals on the same or similar items you would find at the big-box stores. While you may not be able to purchase Sheetrock, the smaller places may carry everything from plumbing supplies to finishing notes for your home. There is also the added appeal of supporting locally owned family operations.

## 2. Tester cans and used paint

Next to buying a nice area rug, painting is probably the easiest way to change the look of a room. Unfortunately, home improvement stores are aware of this and they like to make you pay for it. There are definitely ways to get around the high prices though.

If you only have a small space to paint, there's no need to invest in a whole gallon of paint that'll inevitably take up space in the garage or closet. Ask about small tester cans that can often be found for $5 or less in a variety of colors.

The word is starting to get out on used paint, too. When people order large amounts of custom paint, they often order too much. This paint gets returned to the stores, but the merchant can't put such cans back on the shelf with the rest of the paint. If you're in the right place at the right time, you might be able to get gallons of paint for around $5. Not all stores will have used paint, but it doesn't hurt to ask.

## 3. Buy lumber in bulk

Working with lumber can be intimidating. It requires precise measurements and cuts, or you'll end up wasting money and materials. Prices vary by lumber grade and wood type, so be aware of what materials are required to get the job done.

## 4. Generic vs. name brand

There's an incredible variety of nails and screws available, but how much of a difference is there, really? Generic brand nails and screws are often up to par with the name brands but cost significantly less. In some cases, the only difference between a generic and the name brand is the box!

The same can be said for pipes and plumbing fixtures. Unpackaged fixtures in a bulk bin can have the same quality as their packaged counterparts on the shelf, but cost much less. Longevity is also something to consider when working on a plumbing project. Copper pipes and PVC pipes typically give you the most bang for your buck, lasting up to 60 years.

## 5. Caulk singles

Caulk certainly won't be the most expensive item on your home improvement list, but it's useful for patching up holes and sealing cracks. Often when people buy a tube of caulk for a small project, they end up making a mess of it and throwing half the tube away.

If you want to keep some caulk around for projects that spring up, try out some caulk singles from General Electric. Much like the fast-food ketchup packet, they're enough for one project and cut back on waste and mess.

Watch for coupons to home centers like Home Depot that offer General Electric's caulk singles.

## 6. Government rebates

When cold weather is on the way, you can replace your old windows and doors with more energy-efficient ones. While it's a big project, it may be worth it when you save on heating costs next winter.

## 7. Buy reconditioned or rent power tools

It's hard to justify buying an expensive power tool, especially when you know you'll never use it again. If you live the DIY credo, Home Depot rents such power tools as power washers, paint sprayers, chainsaws and buff sanders. By renting, you'll get the professional finish you want without having to cut corners on expensive equipment.

Many power-tool manufacturers have online outlets where they sell reconditioned tools at a discount. These tools are certified by the manufacturer, so you have a guarantee that they'll work. Also check company websites and other online sites for possible coupons.

## 8. Used hand tools

The garage sale may still be king for finding good deals on hand tools. Many people don't enjoy inherited tools and are willing to part with them for next to nothing, compared to new tools. Wrench sets, hammers and screwdrivers made by quality toolmakers like Craftsman and Stanley can stand the test of time and are as good today as they were 30 years ago.

## 9. Working together

No one escapes a little home maintenance from time to time. If you and a neighbor are working on similar projects, sharing the cost of renting a wood chipper or cement mixer can save both of you time and money.

While skilled friends and family don't necessarily enjoy manual labor, they can be coaxed into it with the promise of good food, drink or a labor exchange to be named later. Working with friends gets the job done faster and is usually much more fun.

LEFT TO RIGHT: ISTOCKPHOTO.COM/PHILLIP SPEARS; FOTOLIA/MEARICON

Small Project

# How to Build a CHICKEN FEEDER

**Feed your flock securely without encouraging mold or supporting the local mouse and starling populations.**

By JEFF NICKOLS

Whether you have a large laying flock or just a few backyard hens, keeping them fed is a regular chore (never mind the expense), especially if the feeder isn't weatherproof and allows rodents and wild birds access. One way to keep the feed safe from spoilage and purloinage is to keep it covered – but how will the chickens gain access? Through a bit of physics, it's possible to employ some carefully designed levers and fulcrums that will cause the feeder to open when a chicken (or an object of similar weight) steps on a perchlike treadle. The best part is that you can build a treadle-opened feeder yourself – in fact, it makes a fun weekend project that can be completed with common tools and basic carpentry skills. You will be pleased with the result because the feed is kept dry; songbirds, mice and other rodents can't get in the feed; and less feed is wasted by the chickens scattering it, and the feeder will hold several days' worth of food.

## Using the feeder

This was our first time raising chickens, and when I first put the feeder out, the chicks were too small and frightened to raise the lid by themselves. I put a brick on the treadle and left the lid up for a few weeks. After the chickens got used to standing on the platform to eat, I removed the brick. They had no problem adapting to the treadle after that.

Several people have been concerned that the feeder will become some type of decapitation device, clamping down on a chicken's head, leaving the chicken running around like a … well, you

## CONSTRUCTION

### TOOLS:

- Table Saw
- Drill with countersink drill bit
- Hand saw (I recommend the finer-cut Japanese pull saw)
- Electric sander or sandpaper
- Miter saw (optional)
- Air nail gun (optional)

### MATERIALS LIST:

- 2 1/32" x 16" x 72" paint-grade, edge-glued pine panel (1)
- 5/8" x 6" x 72" cedar fence board for lid, trim and treadle (2)
- #6 1½" wood screws (40)
- #6 1" wood screws (4)
- Exterior wood glue
- Primer and paint of choice

## FEEDER BOX

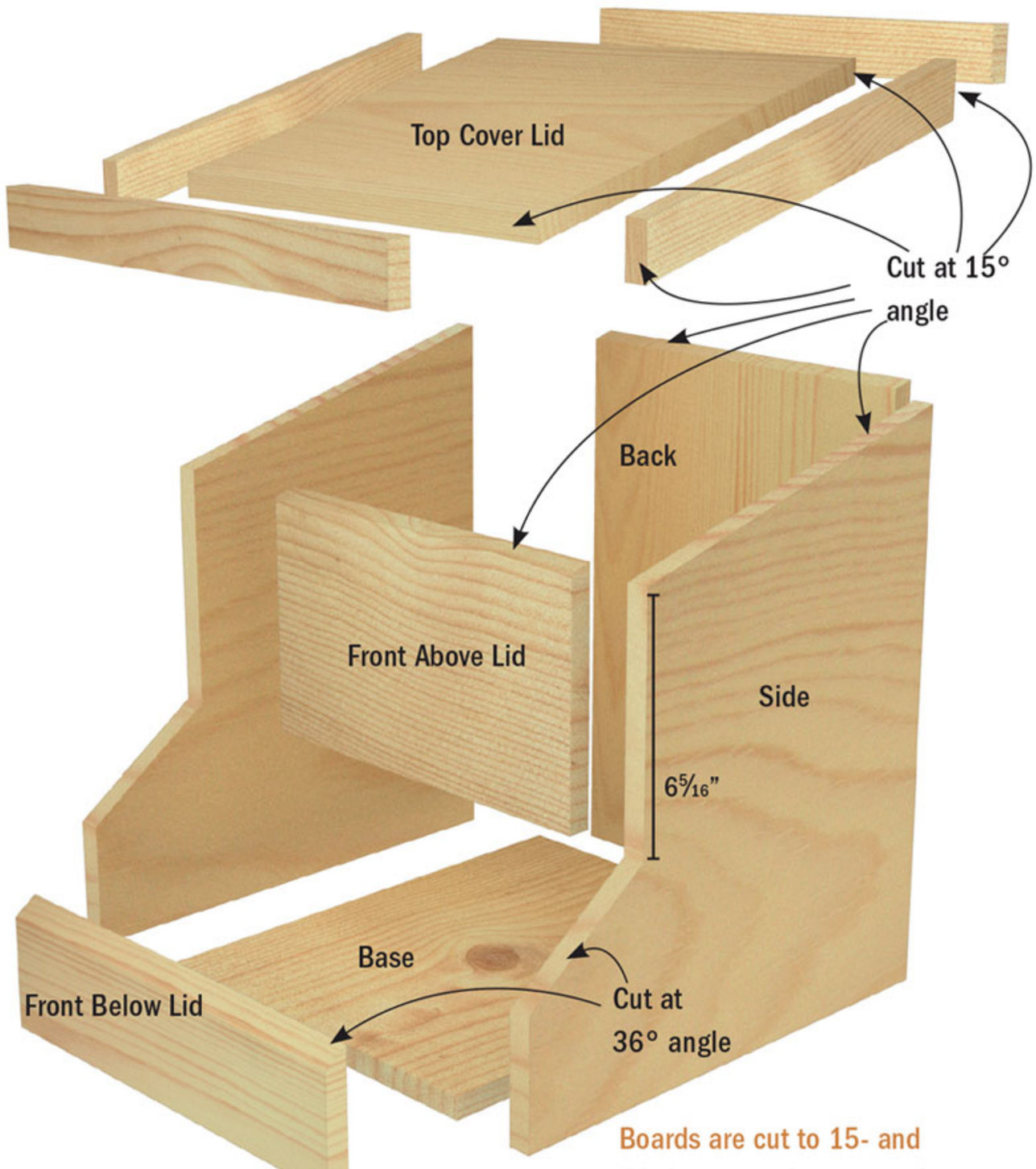
1. Attach sides 1 and 2 to the base using 1½-inch wood screws and glue.
2. Attach back of feeder to the sides and base with 1½-inch wood screws and glue. The 15-degree angle along the top should be flush with the angle of sides 1 and 2.
3. Attach the 2 front pieces to front of feeder with 1½-inch wood screws.
4. Attach the 1½-inch cedar trim pieces to the top of the lid board so that the lid will nest over the top of the feeder box.

## HINGED TROUGH COVER

5. Attach the 6-inch-wide cedar board to the 1½-inch cedar arms using 1-inch wood screws. The cedar splits easily, so predrill carefully.
6. To attach the cover to the feeder, I put the cover in place in the closed position, and then marked my attachment point on the feeder box. I experimented with using wooden dowels, machine screws, and various nuts and bolts. All of them worked fine, but not any better than using 1½-inch wood screws.
7. Remember not to screw the arms tight to the side of the feeder, leave some wiggle room for the cover to swing freely.

## FEEDER BODY AND COVER

Exploded view

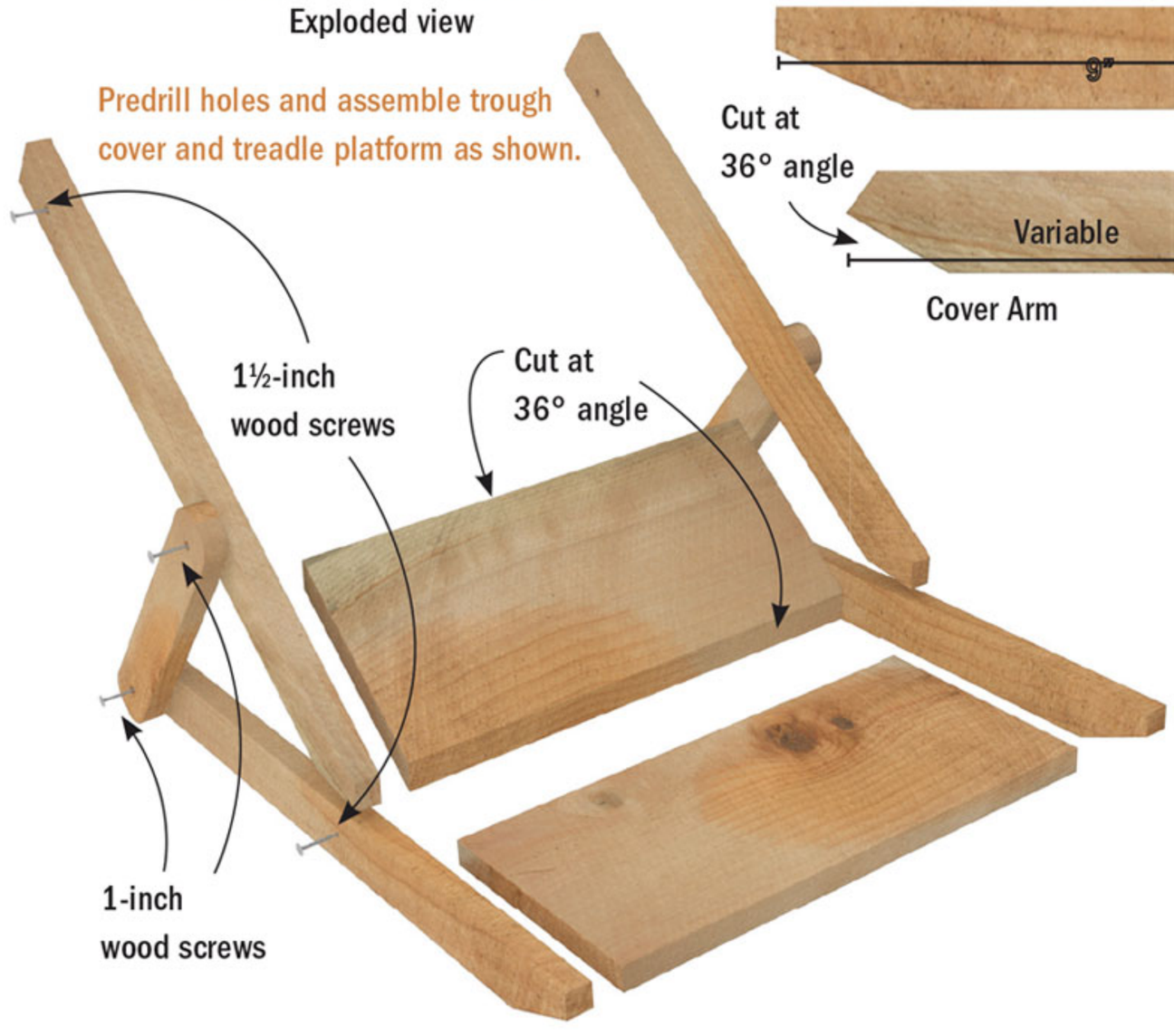


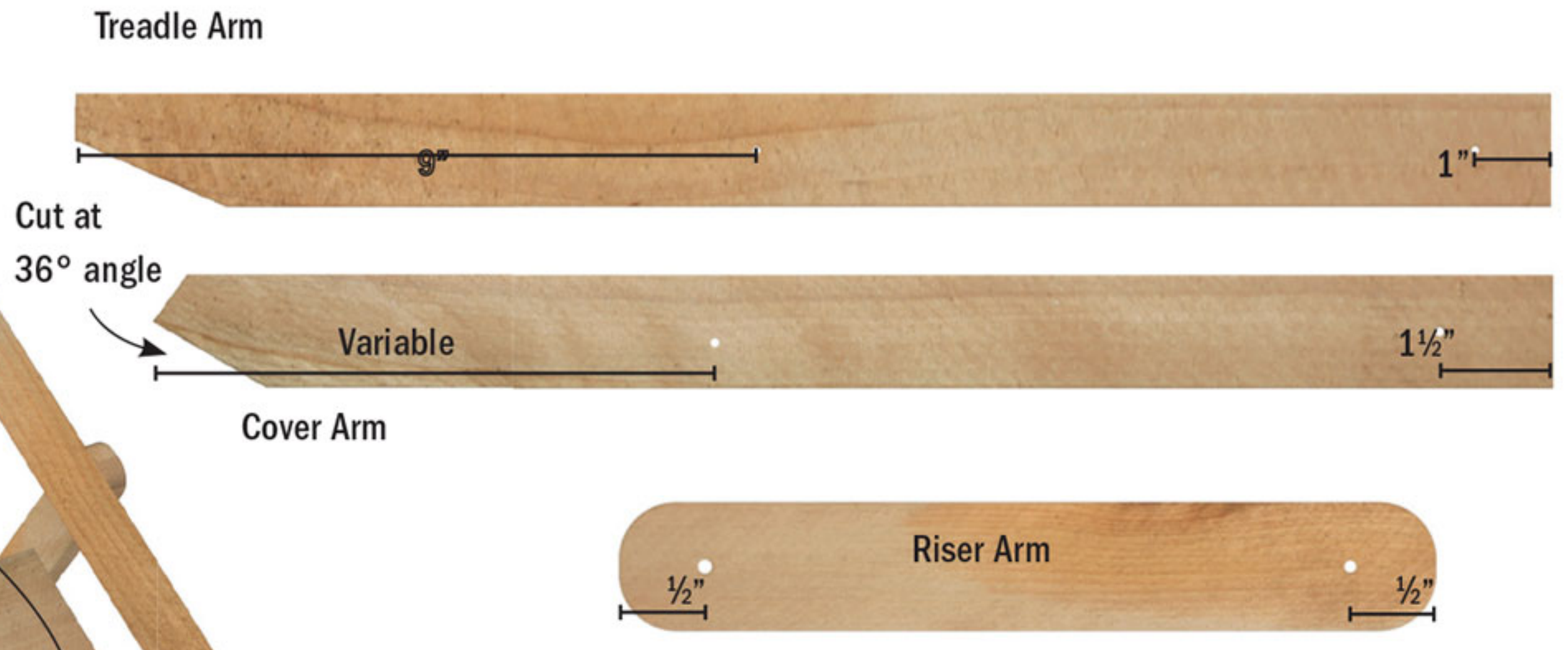

Boards are cut to 15- and 36-degree angles to match the lid and the top cover, then screwed together.

## TROUGH COVER AND TREADLE

Exploded view

Predrill holes and assemble trough cover and treadle platform as shown.



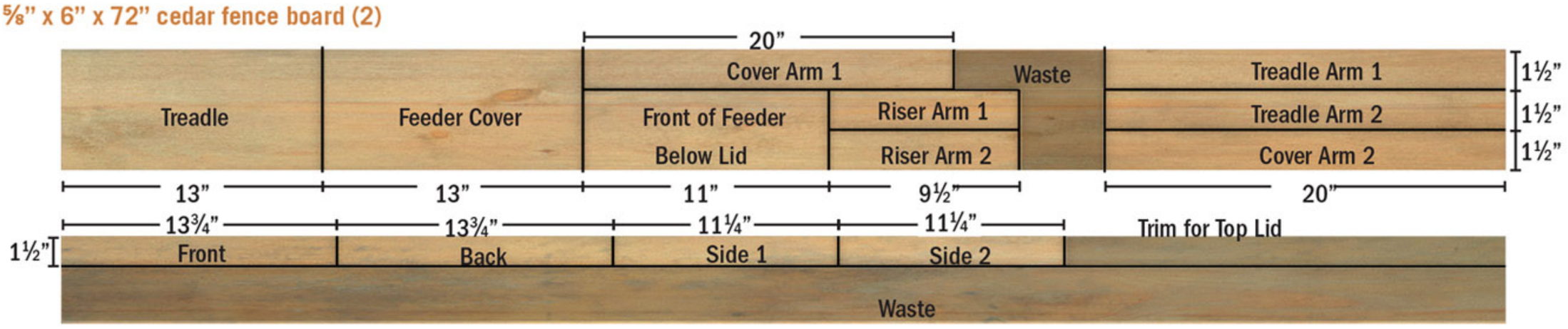

## TREADLE PLATFORM

8. The treadle is constructed in the same fashion as the trough cover. Attach to the feeder box with 1½-inch wood screws 9 inches from the front end of the platform.

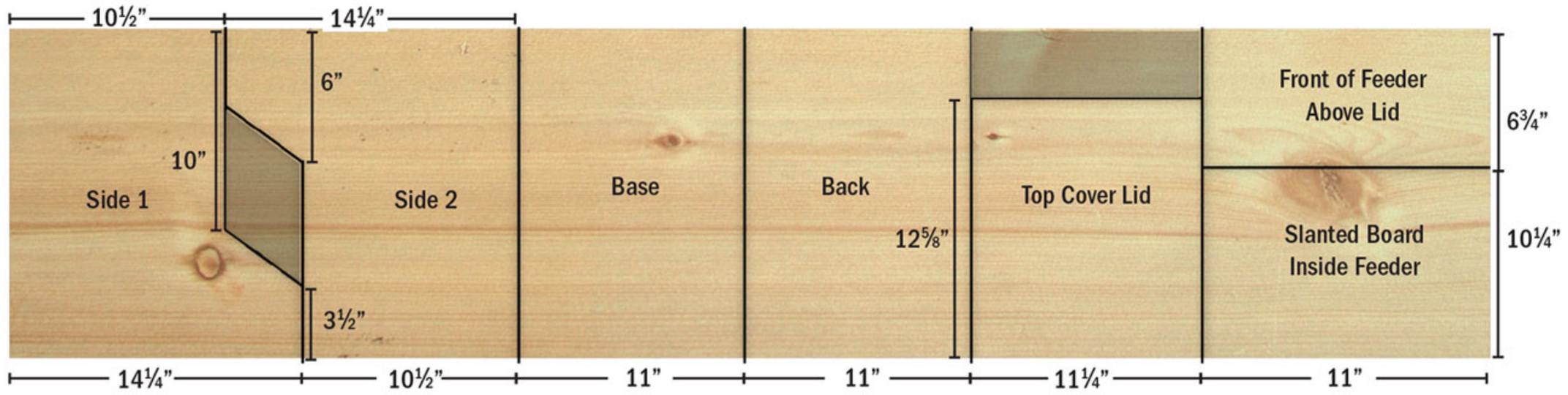
LEFT TO RIGHT: JEFF NICKOLS; NATE SKOW ILLUSTRATION (5)

# CUTTING DIAGRAMS

5/8" x 6" x 72" cedar fence board (2)




21/32" x 16" x 72" paint-grade, edge-glued pine panel (some waste not shown)

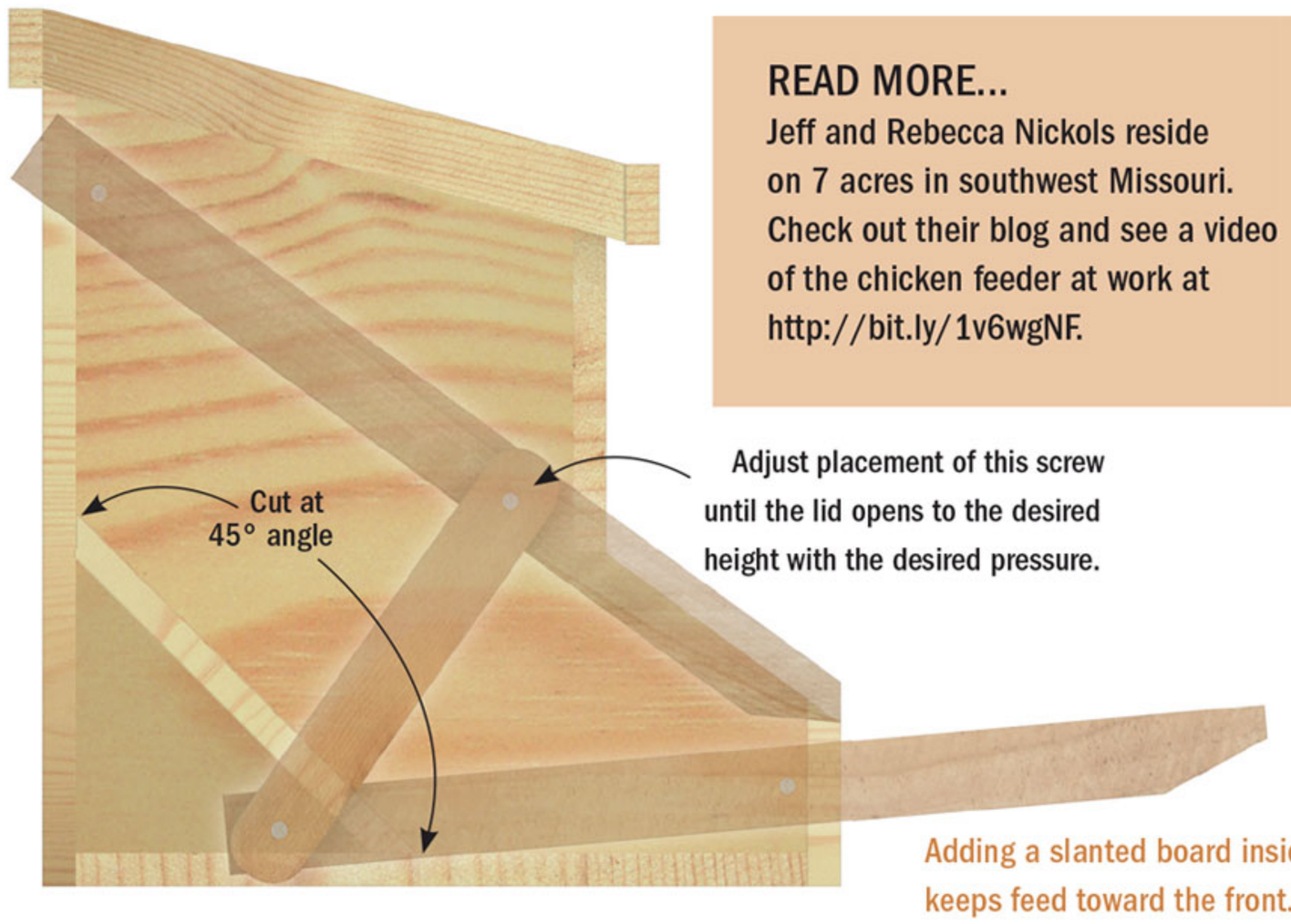



know. First, cedar is a fairly light wood, so the lid does not crash shut with a lot of force. Second, chickens learn quickly; they only have to get whacked on the head a couple of times before they figure it out.

The first few days after removing the brick from the treadle, I did notice a process I called "eating from the side." One chicken would stand on the treadle eating, while a second chicken would come in from the side and start eating without being on the treadle. When the first chicken finished eating and stepped off the treadle, the second chicken would get whacked on the head. Our chickens are growing just fine, and they don't seem to have suffered any harm; they're every bit as entertaining as they've always been.

I constructed my feeder using one 2 1/32-inch-by-16-inch-by-72-inch edge-glued pine panel for the body of the feeder and two 5/8-inch-by-6-inch-by-72-inch cedar fence boards for the trim and arm pieces. You may substitute plywood for the pine and cedar boards.

I used scraps from my chicken coop construction for the first feeder I constructed. Even purchasing all of the lumber, the cost was less than $20: $15.79 for the pine panel and about $2 each for the cedar fence boards. Add a few wood screws and wood glue, and you have all the supplies you need to get started.




Adding a slanted board inside keeps feed toward the front.

## READ MORE...

Jeff and Rebecca Nickols reside on 7 acres in southwest Missouri. Check out their blog and see a video of the chicken feeder at work at http://bit.ly/1v6wgNF.

## RISER ARMS

9. The riser arms are screwed to the treadle arms 1 inch from each end using 1-inch wood screws. With the riser arms attached to the treadle, depress the treadle all the way down, as if a chicken were standing on it, and then raise the trough lid as wide open as you would like it to be when in use. Put a board or brick on the treadle so you don't have to hold it. Now you can attach the riser arms to the trough lid using 1-inch wood screws. Mine is 7½ inches from the front of the trough lid. The farther away from the hinge point you attach the riser arm, the less force it takes to raise the lid, but the lid will not open as wide. The farther back you attach the riser arms, the more weight required to open the lid, but the lid opens wider. If you are starting off with small chicks, adjust the riser arms further from the hinge point – it is easy to adjust this mechanism as the chicks grow.


# Not just down to earth.

## One with the earth.

We each have our own unique relationship to the land. Some of us tend to its creatures. Some of us rely on it for food. And some of us just enjoy basking in its endlessly evolving beauty. What we all share is a common dedication to the soil and a commitment to put back into it more than we take out of it.

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# Necessity is the Mother of Invention

## FARM SHOW readers share the how and the why of making a triple calf feeder and a small-scale honey extractor.

From our friends at FARM SHOW ®

### Teen Designs Triple Calf Feeder

Samuel Thompson, 20, feeds three calves in the time it takes to feed one with his triple calf feeder.

His design ensures that each calf gets an equal share and that the feeder can be easily and thoroughly cleaned.

Thompson, of Rushville, New York, came up with the idea when he was 18 and had a full-time job, plus calves to feed before and after work. He didn't like commercially available multiple feeding units because they clog easily. Using the basic idea, he decided to use PVC sewer pipe – a T, two 45-degree sections, and three ends. He also cut the edges off two caps that fit inside the PVC to create half walls to hold a quart of milk in each of the 45-degree sections. He then cut out the ends to insert Peach Teats calf nipples that have threads.

"They are threaded so they reseal each time," Thompson says.

"I wanted to be able to unscrew the ends to wash them out."

He added a funnel by drilling a hole in the PVC T for a screw-in fitting. The funnel is plastic welded to the inside of the fitting. He added vents for good airflow.

Thompson secured the feeder on a wooden shelf with iron strapping.

He runs water through the unit after every feeding and takes it apart a couple times a week to clean it thoroughly in water with bleach.

The feeder works well on the calves right up to weaning, says Thompson, who buys calves in groups of three to raise and sell. For more information, contact Samuel Thompson at *boomboy13@gmail.com*.

This simple and creative solution to feeding more than one calf at a time was designed by Samuel Thompson to help him cut the time it took to feed calves on his New York farm.

### Bucket Spinner Extracts Honey

Spending hundreds of dollars on a honey extractor for his few hives didn't make sense to James Noble, so he built his own. It needed to be big enough to hold two standard hive frames loaded with honey (about 6 pounds each). Using a plastic pail and an electric drill to power the spinner, he's able to extract honey without damaging the delicate comb.

"I'm a hobby beekeeper with just three hives. I only need an extractor for a day or two each year," says Noble.

To make the extractor, Noble needed a chamber, a spinner with a central rod with mounts for the frames, and a way to seat the spinner in the chamber. For the chamber, he selected a food-grade 7-gallon pail. It's slightly taller than a 5-gallon pail with a similar diameter.

He bought a 1½-inch honey gate, available through beekeeping retailers for $10 to $12, and installed it over a hole cut near the bottom of the pail.

The spinner was made with a 36-inch-long, ⅜-inch stainless steel threaded rod and frame holding boards cut from heavy-duty, white plastic cutting board stock.

"I used ¾-inch-thick stock to give the centrifuge some heft, which is helpful so the frames do not completely dominate the weight," says Noble.

The top board is a 5-by-8-inch rectangle.

The bottom board is an 8-inch hexagon. Both boards were center drilled for the rod. Two ½-inch square holes were cut out of each plate (opposite each other, not across from each other) to accept the tips of frame top bars. The holes are positioned 1¼ inches from the edges of the board.

Noble attached a threaded flange with three screws over the hole on the top side of the lower plate. Once the rod was threaded through the flange, a washer, lock washer and smooth end cap nut were attached to the end of the rod.

"The bottom board needs to be fixed in place on the rod, but the upper board needs to be easily removed to load and unload frames," says Noble.

"I put a washer, lock washer and wing nut on the rod to match the length of a frame. A second washer, lock washer and wing nut are used to secure the board when frames are in place."

To stabilize the spinner in the pail, Noble attached a 2-inch-diameter circle of cutting board stock to the bottom of the pail. He drilled a hole in the center of the bottom of the pail and through the circle. He countersunk a ½-inch-diameter hole in the top side of the circle, shallow enough to accept a round nut.

He placed a 1-inch rubber O-ring between the circle and the pail's bottom, securing all three with a short screw and nut.

"I created a stand for the 7-gallon pail, with room underneath it for a 5-gallon pail and honey filter," says Noble.

Two vertical 2-by-4s on either side of the stand extend above the bucket. A removable crossbar with a hole for the spinner rod attaches to the verticals with wing nuts. The crossbar stabilizes the rod.

Once he was done, the honey frames extended out over the top of the bucket's edge, causing honey to spatter out of the bucket when frames are spun too fast. To add height, he cut the bottom off of a 5-gallon pail and slipped the top half (with its larger top diameter) into the 7-gallon pail to gain needed height.

For more information, contact James at *demarestfarmer@gmail.com*.

*Reprinted with permission from FARM SHOW Magazine, www.farmshow.com.*


Using plastic pails and an electric drill to power a spinner, James Noble extracts honey.


# Chugalug Chickens

## Using these DIY plans for an 8-station hydrator, you'll never change another chicken waterer again – at least not daily.

By RD COPELAND

I'm of the opinion that chickens do better in large numbers; dozens of hens hanging out together, just like their eggs. Gangs, armies, fantastic flocks of fowl, hustling about the barnyard, grassy pastures, and all along the fence lines. Community chickens. Chickenopolis. More chickens, more eggs. More roasted chicken. More chicken and dumplings. More chicken stock, chicken enchiladas, chicken tetrazzini.

You get the picture: Plenty of farm-raised chicken for you and the family. The correct number and balance here at my farm seems to be around 25 hens and a couple of roosters. But I'm always in the market for a few more chickens. Got any for sale?

Once you find yourself surrounded by 20 or 30 chickens, you'll need to help them out with a source of clean water, supplemental food, and a place to lay their eggs and stay safe at night. Even though I have a few cocky birds that go off the chicken grid here once in a while – a rooster and two hens sometimes camp out at night when their extreme free-ranging nature carries them deep into the woods – I still like to provide a friendly habitat for the rest of the gang. They could possibly be outnumbered by predators out here where I'm located. Coyotes love chicken enchiladas. Dang coyotes.

## SUGGESTED PARTS LIST

- 12 feet of ¾-inch PVC pipe (two 6-feet sections will work and fit into your Jeep Liberty or pickup truck bed.)
- 10 - ¾-inch PVC caps
- 9 - ¾-inch PVC Ts
- 1 - ¾-inch collar
- 1 - ¾-inch PVC compression valve
- 1 - ¾-inch PVC drain valve
- 1 - ¾-inch PVC to standard pipe fitting (check your water tank for the threaded size PVC fitting you'll need.)
- PVC glue and cleaner
- 12 water nipples for poultry (local feed stores, Tractor Supply, FarmTek, etc.)
- Rain gutters (to fit your chicken coop)
- Gutter downspouts (2 or 3 according to coop roof style – shed or gable)
- Gutter pipes (lengths to fit, from coop to top filler hole of barrel)
- Screen (to cover the top filler hole of water tank)
- Roofing screws
- Pipe thread tape
- Water tank (size to fit top of tank under roof of coop, but 10 inches higher than floor of coop if possible; bottom drain hole must be sized to fit ¾-inch PVC from standard pipe threads)
- Water tank stand (for positioning tank at side of elevated coop or alongside barn)

## TOOLS

- Drill/screw gun (I like cordless. If you find one that outlasts a child's attention span, please let me know.)
- Hacksaw or PVC cutter
- Open-end adjustable wrench (aka crescent wrench, small size)
- ⅜-inch drill bit (for drilling holes in PVC caps; match bit size to water nipple threads, some are different)
- ¾-inch drill bit (speed, metal; depends on type of wall you are passing through)

LEFT TO RIGHT: ISTOCKPHOTO.COM/GEORGE CLERK; NATE SKOW ILLUSTRATION

You can go about your day refilling water buckets (as they get tipped over) and water troughs (as they are fouled regularly) to make sure your feathered friends have plenty of fresh drinking water, or you can set up a constant flow of H2O for the thirsty little cluckers. Where might you get such a life-giving gadget? Well, Tractor Supply Co., Atwoods, your local feed store, even online at sites like www.farmtek.com – they all sell watering systems and water bottles for use with almost every species of livestock, chickens included.

However, the price tag might ruffle a few feathers if your chickens are on a dirt farmer's budget like mine.

If my chickens and I owned a chicken supply website, we'd have a much fancier watering system, and possibly fancier chickens, but don't tell these hens – they're already looking for an excuse to take a day off from egg laying.

So, in the absence of a dot-com windfall, I made my own chicken watering system using spare PVC, a dozen water nipples, roofing tin and screws, a 100-gallon tank, and few spare parts. And it works just fine, at a fraction of the price. More money for more chickens. See where I'm headed?

I'm sure your chickens already love you, but with a constant flow of fresh water, they're going to really thrive. Here's the DIY instructions for a setup similar to mine, with the capability to supply eight chickens fresh water all at once.

## Assembly

Understand that this watering system could have thousands of different shapes and sizes (and the illustration on the previous page is yet another example of the possibilities), applications, and coops or barns to match up with, not to mention the possibility of using all secondhand parts, pilfered from dumpsters, trash heaps, and that pile of junk out back of the hay barn.

Whatever you already have, or can get for free, use it. If you find a 12-foot stick of 1-inch PVC, use it and buy PVC parts in 1-inch size instead of ¾-inch.

If you have a 20-gallon water tank, use it; just alter your rain catchment and the height of your water tank stand to match the height of your coop's eve. The water tank needs to be short enough to fit under your coop (barn, shed, house, garage, etc.) roof eve, but also elevated above ground at least 18 inches. This makes room for the overhead water feeder pipes out into the chicken yard, barn or coop.

For those starting from scratch, begin by sizing up your coop, barn or box – as long as there's a roof, you can catch rainwater in your water tank from that roof.

My coop is 4-feet-by-8-feet-by-4-feet and elevated 3 feet off the ground. A shed roof runs toward the 8-foot back side and into a rain gutter, which is attached to the coop. Use the proper brackets and/or roofing screws to attach the gutters to your coop (I screwed the gutters right to the coop on mine).

Attach a downspout to the gutter nearest the water tank. Measure the length between the downspout and the tank filler hole. Try to keep the tank close to the coop so you won't need a long length of pipe to connect the two. Attach one end of the connecter pipe to the downspout, then place the other end over the top hole in your tank.

Attach a downspout to the tank end of the pipe. Now, rainwater will run off the coop roof, into the gutter, through the pipe and into the tank. Also, it's best to attach a screen cover over the top tank hole, or fill in the opening around the rainwater downspout with something so nothing sneaks into the tank, clogging the pipes and fouling your chicken's water.

Now that you have a tank full of fresh rainwater and a flock of thirsty birds, a delivery system with easy access for the chickens is needed. PVC pipe and fittings are the cheapest parts you can buy and there are usually discounted bits and pieces available from most home improvement stores, especially your local hardware dealer. Shop with Mom and Pop and you'll likely be made aware of many steals and deals.

Chickens could be drinking gallons of water at night, but I doubt it. Every time I peek in on them they look at me like my ex-wife did when I woke her up an hour before the alarm clock went off.

Chickens do like to hang out inside their coop on cold or rainy days, so I added a pipe from the water tank to inside their coop with two drinking nipples they can access any time they need a drink.

Just to be safe, I drilled a few small holes in the floor of the coop beneath the nipples in case the inside pipe or nipples get broken, so spilled water can drain out of the coop. If your birds are in a big barn, they'll be safe from any spillage.

Extending in the opposite direction from the coop off a PVC T, the pipe runs for 8 feet across the coop fenced area, 1 foot above ground. The nipples hang at 1 foot intervals along the length of the PVC pipe. To build the watering stations along the pipe, prepare all your lengths of PVC pipe first, gather up all the Ts, the end caps, and however many nipples you need for your flock. For my version, we're using seven outside stations, and one inside the coop.

Cut eight pieces of pipe to 10-inch lengths. Assemble with watering nipples, and you're in business.

Now that you have infinite watering capacity, you just might need some more chickens for your flock. Maybe get an incubator and start hatching chicks? Yep, gonna need a couple of broody hens too, for natural hatching … anyway that's another story. But seriously, y'all gotta get with the "Community Chickens" program.

THINKSTOCK/JUPITERIMAGES

Small Project

# DIY Mason Bee House

**Getting ready for spring with a fun way to help our bee populations.**

By JEANNE KUNZ HUGENBRUCH

A number of good tutorials exist on the Internet describing how to make Mason Bee houses. In an effort to help our bee population, we decided to give it a go.

What you'll need is a wooden frame and anything that is either already is hollow or can be made so.

We used different size bamboo canes, with diameters up to about ½ inch. We also used old corn stalks from last summer. They are either hollow already or the bees can easily chew their way in. Pack them in pretty tight.

Consider starting smaller than we did. We underestimated how many canes we would need when we built the frame, so we drilled a few wooden blocks and added a wee bit of whimsy to help fill in the area.

The figurine is of a bird catching a butterfly with a net, a gift from my late mother. So in her honor we set up an old birdbath in her area of the garden and placed the bee house on the basin. We added dirt to the basin, which will become mud when the spring rain comes. Once we see the nesting is pretty much complete, we'll cover the basin to be sure there is a safe place for the young ones to land when they emerge.

The area also has lots of fallen leaves. We learned from perusing the Internet that different Mason Bees use either mud or leaves to seal their larva in the hollow opening.

The area is the southeast section of the garden, which is where it is recommended to place the house. We used twine to secure the house to the fence, just to play it safe.

Now we will wait until spring to see what happens. Hopefully the new area will be all a-buzz.

Visit my website, Gardening Jones, to discover more ways to help our bees (http://bit.ly/2d9b26o).

The finished product now resides in the southeast section of Jeanne's garden.

## How to Make Bee Boxes

By GRIT STAFF

A bee box is a place where bees can find cover and create the next generation. You can make them quite easily, or, if you'd rather, you can buy them.

The Orchard Mason Bee, unlike other types of bees, does not live in a nest or hive; instead, it lives in holes in blocks. Other insects drill holes for themselves, sometimes destroying the wood in the process, but not so with Orchard Mason Bees. They find holes that already exist and use them.

### BUILDING A BEE HOUSE:

- Find some scrap lumber (be sure your wood is untreated) and your drill. Using drill bits of various sizes (the Mason bees seem to like five-sixteenths of an inch), drill holes 3 to 5 inches deep. Do not drill all the way through the wood. (For example, if you're using a 5-by-5 drill holes that are 4½ inches deep.)
- To keep birds away, cover the holes with chicken wire.
- Now take your box and attach it to a building, fence post, or tree – on the south side.
- Take some bee boxes to other places in your community. Another location may have many bees, which you can capture and move to your place.
- Once your bee house is in place do not move it until late fall (November).
- Don't spray any insecticides around your bee boxes.

For more information check out the National Wildlife Federation website (http://bit.ly/2cHyYOg).

JEANNE KUNZ HUGENBRUCH

Small Project

# Pallet Wood to Pot Rack

**Keep your planted grafted fruit trees upright, for next to nothing.**

Article and photographs by ANDREW WEIDMAN

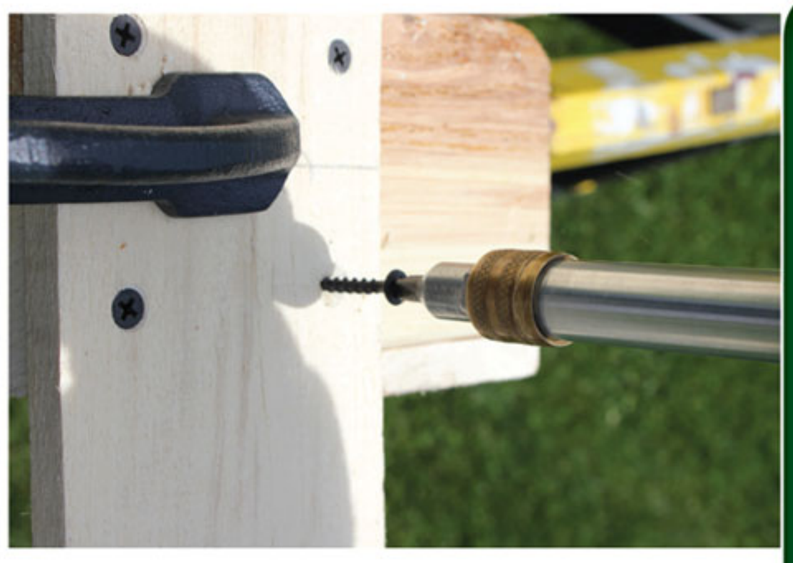
It's true: Necessity is the mother of invention. I was reminded of that fact last spring, when I moved some apple trees outside for the season. Up until then, I had always grown newly grafted trees in 2-gallon nursery pots. These, however, were potted up in "deep root" pots – tall and skinny, designed to create an impressive root ball in minimal space. The pots did an excellent job of this. What they did not do well was stand up on their own. A 16-inch-tall pot with a base only 4 inches by 4 inches will tip in the slightest breeze.

A new graft is a delicate thing. For the first year, a songbird's weight or the force of a stiff breeze can snap off a graft union. Add to this a pot prone to tipping in the best of conditions, and you have a recipe for disaster. I needed to find a solution. As it happens, there is a pot stand specifically made for deep pots, but I didn't know that at the time. I did the next best thing: I designed a pot rack of my own, from a repurposed shipping pallet.

Shipping pallets are readily available and economical, sometimes free. You can usually get them from a hardware or appliance store, supermarket, or any place that receives regular shipments of bulky items. Take the time to find a pallet in good condition – clean and unbroken. Most pallets are manufactured from low-grade wood, secured with cement-coated nails. Resist the temptation to try to pull the nails; you will only succeed in splintering the wood and frustrating yourself. Another thing to look for is the letters "HT" on a code stamped on the side of the skid. These letters stand for "heat treated," a process designed to kill potential hitchhiker pests without using toxic pesticides.

## TOOLS & MATERIALS

- Clean wooden pallet in good condition, heat-treated if possible
- Decking screws
- Safety glasses
- Pencil
- Tape measure
- C clamp
- Speed square, rafter square, or combination square
- Handsaw
- Power saw (jigsaw, circular saw, saber saw or reciprocating saw)
- Electric drill
- Pot for sizing purposes



The following instructions are just guidelines, but you can tailor-make your rack to suit your purposes. Your rack could be tall enough to store long-handled tools in your shed, or maybe hold several tiers of alpine strawberries in a vertical garden. It's all up to you.

These instructions make use of several power tools. Always practice safe work habits. Keep your hands away from saw blades, cut away from your body, and always unplug a power tool before changing blades or bits. Finally, wear a pair of safety glasses while you work.

1. Select a suitable pallet for your project. Look for one with solid skids; some will have cutouts for side loading, making them difficult to work with. Also, pay attention to the spacing between the top and bottom boards. Be certain the spacing is right for your application.

2. Determine the finished height of your rack. It needs to be at least half the height of your pots. To do this, stand the pallet on one end and insert a pot into the space between the boards, seating it securely in place. Note: This step is easier if you prop the pallet against a sawhorse or shed wall as you fit the pot.

3. Mark the side of the pallet at the bottom of the pot. Measure from the pallet end to the mark, and increase the measurement to the next whole inch (for example, 9⅜ inches becomes 10 inches). This is your cut length. Use a carpenter's square or speed square to transfer this cut length to the other side skid and center skid.

4. Cut along the squared marks on all three skids to remove the pallet end. This will be the body of your rack. As you cut, support both sections of the pallet securely to avoid twisting, which could cause the boards to splinter. You may find that you cannot make complete cuts with a jigsaw or circular saw, especially on the center skid. Use a hand saw to finish the cuts. Set the rack body aside.

5. Select a good, complete board on the pallet remnant, one that is free of splits and cracks. Measure the longest possible whole-inch span of clear board, and mark squared cut lines. Cut this board from the pallet. Repeat this step to produce two boards of equal length. A good length is 16 inches, but your pallet will determine the final board length. These two boards will be the feet of your rack.

6. Locate and mark the center of each board along its longest measurement (8 inches on a 16-inch board), and mark a squared centerline across its width. Decide which end of the rack will be the base, and mark the centers on the side skids on the base. Mark a squared line running the length of the skids, an inch longer than the width of the board feet. Use these centerlines to position the feet on the ends of the rack.

7. Position one foot on the end of the rack, lining up the centerlines, and secure it temporarily with a C-clamp. Be sure the bottom of the foot is flush to the bottom of the rack, and squared off to it. Drill a pilot hole slightly smaller than the diameter of the deck screws, countersinking the hole to match the diameter of the screw heads. Note: Drilling pilot holes helps to prevent wood splitting.

8. Select deck screws long enough to secure the foot to the frame without jutting out the other side. Using screws that are too long creates a snag hazard and risk of injury. Securely run a screw into the pilot hole to secure the board. Pilot drill and secure two more spots on the foot before removing the clamp. Repeat steps 7 and 8 on the opposite side of the rack.

9. If desired, apply two coats of outdoor acrylic paint to the pot rack. Because pallet lumber tends to be dry, you may find that the wood requires a third coat. While painting is not absolutely necessary, it will make the pot rack more attractive, and it will also extend its lifespan noticeably.

10. Place the pot rack in your nursery area after the paint has dried completely. Set the pots in the spaces between the sides, settling each one in securely. I set my rack beside our deck, within easy reach of a hose and sheltered from storms, high winds and perching songbirds. My unpainted pot rack, weathered to a silver-gray, proved to be functional and attractive.

Small Project

# Build Your Own Sprout Racks

## An easy woodworking project to help organize your fodder-sprouting system.

By BRIAN TOKARCHUK

## MATERIALS LIST

- 18 feet ¾-by-1½-inch spruce, pine or pallet wood
- 8 plastic tubs, 10½-by-8½-by-3-inches deep
- 1¼-inch finishing nails
- Carpenter's glue

## CUT LIST

- 6 – 24-by-1½-by-¾-inch tub supports
- 6 – 10⅞-by-1½-by-¾-inch horizontal end spacers
- 4 – 26-by-1½-by-¾-inch legs

Growing your own fodder is a great way to save on feed costs and provide nutritional, additive-free feed for your livestock. I use mine to feed my rabbits, and have sprouted both wheat and barley – as fodder the animals relish it.

I constructed my fodder rack from nearly 100 percent recycled materials. I used pallet wood for the lumber and bulk margarine containers for the tubs. My cost was only time invested, glue and nails.

If you can't source bulk margarine containers locally, you could substitute plastic food or freezer containers close to the same size, and adjust the length and width measurements of the rack accordingly to fit your containers. There's plenty of room for flexibility within this design plan.

## Assembly Instructions

**1** RACK: Cut all the lumber to size, and start by assembling the legs and short spacers as shown in the diagram. Use glue and nails, and square them up so they will stand nice and straight.

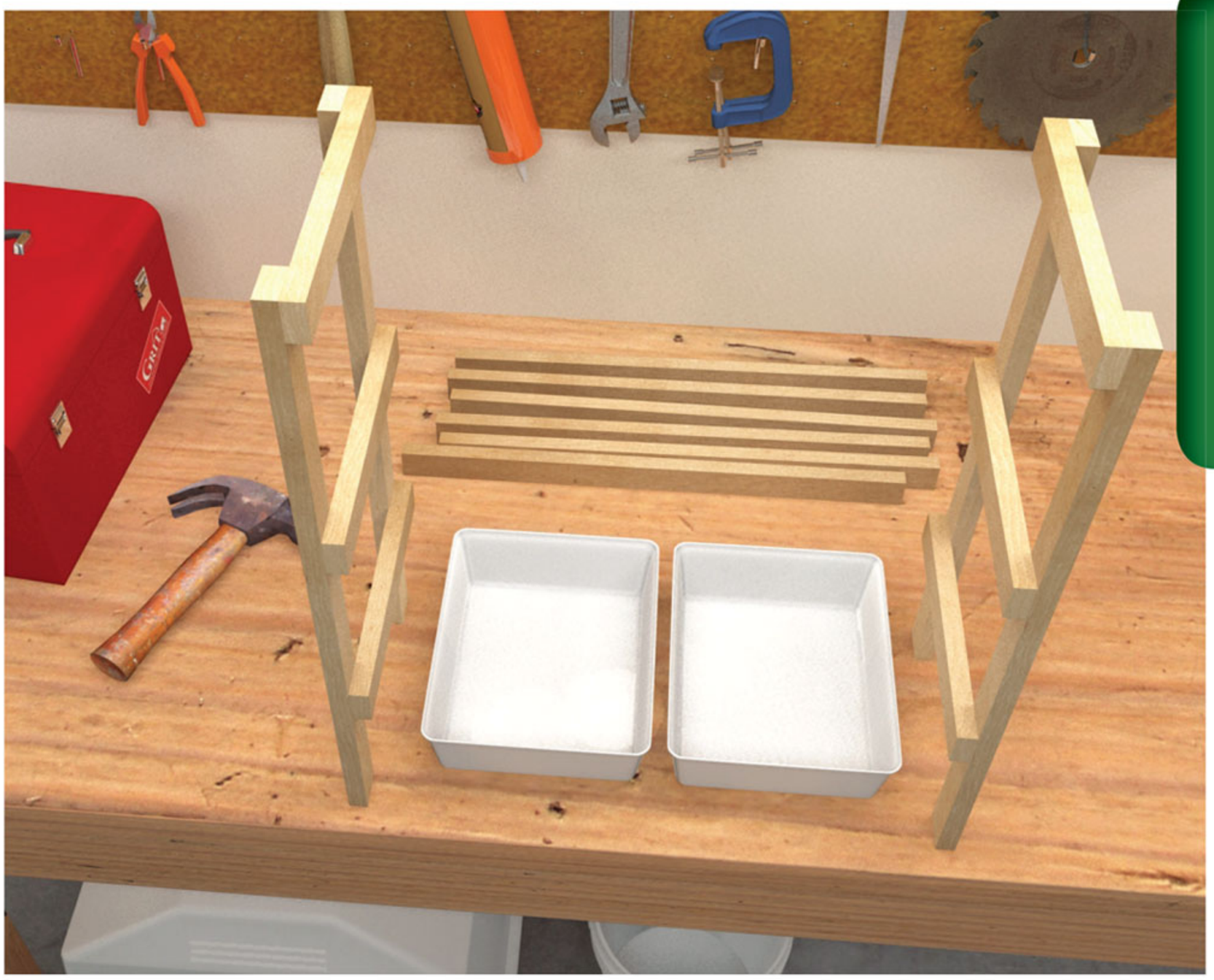
**2** Complete both ends of the rack, and then proceed to measure and lay out the location of the front and rear tub supports. Fix these in position with both glue and nails, keeping the unit square.

You can use a framing square for this purpose, or you can take diagonal measurements, and when they are both equal, the unit is square. Sand and finish as desired. I chose to paint mine with exterior paint.

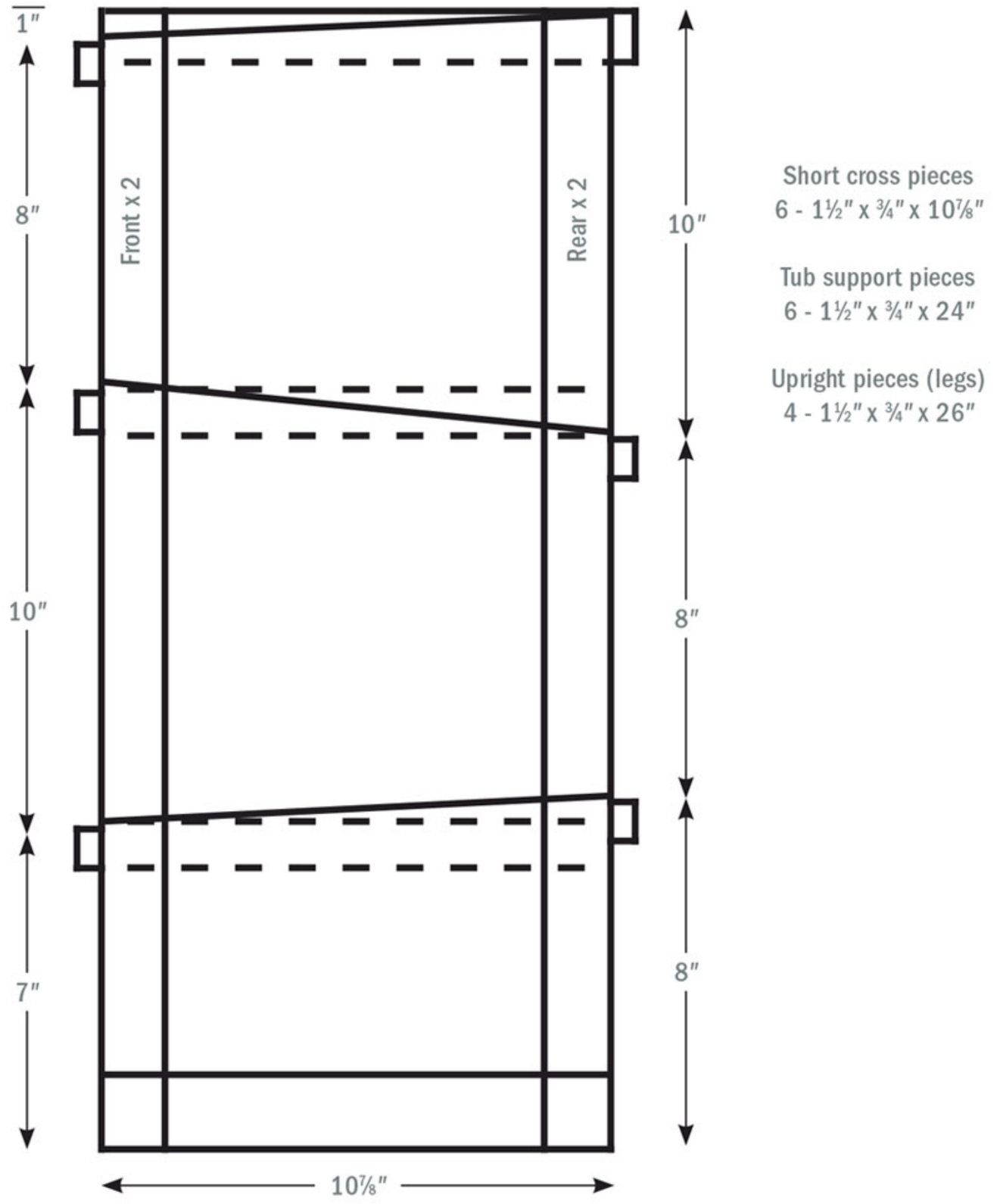
**3** TUBS: Six of the plastic tubs will require drainage holes in one end. I drilled three rows of ⅛-inch-diameter holes spaced ½ inch apart. I created a template and made all the tubs identical to give it a professional look, but it need not be that exact as long as the water will drain through – that's all you need for the rack's functionality.

**4** When fully assembled, the tubs will incline in a zigzag pattern so the water can drain from the tub above to the lower tubs, and finally into the two undrilled tubs that act as catch basins. With this system, you water the top trays, and gravity takes care of the rest.

**5** I harvest one tray of fodder daily on a seven-day cycle and use approximately 1 cup of seed, wheat or barley, that's been soaked overnight per tray. It works well for me, but feel free to experiment for optimum sprouting, as germination rates will vary. I've used this system for a couple of years now, and it's served me well.



This simple woodshop project results in a rack you can use year-round to save you money on chicken feed.




CLOCKWISE FROM LEFT: NATE SKOW ILLUSTRATION (2); MICHELLE GAUINS ILLUSTRATION


# *Looking Sharp*

# BUILD YOUR OWN UTILITY KNIFE

**To customize your own knife, order blade blanks online, and round up some spare wood for the handle.**

*Have you ever considered making your own knives? It's much easier than you may imagine. To get started, you can buy blade "blanks" in many styles, and then all you have to do is cut handle scales, rivet them to the blade, and then shape, sand and oil the handle. The photo on Page 23 displays the variety of blade blanks you can choose, while the photo above shows the range of knife options you can create, from simple to fancy. MOTHER EARTH NEWS Editor-in-Chief and hobby knife-maker Hank Will provided the following basic steps, and made all the knives shown above.*

By OSCAR H. WILL III

The indispensable utility knife is, without argument, the most useful implement for tooling about a farm, homestead or shop. Whether you're cutting baling twine or slicing an apple, you're simply not equipped without a sharp knife.

To build your own beautiful utility knife, you'll need a full-tang blade blank (see Photo One, Page 23) without a bolster or finger guard, wood for your handle scales (the halves of the handle that you'll rivet to each side of the tang), some epoxy glue, and a handful

When you purchase blade blanks, look for rivet holes, and features such as bolsters and edge-finishing, which will determine the complexity of your knife build.

of brass pins or cutlery rivets. You can source all the materials for the knife featured in this article, including the tools and handle material, from Jantz Supply (www.knifemaking.com; 800-351-8900).

## Tracing the Template

1 Trace the handle area of the knife's tang onto a piece of paper or light cardboard. Extend your mark to the blade and indicate where the sharpened area begins. Cut out your traced template, leaving ⅛-inch margins for your outline. To finish the handle's mock-up, trace any rivet holes from the blade blank onto the template.

2 While the knife's tang will determine the butt end of the template, you'll have to commit a bit more thought and care into crafting a symmetrical, eye-pleasing blade end design. Start by measuring from the center of the rivet hole nearest the handle's butt end to the bottom of the handle. That measurement will also mark the distance from the center of the hole adjacent to the blade to the blade end of the handle. Position the bottom of a glass or bottle against the blade end mark, with the outside of the curve pointing toward the blade, and trace the outline. This will define the blade template. Finally, punch out the centers of the rivet holes you traced onto the template.

## Handle work

3 To select a wood source for your handle, consider availability, grain pattern and hardness. Because I work in northeastern Kansas, I prefer species such as Eastern black walnut, black locust and Osage orange.

4 Trace the outline of the template onto the wood, mark the holes, and label the top. Next, cut out the handle-shaped piece with a bandsaw. If you don't have access to a bandsaw, use a coping saw, jigsaw or other handsaw with rasps to form the shape. Finally, cut the wood in half – again, preferably with a handsaw – to create two identical scales, one for each side of the handle.

5 Match a drill bit to the size of the holes in the handle end of the blade's tang. Next, carefully drill a hole at the rivet mark in one end of a handle scale (a drill press will work best). Use the bit or a pin to locate one end of the





CLOCKWISE FROM LEFT: HANNAH KINCAID (2); KAREN K. WILL (4)







This finished utility knife is the perfect size for day-to-day farm and garden tasks.

scale with respect to the hole in the knife tang. Adjust the scale until it's aligned with the tang hole, and then bore the other two holes. Repeat with the other scale. Finally, use a drill bit – approximately the diameter of your cutlery rivets' heads – to bore countersinks to the depth of the rivet heads into the outer openings of all the holes.

6 Clamp a hand-held sander upside down in a vise and flatten the inside surfaces of the handle scales. Clamp the two halves together to resemble the final assembly and shape and sand the edges that will face the blade.

7 Dry-assemble your knife handle to check the alignment of all the holes. If everything lines up, disassemble the handle scales and scuff the tang area of the scales with low-grit sandpaper. Work on a hard metal surface for best results. Next, mix epoxy and apply it liberally to the inside surface of one of the scales. Insert the female half of the cutlery rivet through the scale and knife tang, and set it on your work area or bench. Apply epoxy to the inside surface of the other scale, and install it on top of the female half of the rivets. Insert the male rivet halves and drive them home with sharp hammer blows, taking care not to spray epoxy. Wrap the handle with plastic wrap or wax paper, and then clamp it at each end and in the middle. The epoxy type will determine the glue's set time.

8 After the epoxy has hardened, unclamp and unwrap the handle. Cover the blade with cardboard or painter's tape, and get to work on the final shaping. Whether you clamp the knife blade to the bench or in a vise, use wood blocks to avoid marring the steel. Use a combination of rasps, files, power sanders and sandpaper to bring the handle contours flush with the edge of the tang. Round all the corners until the handle feels good in your hand. Finish with steel wool if you want a smooth handle. Finally, apply several coats of Danish oil to the handle, and buff with superfine (#0000) steel wool between coats.

## Happy carving!

After your friends and family see your handsome and handy blade, they're sure to come your way for kitchen, farm and utility knives of their own. Just show them these simple instructions and they'll be one step closer to the goal of self-sufficiency.

*Special thanks to Massey Ferguson's* Farm Life Magazine *for allowing us to reprint this article.*

CLOCKWISE FROM BOTTOM LEFT: KAREN K. WILL (4); HANNAH KINCAID

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Small Project

# SEED STARTING

# 12 Easy Setups for Home Gardeners

**Glean creative ideas from these real-world methods, and give your seedlings a healthy start at home this coming spring.**

Growing your own seedlings indoors can save you big bucks, as well as open up a whole new world of crop variety options. When you start seeds at home, you aren't limited to the, well, "garden variety" plants available at most garden centers. You can order seeds of anything you desire to try – such as disease-resistant, organically bred, regionally adapted or rare heirloom varieties – from the many mail-order seed companies across the United States, and then sprout them yourself.

The range of setups you can use to start your seeds is nearly as diverse as the plants you can grow.

We reached out to our readers to find out what seed-starting setups work well for them, and this is a roundup of their ideas. As you get set up at home, keep in mind that using lights will usually work better than placing plants on windowsills, and certain lights are superior for this purpose. We recommend standard fluorescent T8 bulbs because two of them together produce about 3,000 lumens. Even though the glow looks bright to human eyes, 3,000 lumens is only a small fraction of the light a seedling would receive outdoors. Keeping your seedlings within only a couple of inches of these bright lights will make them sturdier and healthier.

Not all the advice here precisely follows the "best practices" for seed starting, but together the tips comprise practical ideas that have worked for resourceful gardeners. For more guidance, check out "Best Tips for Starting Seeds Indoors" at http://goo.gl/aTPQxM.


## 1 Cool Cart on Wheels

I built my grow-light stand last year using ash wood from my backyard that I cut on my bandsaw mill. The stand has two levels, and it's equipped with shop lights and bulbs I purchased at Home Depot. The bulbs are Phillips ALTO T8s, which put out about 2,750 lumens. I'm able to adjust the fixture height to keep the bulbs within a couple of inches of the plants for best results. This stand easily disassembles for storage, and I can also move it around because I built it on wheels. It works so well that I use it to grow lettuce indoors when I'm not starting seedlings. —*Edward Hollmen*

## ❷ Grow-Light Bookcase

I start my seeds on a multipurpose unit that functions as a seed-starting stand and bookcase. The grow lights are a permanent fixture of the stand, affixed to the underside of each shelf. When I'm starting seeds, I stack a few books underneath the seed-starting trays to keep them close to the lights, and then adjust the height of the book stacks as the seedlings grow.

To build such a unit, first purchase light fixtures, and then compile a lumber list based on the length of your lights and how many shelves high you want your bookcase to be. Find full plans for this structure online at http://goo.gl/DdKj4a. — *Cheryl Long*


## ❸ Yard Sale Sensation

My seed-starting setup resides on top of a bookcase in my den, and it never fails to produce a full complement of seedlings. Except for some cups and compost, I scored all the components at a yard sale. The cost? Amazingly cheap:

- 4 plastic shoe boxes at 25 cents each: $1
- Fluorescent light fixture with 2 tubes: $3
- Timer: 25 cents
- Extension cord: 10 cents
- Package of foam cups: $2
- Ice pick/awl: 50 cents
- Homemade compost: free
- **Total cost: $6.85**

I heat the tip of the awl over one of my gas stove's burners, and then use the awl to melt irrigation holes around the base of each foam cup, which I can reuse from year to year. I hung the fluorescent fixture beneath an overhead shelf. — *John Grass*


## ❹ Making Do at a Mile High

I'm a Master Gardener, but I'm also a mile-high, off-grid, limited-finance gardener. After hauling potting mix home on the back of my snowmobile, I fill up a couple dozen 2-inch peat pots and a couple dozen 3-inch pots, as well as some egg cartons and large yogurt containers. I start tomatoes, peppers, basil, cilantro and more.

The yogurt containers work well for repotting seedlings after a couple of weeks, when the starts need larger containers. Recycling and reusing readily available items in my price range? Perfect!

I cover my seeds with damp newspapers and place them near the woodstove until they sprout (keeping them far enough away so that the plastic pots won't melt). Then, they graduate to the lighted seed table, but we only run power for an hour or so at night; the rest of the time, they sit in the south and west windows. When the "babies" get bigger and the temperature rises above 45 degrees Fahrenheit, I move them into my cold frame on the porch during the day. My germination rate is about 90 percent. At the end of April, I plant my seedlings in raised beds that I cover with plastic hoops to provide extra protection.

Anyone can do this who has a warm corner, a bright window, and a fluorescent light or two. Just buy quality seeds and use a good seed-starting soil mix. Never let your soil dry out, but don't drown the small plants either.

Transplant the seedlings to a bigger pot when they get taller than the one you started them in. Place them in sunshine as much as you can. — *Betsy Mehaffey*

BOTTOM RIGHT: TERRY WILD


4

## 5 New Seeds on the Block

I start my seeds in soil blocks, which means I don't need any small containers. I make my own seed-starting mix based on a recipe from Eliot Coleman's book *The New Organic Grower* (available at www.grit.com/store). I also place a heat mat underneath to give the seeds bottom heat to help them sprout, and I mist the seeds with a spray bottle daily. After they sprout, I unplug the heat mat.

When the sprouts develop their first true sets of leaves, I transfer them to six-packs (you can use larger soil blocks at this point to avoid plastic containers altogether). I place them in a south-facing window until it's time to start hardening them off for planting in the garden. To harden seedlings off, place them outside in a relatively sheltered area for an hour or so per day at first, and then gradually increase the length of their outdoor time each day. — *Dale T. Rodgers*

## 6 Banking on Blankets

I'm a horticultural technician, and I have a large country property in western Quebec. Our growing season is much shorter than most.

In winter, our temperatures drop to minus 30 degrees Fahrenheit, so the soil doesn't warm up enough to host tomatoes and other heat-loving, long-season crops until July. My seedlings need to be large, hardy and ready to produce within this short growing season.

Bell peppers and tomatoes require an eight- to 10-week jump-start in our region. To get them going, I place an electric blanket under my seed-starting trays. I put a piece of heavy-grade plastic over the blanket to keep it dry. I was able to purchase used electric blankets for less than $10 apiece.

For plants that germinate best with a soil temperature of about 70 degrees, including tomatoes, we use the low setting on our electric blanket to maintain that range of heat under the trays. For plants that do best with soil temperatures of about 80 degrees, such as bell peppers, we use the blanket's medium-high setting.

Between bottom heat and overhead grow lights, my seedlings are large, vigorous and ready to produce abundant yields for my family to enjoy. — *Christina Eckerlin*

5

7

## 7 Milk Jug Mini-Greenhouses

I've tried many types of containers for starting seeds, including paper cups and plastic trays. So far, 1-gallon, clear plastic milk and water jugs have worked best. To try this, remove the caps and cut small holes in the jugs' bottoms for water drainage. Then, cut around three sides of each jug, about 3½ inches from the bottom, to create a hinge that will keep the bottom of the jug (your seed bed) connected with the top of the jug (your seeds' protective lid).

I fill the jugs with soil mix and place nine to 16 seeds in each jug, depending on plant size. In early spring, I keep the jugs inside in front of a southwest-facing window, and then move them outdoors when the weather starts to warm.

When I transfer the seedlings to the garden, I simply scoop them out with a large serving spoon, taking care to bring as much soil with each plant as possible to limit root disturbance. This idea originally came from one of your other contributors. Thanks to all who generously share their gardening ideas and experiences! — *Lisa Facciponti*


11

## 8 No Lights Required

In the past 40 years, I've tried many ways to start seeds. For cold-hardy plants, such as onions and cabbage, I've found that the least messy and least fussy method is to sow seeds in large plastic containers with lids, and then set them outside. That way, the containers double as simple cloches for frost protection.

You can use recycled lettuce clamshells, milk jugs cut in half — really, any container made of clear or opaque plastic. Fill each halfway with damp seed-starting mix, add a few seeds, and then lightly cover the seeds. When it's time for the seeds to come up, they'll come up! You won't have to repot or harden off. I start my seeds in late winter, and I've found that they'll sprout even when the cloches are covered with snow. When the weather warms and the baby plants begin pushing off the lid, I open it, give them a dose of fish emulsion, let them get stronger, and then transplant them to their new home. — *Laura Johnson*

## 9 Freezer Pleaser

To germinate my seeds, I've made a heated germination station out of an old, non-working upright freezer. It's outfitted with a 40-watt bulb attached to a shop light fixture that I hung inside the freezer to provide warmth. The freezer is situated on an unheated porch, and its inner temperature averages 75 to 80 degrees Fahrenheit, even on subzero nights. This method has sped up my seeds' germination time significantly. It's my greatest low-tech repurposing achievement to date! Not bad for gardening on a shoestring budget. — *Cris Canton*


## 10 Greenhouse Cultivation

I do all of my seed starting in a 6-by-8-foot greenhouse. My seed-starting pots sit on built-in shelving that's about chest-high, which makes for easy planting and repotting. I make sure to vent the greenhouse on sunny days so my seedlings don't overheat.

The greenhouse provides a warm, bright spot to get plants started, and I don't have to take up any space inside my house for the process. —*Vicki Slater Fugate*

## 11 A Festival of Lights

A friend named this my "Christmas tree light farm." I've been using this setup to start my seeds for four years now. Grow lights hang from a wooden rack and strands of holiday lights rest below my seed-starting trays to heat the soil (not touching the trays, but nested right below them).

I stick a thermometer in the soil to monitor its temperature. —*JoAnn Hana*

*EDITOR'S NOTE: See the photograph on Page 29.*

## 12 6-Layer Racks

I use tall, simple, six-tier shelving units that I adjust as my plants grow. A fluorescent grow light hangs over each shelf. Each light plugs in to an outlet in the light above it, so that each overall unit has only one main plug that goes into a wall outlet.

This photo (left) shows just the hot peppers I grew last year; I started more than 500 of them. Each year, I also start onions, sweet peppers, kale, cabbage, broccoli, edible flowers, microgreens and hundreds of leeks. As soon as nighttime temperatures rise a bit, I start even more seeds in my unheated greenhouse. —*Joanne Tipler*

### STARTING SEEDS INDOORS

Once your garden's soil is in good shape you can think about planting. Actually, you should be thinking about planting some crops like tomatoes long before the last frost. And I don't mean planting in the garden.

Warm season crops like tomatoes generally require several months to mature and produce fruit. Even if you live in Kansas and can expect seven or eight frost-free growing months, you will want to give those jalapeno peppers a jump start by starting seeds indoors. It's really easy.

Four to 6 weeks before the last frost date for your area, you'll collect some likely containers: peat pots, small plastic pots, fiber egg cartons and even plastic water bottle bottoms will work if you poke some holes in them for drainage. Once you have your containers in hand, source some quality potting soil or seed starting mix, fill your containers and plant a couple of seeds in each.

Water thoroughly and gently and place under a grow light, in a well-lit window or even in a temperature controlled greenhouse if you have access to one. In a week or so seedlings will start to appear – by the time the seedlings are well established you should thin each pot to a single robust plant by pinching off the stem of those you want to get rid of.

As the seedlings outgrow their starter containers, you can transplant them into larger pots and grow them on until they are ready for the garden.

Planting starts in the garden is easy, but you need to harden them off before they can live outdoors. This is accomplished by moving the plants outdoors to a relatively protected area for an hour or two at a time initially.

Avoid windy full-sun sites until the plants can withstand a day in their protected area without harm.

Once you get the hang of starting your garden from seed, you will reap the rewards offered by thousands of fruit and vegetable varieties instead of the score or so available as plants from your local nursery or garden center. Either way, you'll be able to eat the freshest, most delicious produce there is.

*—Oscar H. "Hank" Will, Editorial Director*

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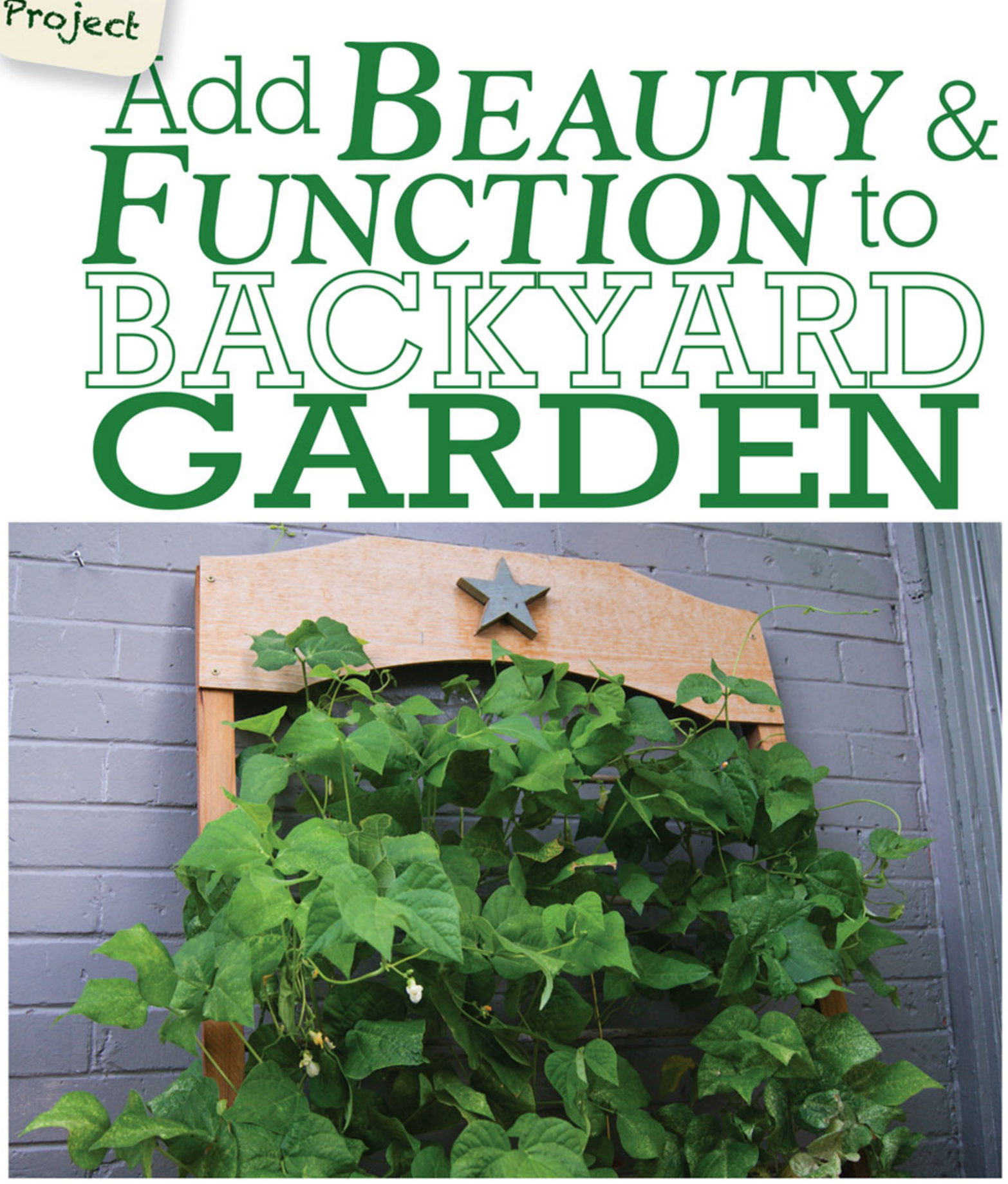
Small Project

# Add Beauty & Function to Backyard Garden





## Two easy-to-make projects transform a backyard into a productive farm.

By CHRIS GLEASON

Transform an ordinary backyard into a productive farm with two easy projects from *Building Projects for Backyard Farmers and Home Gardeners* (Fox Chapel, 2012). It includes 21 gardening and animal projects.

### DIY Moveable Bean Trellis

Trellises, at least in my mind, come in two forms: those that are free-standing, and those that require some other kind of support. This particular trellis belongs to the latter group, in that I designed it to be leaned up against whatever else is around. Originally, I had placed it against a fence, but it turned out I didn't need it there, because the beans I had planted in that spot were bush beans instead of pole beans. I guess I did a pretty bad job of reading the seed package!

In any event, it was no problem to move the trellis to a different bed where I was getting ready to plant more beans. The second time around, I was much more careful about checking the label. And leaning trellises aren't just useful when you need to correct a silly mistake: they are really handy because they can be moved around from year to year. Since they have no moving parts, they're easy to set up, take down, and store during the off-season.

**1. Cut the posts.** Since this trellis is basically a large rectangle that gets most of its strength from its two vertical posts, that's where I started. I ripped a 2-by-4 in half on my table saw to produce the posts (A), and then I set them next to each other on a pair of sawhorses to lay out a series of marks where the horizontal rods would be placed. The easiest way to do this is to start in the middle and keep dividing each length about in half until you have as many marks as you want rods – an even number is easiest. I picked eight.

**2. Drill holes**. To ensure that the holes for the rods (B) were drilled exactly perpendicular to the surface of the posts (A), I used my drill press. You could definitely use a hand drill in a pinch, but the drill press does help to make certain that the rods will line up neatly later on. Make sure the holes you drill are the same size as the diameter of the dowels you're using.

**3. Insert the dowels into one post.** Since I planned to use this trellis





## DIY BEAN TRELLIS MATERIALS LIST

| ITEM | MATERIAL | DIMENSIONS | QUANTITY |
|---|---|---|---|
| (A) Posts | 2x2 | 66” | 2 |
| (B) Horizontal Supports | 7/16” dowel rods | 30” | 8 |
| (C) Top Rail | ¼” plywood | 32” x 9” | 1 |
| (D) Star Decoration | Scrap wood | Size as desire | 1 |
| (E) Vertical Supports | Nylon string | | |

## BEAN VARIETIES

Since you’re already hard at work building a support structure for your bean plants, here’s a list of the different varieties you can grow when you’re finished:

| NAME | VINE SIZE | DAYS TO MATURITY | NOTES |
|---|---|---|---|
| Blue Lake Pole | 6’-7’ | 70 days | Use in soups or freeze and can |
| Genuine Cornfield | 5’-6’ | 70-90 days | Often grown in cornfields |
| King of the Garden Pole Lima | 8’ | 90 days | Large beans with a sweet flavor |
| Old Homestead Pole Bean (Kentucky Wonder) | More than 6’ | 70 days | Variety from the 1860s |
| Romano Pole Bean | 6’ | 70 days | Harvest pods often |
| Scarlet Runner Pole Bean | 10’ | 70 days | Vines have bright red flowers |

for beans and peas, which are pretty lightweight, I didn’t have to worry too much about making the rods (B) extra-strong: I just used a bunch of dowels from an old clothes drying rack that my neighbor was throwing away. Using a rubber mallet, I pounded the rods into one of the posts (A). It was easiest to just lay the post down for this step. I didn’t find it necessary, but if you wish, add glue to the holes.

**4. Insert the dowels into the second post.** Getting the second post (A) to fit onto the exposed end of the dowels (B) is a little tricky – you’ll wish you had three hands – but once the dowels have gotten started, you can used a pair of clamps to squeeze the posts and tighten up the fits.

**5. Shape the top rail.** The trellis is capped off by a wide horizontal rail (C) that I made from ¼-inch plywood. Its main purpose is to add rigidity to the structure and keep it from getting wobbly over time. I shaped the top of the rail with my jigsaw. Once I cut off one corner, I saved the scrap as a pattern for the opposing one. A band saw is also a fine way to cut out the curved portions. Attach the rail (C) to the posts (A) with a few screws. I also cut a small star (D) out of scrap stock and fastened it to the top rail as a nifty decorative touch.

**6. Add vertical supports.** To add more places for the pole beans to climb, I tied a row of strings (E) to the top and bottom dowels and wove the nylon in and out of the other horizontal supports (B).

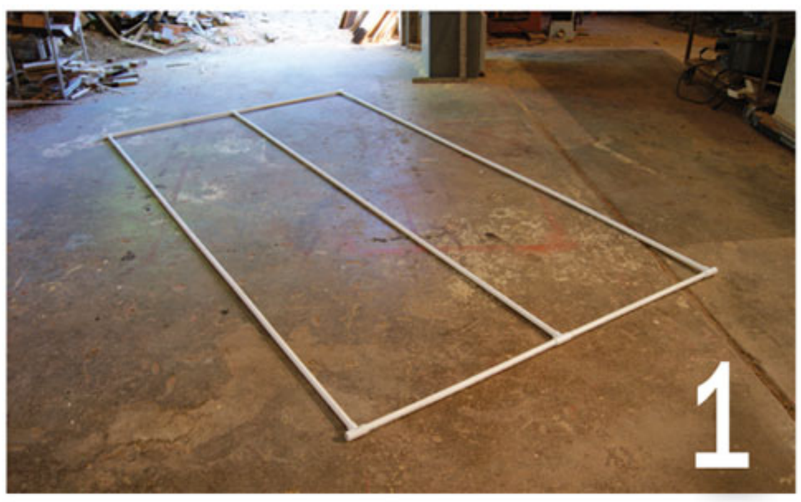
## Build a Versatile PVC Cloche

This style of cloche is common in our area, and for good reason: they’re simple, inexpensive and versatile. You can adapt them to fit just about any size area you’d like, and with a little imagination, you can even scale it up and build a large walk-in hoop house. I do recommend doing this with a partner if you can, because the long lengths of PVC tubing can be frustrating to try and handle on your own.

I used ½-inch (13mm)-diameter PVC tubing and standard T connectors from the plumbing section of our

## PVC CLOCHE MATERIALS LIST

| ITEM | MATERIAL | DIMENSIONS | QUANTITY |
|---|---|---|---|
| (A) Base | ½"-diameter PVC tubing | 30" | 4 |
| (B) Ribs | ½"-diameter PVC tubing | 10' | 3 |
| (C) Connectors | ½"-diameter T fittings | | 6 (or you could use 4 right-angles for the ends) |
| (D) Nylon string | | 8' | 3 |
| (E) Plastic covering | Greenhouse film | 11' x 11' | 1 |
| (F) PVC clips | ¾"-diameter tubing | 3" (Cut in half) | 10 total, so 5 lengths of tubing that are then cut in half |
| (G) End clips | Office supply binder clips | Any size will work | 4 |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4

local home center, and that aspect of the construction is pretty self-explanatory. The 10-foot-long (3,050mm) tubes easily bend to create a cloche that is 8 feet (2,440mm) wide and about 3 feet (915mm) high, but you could bend them to a tighter radius, which would produce an arch that is narrower and taller.

You could also cut the tubes down – when in doubt, I suggest buying one or two extra lengths and experimenting to figure out the size that will work best for you.

**1. Prepare the ribs and base.** I cut up the base tubing (A) into 30-inch lengths, so you can see this project will be 60 inches long (well, slightly longer, since each connector adds an inch or so). Lay out the base pieces (A), rib pieces (B), and T connectors (C) as shown. The T connectors (C) make it easy to join the sections of tubing (A, B). I didn't use any glue, since it is nice to be able to break down a cloche and store the parts when it isn't needed, but you might want to use glue if you plan on building a more permanent structure. You could join as many sections together as you'd like.

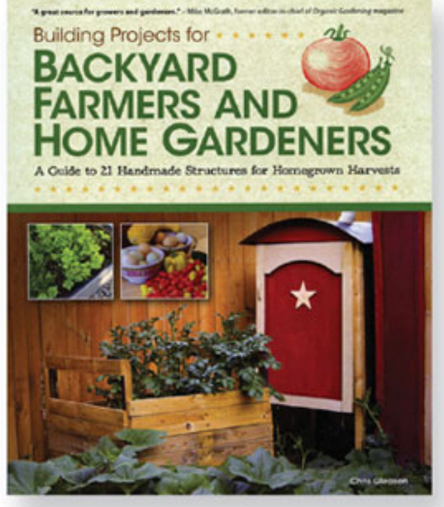
**2. Bend the cloche.** To spring the flat assembly into shape, I tied some nylon twine (D) on one side and then pulled it taut and tied it off on the opposing side.

I placed a length of string below each PVC rib (B), and this worked great. The finished skeleton is extremely lightweight and easy to move around. Having an assistant would've made this step a lot easier, though.

**3. Create clips.** To hold the plastic to the frame, I made a set of clips (F) using ¾-inch PVC. I used my table saw to make two parallel rip cuts, thus removing a portion of the center of the tubing. Viewed from the end, the tubing was shaped like a C instead of an O. I then cut the tubing into 3-inch chunks on my chop saw. I suggest making a pile of the clips, since it is better to have too many than too few. You can also buy these clips from most garden supply centers for around 50 cents a piece. If you have a table saw, this method will save you a few bucks – the homemade version will cost about 10 cents each.

**4. Attach plastic.** The finished clips (F) just click onto the skeleton base (A) and hold the plastic (E) in place. Put two or three on each base piece (A). To attach the plastic (E) to the nylon twine (D) on the ends, simply fold the plastic under the twine and secure with a binder clip (G).

These excerpts have been reprinted with permission from *Building Projects for Backyard Farmers and Home Gardeners: A Guide to 21 Handmade Structures for Homegrown Harvests* by Chris Gleason and published by Fox Chapel, 2012. Order the book from GRIT's Bookstore, www.grit.com/store, or call 866-803-7096.




COURTESY FOX CHAPEL PUBLISHING (4)


# Porch Swing Plans

## Make this porch swing using recycled wood pallets.

By JEFF HOARD

Living out where the pavement ends offers the simple pleasures of country life. Unadulterated stargazing, the sound of a rooster's crow each morning, and weathered farm structures are just a few to mention. Rural folks use the front porch as a place to gather the family and take in their surroundings, and nothing encourages a relaxing get-together more than a classic porch swing.

Most porches have sturdy beams and rafters from which to hang a swing. For those looking to forgo the expense of purchasing a brand-new wooden swing and hiring someone to hang it, there are several economical options that will yield the same laid-back results. Using recycled pallets and my simple porch swing plans is one way to make your front-porch-swingin' dreams a reality.

NATE SKOW ILLUSTRATION

### Porch swing plans

Living on an "off-grid" ranch, we save just about everything, so I built our swing for zero dollars. But even

if a person can find a pallet, the cost of the hardware needed would be minimal. The size we built (4 feet long) required only one large pallet, and because of the ranch setting, we occasionally place orders that require a pallet for delivery, which we save. I picked one out that was in decent shape and dismantled it.

Sometimes pulling nails can be tough, so to make it easier, soak the pallet with a hose or work on it a couple days after a rainstorm. You just need to separate the 2-by-4s from the 1-inch-by-6-inch slats to make the simple swing shown on these two pages and on Page 35.

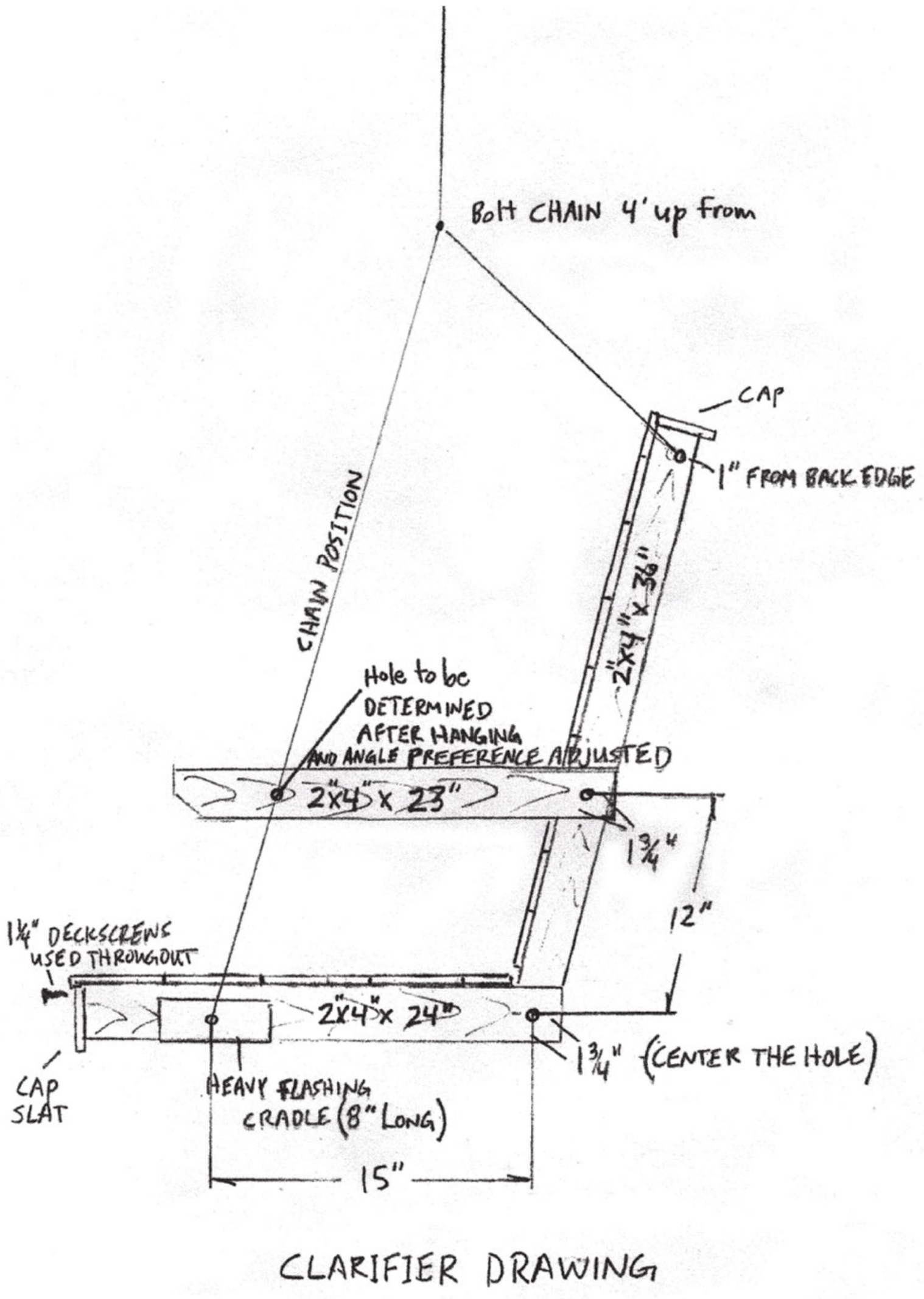
One large pallet was all the wood I needed to build ours. Basic tools required to construct the swing include a hammer and nail bar to dismantle the pallet. If the slat ends are split or the nails are just too hard to pull, use a saw to cut 1½ inches off each end and shorten the swing's width accordingly. On ours I was able to keep the full 4-foot width of the pallet.

After the pieces are cut to size, it's time to drill the holes. Start with the 2-by-4 pieces. I used 5/16-inch all-thread that I found in my scrap pile to fasten the support pieces together. If you use bolts, choose carriage bolts the lengths shown on Page 37. The hardware listed is just what I used and will hold the weight of two average-sized adults. Use your best judgment, but do not use smaller diameter hardware than that listed.

Attach the shorter 2-by-4s to the larger ones as shown in the illustration to create the supports. "Snug up" the nuts, but not too tight. Now it's time to smooth up the 1-inch-by-6-inch slats with a plane or sandpaper.

Arrange the outer 2-by-4 supports upright on a smooth, flat surface and cross-tape to make sure they are square. Attach the seat's front slat flush with the edges and overhanging one inch past the ends of the 2-by-4s using 1¼-inch screws (predrill and countersink the holes to avoid splitting) and a generous bead of construction adhesive. Find the center point in the slat and position the center seat support beneath it, square it to the end supports, and screw and glue the slat to it. Make sure the whole project remains square as you glue and screw additional slats to the seat and back supports.

Note that the back slats will overlap their support ends by about 1½ inches. I created a space between each slat with a nail. When you get close to the bolted joint, lift the back up to the approximate finished angle and snug up the bolts to hold them in place.



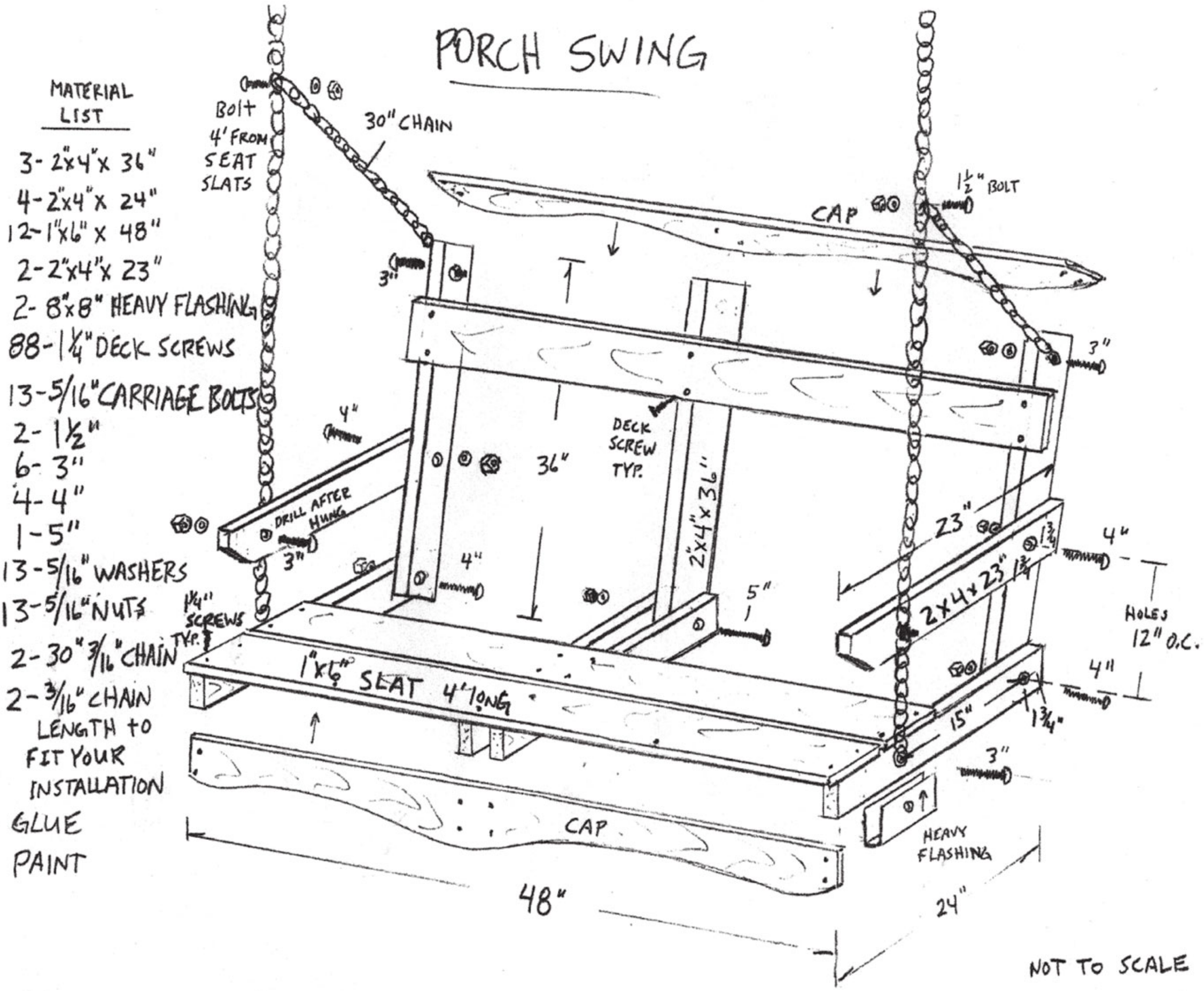

Be sure to hang your swing on sturdy beams.

If needed, rip the last two slats to the proper width and install them.

Now cap the end of the seat and the top of the seat back with the two remaining slats. I took a jigsaw and made ours curvy to class it up a little, but it's not necessary.

Next install the arm rests. Remove two 3½-by-1½-inch pieces from the ends of one back slat at a height that makes sense for the 2-by-4 armrests. Install the armrests using bolts. Now it is ready to be painted. Being built

Jeff Hoard Illustration (2)




These plans include plenty of flexibility; take advantage of that to make a delightful porch swing that suits you, your family, your porch size and the materials you have on hand.

from a pallet, it obviously has some rough areas. Two good, thick coats of paint covered a lot of the rough stuff. Remember, this is an old-fashioned swing here, not a piano!

I used 3/16-inch galvanized chain for hanging. I had only a limited amount of chain leftover from another project, so I used 5-foot-long pieces of pipe from my scrap pile on the sides, but it can all be done with chain.

The length of the longer main chains will be determined by the height of your hanging point, but the short chains that attach from the main chain to the swing's back should be 30 inches long, and I attached these chains to the main chain with a 5/16-inch bolt 48 inches up from the top of the seat.

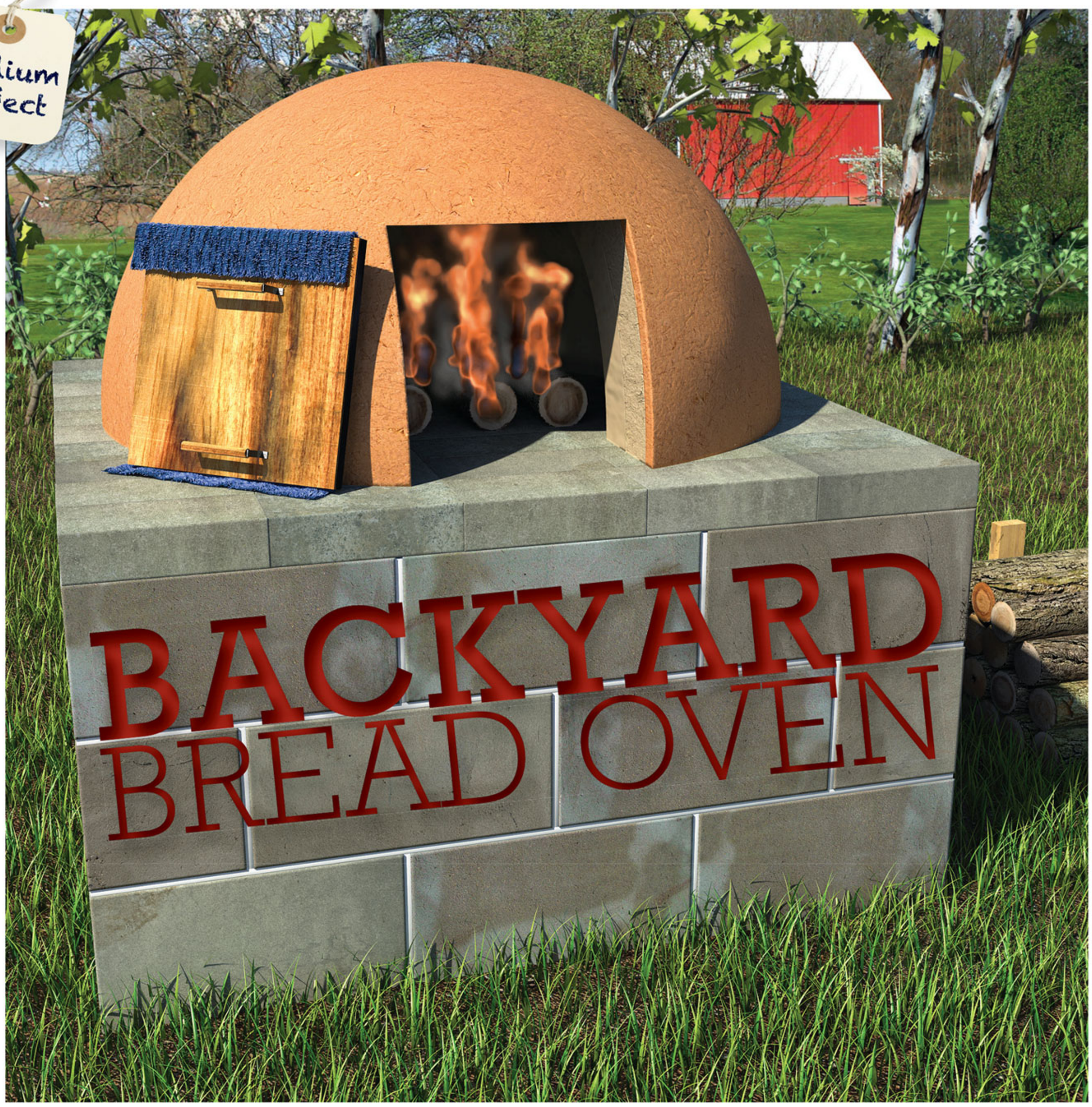
As you can see by this design, the back-to-seat angle can be adjusted. To attach the main chain to the seat bottom, first fashion a set of brackets using heavy-gauge flashing. Cut a strip of flashing, hammer it around the 2-by-4 so it will cradle the weight, drill a hole for attaching the chain, and repeat for the other side.

Now the swing needs to be hung at the desired height, keeping in mind the height of the cushion. With the swing hanging, push the back out to take the slack out of the smaller top chain and tighten the three bolts connecting the back to the seat.

Make sure the arm rests are parallel with the seat, line up the chain, and drill a hole through a link and the arm rest; bolt those. Choose a sturdy beam or rafter to hang your swing. We circled pieces of chain around our beam. I would use parachute clips instead of s-hooks to secure the chain as they are safer. Just make sure you have a good solid mount so you can swing away your troubles like our grandparents used to do!

*For more wood pallet projects, turn to Page 62.*

Medium Project




## Build this easy adobe cooker in a weekend.

By CATHY WILSON

My husband and I first spied an outdoor bread oven while strolling through our neighborhood. The beautiful brick dome was situated at the end of an overgrown driveway. It was so intriguing that we knocked on the house's door and met the oven's owner – a frail Italian granny. She graciously shared her story, which was inseparably intertwined with the oven.

"We came here for the coal mines in the '20s," she said, "You couldn't get good bread here, not like in the old country, so we built this oven. All the neighborhood ladies would get up early to start their bread dough, and I'd be up by 4 to fire the oven. It took five hours to heat that oven, and it was big enough to hold all the loaves. We'd drink tea, gossip and bake our bread. During the summers, some of the men went up to the mountains to herd sheep. I'd go up there to make them bread. I built ovens up there out of clay dirt and baked bread every few days. Those men could eat a lot of bread!"

The woman's fascinating story motivated us to research outdoor bread ovens, with the goal of building one for ourselves. Clay is readily available at our place and was our material of choice. After some serious research and with help from the best adobe-oven-making book ever, Kiko Denzer's *Build Your Own Earth Oven: A Low-Cost Wood-Fired Mud Oven*, we gave it a try. (The book is available at www.grit.com/store.) Using Denzer's thorough, friendly instructions, I built an oven in our yard, several ovens for the local school district,

Nate Skow Illustration (6)

and one for a mountain-man rendezvous. This year, my husband and I built the more refined model covered in this article out in our pasture.

This oven only takes about three days to build, start to finish, working a couple of hours a day.

## A fine foundation

Although you can build them on the ground, we decided to raise our new adobe oven to a convenient working height. For simplicity, we built a foundation for the oven using concrete blocks held together use a construction adhesive such as Liquid Nails. Since Liquid Nails isn't technically a load-bearing mortar, you won't want to build your base more than about three blocks tall. Depending on their size, it will take about 30 concrete blocks to build the foundation's perimeter walls. Once the adhesive has set, fill the container with rubble (broken pieces of concrete, big rocks, etc.). Top the rubble with gravel and sand, to about 8 inches below the rim. Next, add a 5-inch layer of vermiculite or perlite for insulation. And, finally, top this layer with sand; tamp it level with the top of the blocks (see Figure 1).

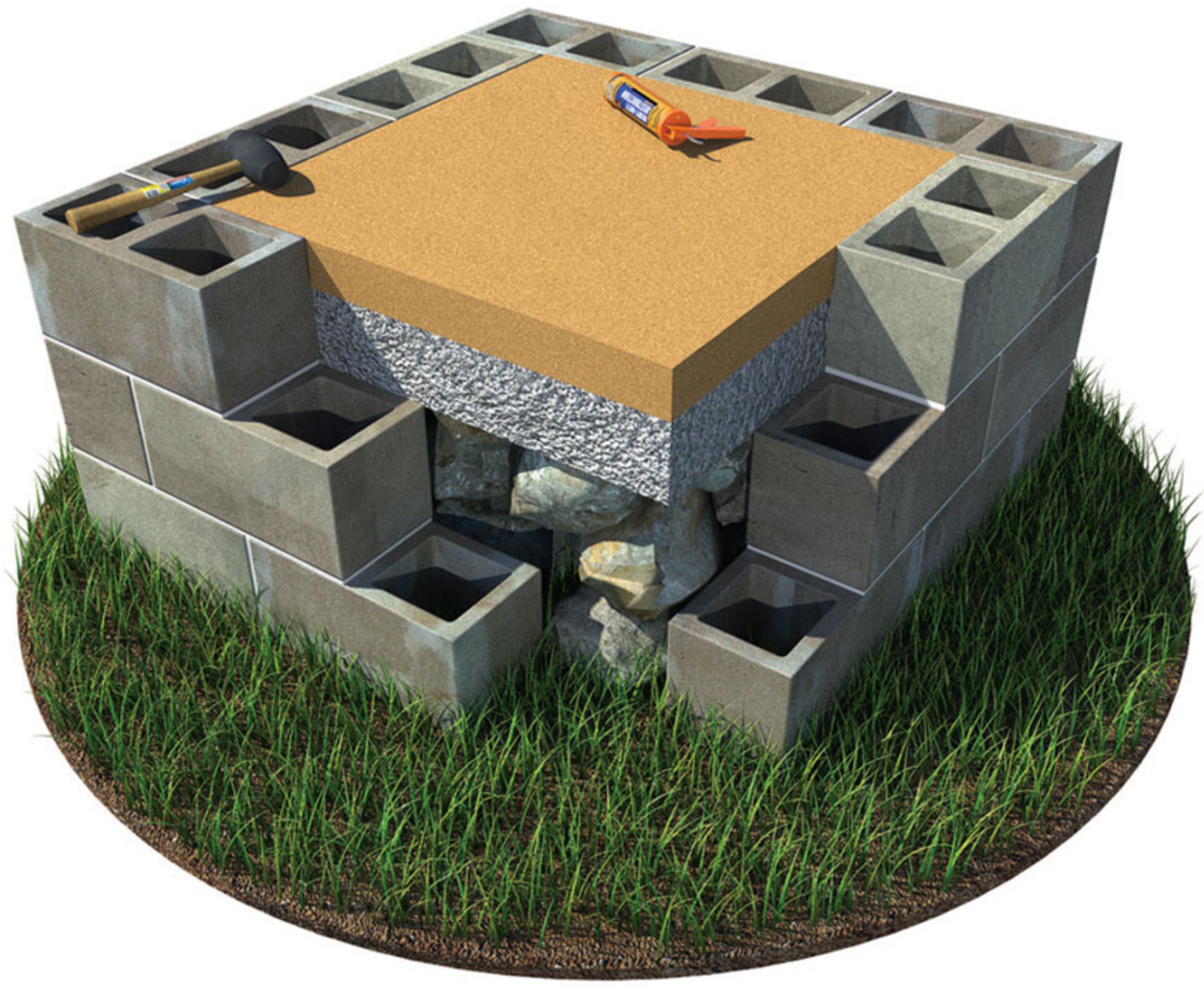


FIGURE 1. Preparing the base: Concrete block walls are filled with rubble topped with layers of a gravel/sand mixture, vermiculite and sand.

## Make a bed for fire

You will build your oven's fires on a layer of firebrick. Place the bricks on the sand and kiss them together, tapping with a rubber mallet to straighten. If they don't go down perfectly, just pick them up and try again. On our oven, we elected to cover the whole top of the foundation with firebrick.

## Domes made of sand

Our base was about 4-feet square, so we used a string and pencil to scribe a 28-inch-diameter circle for the inside of the oven and a 42-inch-diameter circle for the outside. You will want to adjust those values somewhat if your base has different dimensions than ours. Just be sure to leave enough space to allow 7-inch-thick walls on your completed oven (see Figure 2).

Shape a lovely dome with wet sand and be sure that it fits inside the smaller

FIGURE 2. Marking the walls: Scribe two circles on the center of the base, one with a 28-inch diameter and one with a 42-inch diameter.

FIGURE 3. A cross-section of the oven shows the sand and three adobe layers.

FIGURE 4. After the door is cut, carefully remove the sand, and gently scrape or brush it from the interior.

of the two circles. Take your time to make it gorgeous, and spray lightly to keep the sand wet. This shape will create the interior of your oven. Before you go on to the next step, measure the exact height of the dome and make a note of it. You will need this figure later.

## Play in the mud

The ideal mud mixture for an adobe oven is 25 percent clay and 75 percent sand. Shovel three measures of sand onto a tarp and add a single measure of clay initially. If your clay consists of a clay/soil mix, add proportionally more to the sand. Mix the materials together thoroughly – we used our bare feet. Periodically pick up the corners of the tarp and roll the adobe to the center and mix again.

Continue adding and mixing components until the proportions look and feel right. You should be able to hear the sand "bite" as you roll the mud in your hand. Periodically test the mud by making a golf-ball-sized sphere and dropping it from your waist onto a hard surface. If it breaks apart, the mud is too dry, if it flattens significantly, it is too wet. Add small amounts of water or clay/sand to correct for high or low moisture content.

## The first layer

Place brick-sized lumps (approximately 3 inches wide) of adobe around your dome, building up as you go. After completing one row, add another right on top of it. Continue until you have completely covered the sand dome with a 3-inch thick coating of mud (see Figure 3). If the adobe slumps some during the process, use an old knife and slice off the excess adobe on the bottom.

Use a short piece of 2-by-4 to "rock" over your adobe to smooth and adjust any distortions in the form.

Let the first adobe layer set overnight. If it stiffens up nicely, you should cut the door before building the second layer.

If it is still quite soft, you can wait until the second layer is done to cut the door. If the mud seems too soft and wet, your mix may need more clay.

For our oven, we realized our mix was not drying hard and it needed clay, so we

pulled the whole thing off and remixed the adobe. It was an easy fix.

## The second layer

Mix adobe for the second layer as before, but add some chopped straw to it, to hold it together and help prevent severe cracking.

Chop your straw with a weed-whacker in a wheelbarrow or trash barrel and mix the chopped straw into your adobe as you make it. The second layer is built just like the first, up and over. Use the 2-by-4 to rock over the form once more (see Figure 3).

## Finishing touch

Mix up some wet, soft adobe, using more clay than sand and very finely chopped straw, which you make by running the weed-whacker longer in the straw in your container.

If you have some pretty clay, perhaps red, use it for your plaster. Enjoy spreading it evenly over the entire surface of your oven.

## Open the door

In North America, traditional ovens tend to have doors that are 63 percent of the height of the oven's interior, so multiply the height of the dome by 0.63 and cut your door that high, using a large kitchen knife. (Be sure to make it wide enough to allow convenient access.) Remove the sand, using a trowel and your hands. Gently scrape the sand from all the interior surfaces and brush it off the brick floor (see Figure 4).

## Close the door

Trace the shape of your oven's opening on a piece of paper, and cut a piece of wood to fit the shape. It doesn't have to be perfect but try to get it close. Fashion a handle from a scrap piece of wood or buy one and attach it to the door.

## Let it dry

It can take weeks for your oven to dry, but you can speed the process by building small fires to help it along. Some cracking is to be expected during this process and as you use the oven, if large cracks develop, fill them with damp clay.

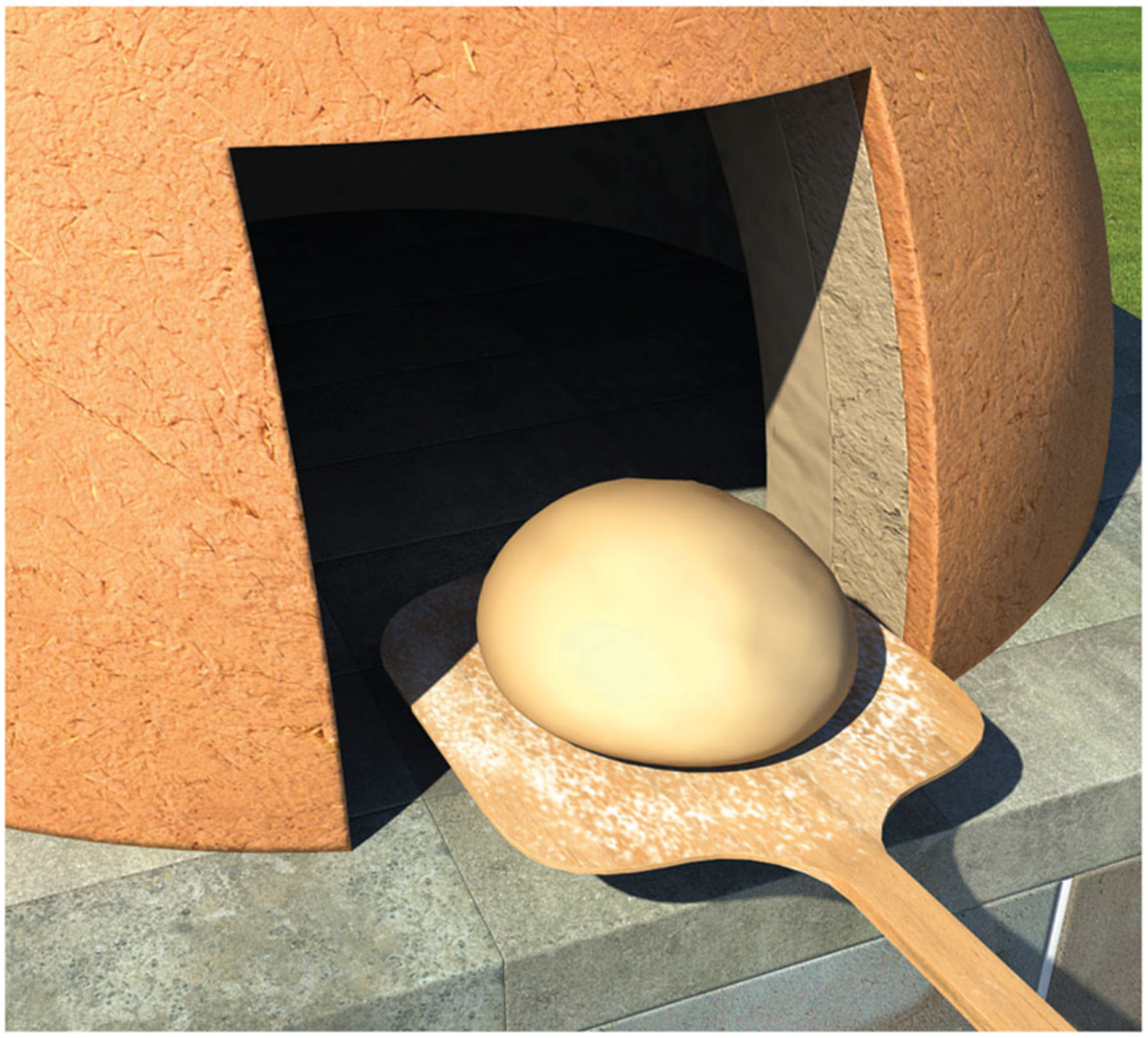


FIGURE 5. A "peel" is used to deposit the loaves into your oven. To heat the oven, build a fire inside and keep it going for about three hours; any good bread recipe should work.

## Now, bake some bread!

Light a large fire built with sticks and small pieces of wood inside the oven. When it dies down, build another. Continue this process for about three hours. While the oven is heating, make your dough.

Any good bread recipe will work in your adobe oven. Use an oil-free recipe for a crispy, European crust.

Let the bread rise, punch down, and form into round or long loaves. For the final rising, place loaves on cornmeal-covered cookie sheets.

Remove all the ashes and unburned wood from the oven. Nail or screw a rag to a stick, wet the rag, and "scuffle" out the bricks so they're clean. Let the oven sit or "soak" for about 10 minutes. Wet an old piece of towel and wrap the door with the towel inside. In a few minutes, remove the door and towel.

Gently place a risen bread loaf on your peel (the shovel-like tool for moving bread). Put the peel into the oven and with one sharp jerk forward, slide your bread right onto the hot bricks. Repeat with all your loaves (see Figure 5). Close the door, using the wet towel as a seal. Let bread bake according to your recipe, but pay attention with your nose and intuition to know when it's done.

You will be tempted to cut into your loaves immediately, but let them cool for 10 to 15 minutes. Your bread finishes baking as it cools. Now you can cut it or tear it, add butter or other toppings, and enjoy crisp-crusty European bread, fresh from your own adobe oven.

## Cooking other foods

You can cook anything in your oven, including meats and vegetables, pies and pizzas. For pizza, prepare your pies to put into the hot oven right after you scuffle out the ashes; don't soak the oven. For meats and vegetables, put in a covered pot after the soak. Remove the cover the last 15 or 20 minutes. Cook pies in a pie tin, but try to avoid fruit spilling over onto the brick floor. Of course, anything you wish to cook in the oven has to fit through the door.

## Maintaining your oven

Cover the oven during rain or snow. If you build an open-sided shed around your oven, it can last for years. If food sticks to the oven floor, you may need to scrape it out once in a while.

Medium Project

# DIY Chicken Tractor

My homemade chicken tractor is simple to build, easy to move, and will make your life a lot easier. I used a lot of leftover pieces from previous projects, including old tin and lawnmower wheels. It took about half a day to build, but a lot of that was me trying to figure out a design that would be easy for me and my wife to easily move. This chicken tractor will hold between four and six laying hens, depending on breed size, and it measures 4 by 8 by 2 feet for the run and 4 by 4 by 4 feet for the coop.

*Zach Marlow*
*North Bangor, New York*

**Tools:** Saw, hammer, wire cutters, tape measure, drill bits, and drill.
**Materials:** 8-foot 2-by-4s (8); 8-foot 2-by-6 (1); 10-foot 2-by-6 (2); 4-by-8-foot chicken wire; 4-by-8-foot ½-inch plywood (2 sheets); 5-foot-long threaded rod (diameter needs to fit bushings tightly); 2 wheels; metal sheets for roof; staples (1 box); 2½ inch screws (1 box); nuts and washers for threaded rod; small hinges; and a door latch or lock (for coop).

1 Cut four 8-foot 2-by-4s to 45 inches. These will connect your frame from side to side.
2 Rip a 2-by-4 in half, making two 2-by-2s. Cut one 2-by-2 into four 2-foot pieces. These will act as vertical supports, holding your frame together at each corner.
3 Build frames for the coop sides using 8-foot 2-by-4s and 2-foot 2-by-2s from Step 2. Join the frames with 45-inch 2-by-4s at top and bottom. You should have a box with the 8-foot sections on top. Offset the top sections by 21 inches to create space for your coop.
4 Attach the 10-foot 2-by-4s to the underside of the top frame to create handles for moving the tractor.
5 Cut your wire pieces to fully enclose the coop's sides, stapling every 6 inches or so. This will keep the predators out and chickens in.
6 Enclose the top and make a cover for the bottom so you have a closed-in 4-by-8-foot box. Don't enclose the 21-inch opening, and leave the last 3 inches unstapled for the coop.
7 Cut one plywood sheet in half to make a 4-by-4-foot piece. Screw in place where you left an opening in the wire, folding up that last 3 inches of wire that you left loose. The coop's floor will hang 2 feet over the end, which will make it much easier to move.
8 Cut a 1-by-2-foot hole in plywood to give chickens access to the lower section.
9 Cut two triangular end pieces from the remaining plywood sheet to 4 feet wide and 3 feet tall. Attach these together with two 2-by-4s cut to 4 feet. Your 2-by-4s will set about 3 inches in on each side, so you'll have a flush surface to mount the roof to later.
10 Fasten your framed structure to the base of the coop, screwing in from the bottom and the sides.
11 Cut your leftover 2-by-2 into two 4-foot-long pieces. Screw one in at the very top for a frame piece, and the other about 12 to 18 inches down. This will be a roost, so adjust according to the size of your birds.
12 Cut some old tin into sections long enough to cover the whole roof, bending at the top and fastening with roof screws.
13 Use a jigsaw to cut an opening into the end for your access. (I cut mine big enough to put a feeder inside.) Fasten with hinges and a locking device. Now your coop on your chicken tractor is done!
14 Cut your 2-by-6 into two 3-foot pieces, attaching to the frame beneath the coop.
15 Measure your wheel-mount so the wheel height keeps the two ends of the run level.
16 Drill holes for threaded rod into each side, running threaded rod through and mounting the wheels. Fasten down with fasteners. Now you can easily move your chicken tractor!

## Easy, Lemon-Fresh Microwave Fix

With two teenage boys at home, I used to have a hard time keeping the inside of my microwave clean. It often smells like the nachos and queso they're fond of making. I knew that lemons work well as a degreaser and disinfectant, and they smell clean and fresh, so I wondered how they'd do in the microwave. One morning while doing dishes, I put about ¼ cup of water into my empty coffee cup and added 3 drops of lemon essential oil. I put this into the microwave for one minute on high – long enough to get the water steaming. I waited a few minutes before opening the door so steam could fill the microwave. After I took out the mug, I wiped down the walls of the microwave with a damp cloth. The stuck-on cheese and chili came off with ease and the microwave smelled lemony fresh. I now follow this procedure every time I notice spatters or smells in my microwave, and it works like a charm. When I remove the cup of lemon-oil water, I set it on the kitchen counter until it's done steaming so the smell can freshen up the whole kitchen.

*Babette Birchett*
*Arlington, Texas*

## A Modern Rail Fence

Fencing is a perpetual challenge for our wildlife-rich farmstead, as we try to balance security, aesthetics, budget, and sustainability. Our fences range

from serious, permanent barriers made from thick cedar posts and wire mesh, to lightweight and portable electric lines.

Recently, we've been experimenting with a modern twist on the classic split-rail fence that fits many of our goals for a satisfactory fence.

This approach uses alternating rails of thin poles held between pairs of T-posts. It's very fast to assemble, after you've cut the poles, and is flexible over rough terrain. Using T-posts eliminates the time sink of drilling and setting wooden posts and the problem of preventing rot.

Our poles are young cedar trees, an abundant resource here in Missouri and a natural byproduct of our annual forest-improvement work; the tops of larger logs set aside for lumber would also work. The cost of the T-posts ended up being lower than the value of the time we would've spent splitting rails for a similar length of fence, especially because we bought them used.

The T-post method keeps the fence straighter than a traditional zigzag-rail fence, making it easier to maintain the adjoining areas with a mower or scythe, and to add vertical extensions or electric lines to increase the fence's effectiveness against deer. It's also easy to build in short segments wherever you need an attractive and sturdy barrier.

Two T-posts keep this homestead rail fence straight and secure.

To build the fence, we cleared the route of brush and did some light leveling work with a shovel, and then stretched a length of twine to create a straight line. Our poles are mostly 8 feet long, so we set a line of T-posts a little closer together to allow the poles to overlap. We set a hunk of salvaged concrete block next to each post to keep the fence's base off the ground and to reduce rot. As we laid each pole in place, we added another T-post opposite the first one, at a reasonable spacing to allow for the typical pole's diameter. Some of these posts I angled slightly inward to account for our plan to use thicker poles at the base and thinner ones higher up. The fence proceeds in a cascading fashion, with each new layer of poles atop the previous one until the far end, where I started working my way back.

At each end of the fence, we used chunks of wood (either cut-up poles or pieces of milled 2-by-4s) as spacers, in place of the nonexistent poles that would otherwise keep the fence going. The weight of the fence keeps these spacers in place.

Spacers can also keep rails relatively level, in the likely event that some poles taper too much at one end and don't allow enough vertical spacing.

When the fence reached its intended height, we wound wire around the top of each T-post pair to keep them from spreading over time.

This kind of fence uses lots of on-farm resources in the form of logs too thin for milling but too thick for chipping. It's quick and easy to construct, requiring a minimum of engineering skill, and can handle rough terrain.

It's also relatively easy to disassemble or repair if, for example, a tree falls on it. It doesn't put a lot of metal wire or mesh into the landscape for future generations to deal with – something we're sensitive to after removing far too much old barbed wire and other metal trash from our land.

Even if this fence is abandoned, the T-posts will remain easily retrievable and useful for many years, and the logs will just rot away with no trace.

*Eric and Joanna Reuter*
*Boone County, Missouri*

## PROTECT SEEDLINGS FROM HAIL

For gardeners who fear the annual spring hail storms, I've found the perfect solution. In my garden, we save our tin cans, cut off one end completely with a regular can opener, and cut off the other end just enough to open it. Next, we place the cans over young plants with the lids open in the direction that hail usually comes from. When the hail comes, it hits the open lid and knocks it closed over the plant. After the storm, we just go out and open each can lid again. As the plant grows, you can change the cans' sizes or remove them.

*Susan Pfaltzgraff*
*Haxtun, Colorado*

Try this can-do gardening method.

## Rosemary Slug Barrier

Slugs are common in the Pacific Northwest. I've tried many natural methods to deter them – copper tape, eggshells, pottery shards, and even a solar-powered electric fence – but, until recently, it's been to no avail. Slugs can be quite sly!

Last year, during one of their stealthy nighttime raids, the slugs broke through the barriers in my herb garden and decimated every one of my newly planted thyme and oregano plants, mowing them down to tiny stalks. It was a sad moment. I noticed, however, that they left the rosemary bushes alone – even the new seedlings. Assuming they didn't like the strong taste or the woody, spiky leaves, I

decided to make a rosemary branch slug barrier, cutting up the branches and placing them in a circle around each thyme plant. It worked! After that, we had no slug damage to the thyme whatsoever. This year, I decided to try encircling the bases of my pole beans with rosemary. So far, all of my bean plants have remained completely slug-free.

*Melinda Barnett*
*Stanwood, Washington*

## DIY Wood Splitter

While I buy all of my firewood from a local source in the community, I still need to split my own kindling. As an aging baby boomer with a less-than-perfect back, I require an easy way to cut and collect the split wood without bending over.

I needed to build a simple device to hold the wood securely at the right height so that the split kindling could fall into a basket to facilitate easy transport. All I really needed was a solid platform at waist level and a simple clamp to securely hold the wood to be split. As I've always been conservative with my resources – you know, cheap! – I used recycled items that I had on hand.



Spare pieces of lumber and a bar clamp are all you'll need for a back-saving splitter.

The platform was an old commode chair frame to which I bolted two 2-by-6 boards, with two 2-by-4 cross members screwed to the top. I then attached a bar clamp to hold the wood in place for splitting.

On the wood deck below the clamp, I attached a scrap of plate steel to protect the wood deck from the splitting maul. To provide a solid base, I fastened a 4-by-4 vertical post running from the underside of the deck.

The post needed to sit on a solid base, such as concrete or brick. Without that support, the deck would crack with use.

My back is much happier these days, and, as a bonus, my hands are no longer in peril while attempting to hold the wood in place.

*Russell H. Erganbright*
*Centennial, Colorado*

## Quickie Compost

Whenever I have discretionary space in my garden and wish to give my soil a boost, I make some quickie compost. I start by digging a trench. I layer in a full bucket of kitchen scraps and sprinkle them with some starter, such as alfalfa meal, and then cover with dirt and water well. I set a couple of black plastic plant trays on top of the trench so the food scraps won't get dug up by animals on the prowl. After three weeks, my food has been well-decomposed and the soil is ready to use.

*Risa Goldberg*
*El Cajon, California*

## NUTS FOR SUDS

Our Appalachian homestead runs only on rainwater, so we need to be conscious of what enters our water system. Because they're 100 percent biodegradable and don't contain the toxic chemicals found in conventional cleaning products, soap nuts are a perfect option for greywater systems. Soap nuts contain a substance called saponin, which is a natural soap. When the berries are agitated in water, they release this natural soap through surfactant, which is an agent that reduces the surface tension of a liquid. Both man-made and natural detergents need a surfactant to break the surface tension of water so it can permeate fabric. Surfactants and saponins work together by shaking loose dirt from clothing and then binding to the dirt particles until they can be washed away.

**Laundry.** Using soap nuts for laundry couldn't be easier. Just put four or five nuts in a cloth bag and toss it into your washing machine. Run the machine as usual and remove the nuts with the clothing at the end of the rinse cycle. You won't need to use fabric softener or take the nuts out early. Hot water will release more saponin, but the nuts will work with any water temperature. Your nuts will last for up to 10 loads. After that, they'll get limp and papery thin and will begin to disintegrate. At this point, they can be composted and replaced with new nuts.

**Dishwashing.** Put two to five berries into the silverware rack of your dishwasher, add a bit of white vinegar, and run as usual. For hand-washing, you can make a detergent by soaking 1 cup of soap nuts in 4 cups of water overnight and then liquefying the mixture in your blender. Alternatively, you can bring the nuts and water to a boil, turn off the heat, and let them sit for an hour. Next, strain the mixture through a fine cloth. This liquid detergent will work as well as any dish soap, just without the bubbles.

**Shampoo and body wash.** Make a detergent as specified above and mix 1 ounce detergent with 12 ounces water. Add any scent you wish, and wash your hair or body as you would with a commercial product. This basic formula can be tweaked in many ways.

*Lydia Noyes*
*Kermit, West Virginia*

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Medium Project

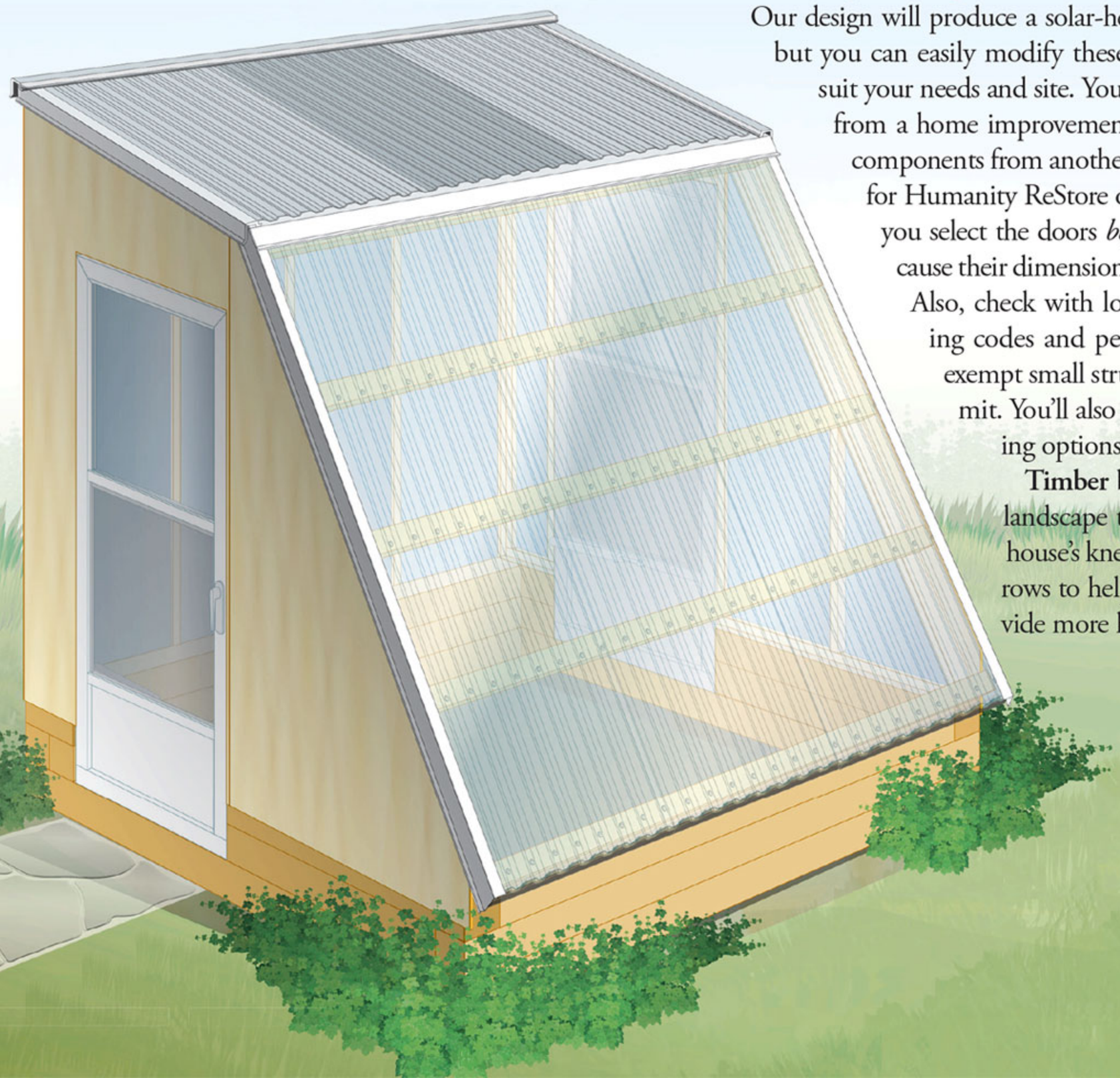
# DIY GREENHOUSE for Winter Growing

**Growing food in this solar-heated structure will be far more productive than doing so with electric lights indoors. Plus, you can build it with low-cost materials.**

By SPIKE CARLSEN

Almost anyone can build an affordable greenhouse to start seedlings in spring or extend the growing season by a month or two in fall. But building a greenhouse designed for harvesting cool-season crops *all winter long* is quite another matter. Happily, that's just what our winter greenhouse plans offer, and any handy gardener can tackle this project with basic tools, a good helper and a couple of free weekends.

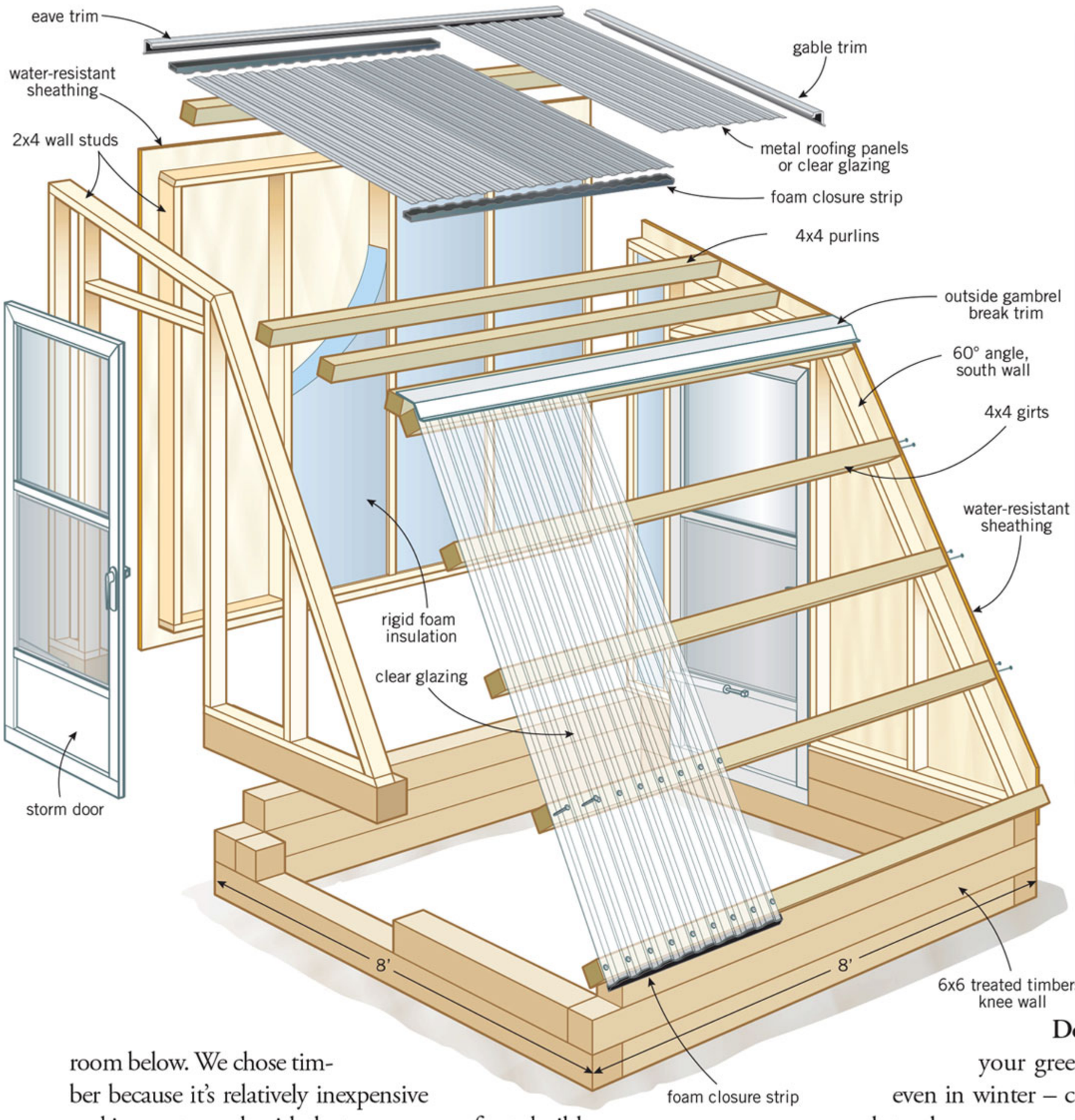
Lately, loads of products promising that you can "grow food indoors" during winter using artificial lights are hitting the market. Don't be fooled – replacing free sunlight with expensive and far less intense electric lighting is not a sustainable choice. Our smart greenhouse design features a south-facing glazed wall that's angled to capture the maximum amount of winter sunlight and heat. The north wall, side walls and roof are insulated to retain as much solar-generated warmth as possible on cold nights. In many regions, these strategic design elements will allow the greenhouse to stay warm enough to support cool-season crops through the coldest, snowiest months without the need for any supplemental heat or light. (For top winter crop choices, see http://goo.gl/icXB8y.)



## Before you dig in

Our design will produce a solar-heated, 8-by-8-foot structure, but you can easily modify these small-greenhouse plans to suit your needs and site. You can purchase new materials from a home improvement center, or you can recycle components from another structure, the local Habitat for Humanity ReStore or your stockpile. Make sure you select the doors *before* you begin building because their dimensions will affect the stud spacing. Also, check with local authorities about building codes and permits. Some municipalities exempt small structures; others require a permit. You'll also need to consider the following options before you build.

**Timber base.** We used three rows of landscape timbers to create this greenhouse's knee wall, but you can add extra rows to help level a hilly site, or to provide more headroom above or planting




## MATERIALS LIST

12 treated 6-by-6 timbers, 8' long
20 (approx.) treated 2-by-4s, 8' long
9 treated 4-by-4 timbers, 8' long
2 storm doors, 32" or 36" width
3 ribbed polycarbonate panels, 38" x 9'
3 ribbed steel roof panels, 38" x 8'
3 pieces of steel gable trim, 10'
1 piece of eave trim flashing, 10'
1 piece of outside gambrel break trim, 10'
Water-resistant sheathing for side and back walls

Other construction materials: foam closure strips, 8d and 16d galvanized nails, 4" and 12" timber screws, flat-head screws, neoprene washer screws, extruded foam insulation, and caulk.

room below. We chose timber because it's relatively inexpensive and is easy to work with, but you may prefer to build a knee wall from 2-by-6s so you can insulate between them.

**Wall angle.** The southern wall is glazed with ribbed polycarbonate and set at a 60-degree angle for optimum heat intake from the sun (aka "solar gain") in winter. The farther north you live, the lower the sun will be in winter. Lindsey Schiller of Ceres Greenhouse Solutions (www.ceresgs.com) in Boulder, Colorado, says an angle equal to your latitude plus 20 degrees will yield the maximum transmission, but you can actually deviate from this angle by as much as 30 degrees and only lose about 5 to 8 percent of potential transmitted light. So, the 60-degree angle of our south wall works well for most U.S. locations. A conventional vertical wall would perform similarly if outfitted with a glazed roof.

**Roof pitch.** We settled on a metal roof with a pitch ratio of 3:12 (about 14 degrees) for good runoff. You can make yours steeper or flatter depending on your site and needs. The interior of the roof is sheathed with polystyrene to make up for metal's poor insulating qualities.

If you choose to build a homemade greenhouse with a vertical south-facing wall (as on the Ceres greenhouse, pictured opposite) instead of our angled version, you should definitely glaze the roof with polycarbonate to let in more light while still offering good insulating qualities. Schiller recommends using a twin- or triple-wall polycarbonate.

**Doors.** You must be able to vent your greenhouse, because sunny days – even in winter – can raise its interior temperature enough to damage your plants. Our design features two combination storm doors set into the side walls. A standard storm door will give you access to the greenhouse interior, provide good ventilation for plants (because you can raise or lower the doors' windows as needed, which you'll have to do manually on a daily basis in most climates), and offer easy installation at an affordable price. Most storm doors are either 32 or 36 inches wide. Buy or scrounge your doors before you frame the side walls so you can adjust the stud spacing accordingly.

**Glazing and roofing.** These greenhouse building plans call for clear, ribbed polycarbonate panels (Pro-Sky brand) for the south wall, and compatible metal panels and trim pieces (Pro-Rib) for the roof. But you have choices galore. Glass transmits light well, but it's heavy, breaks easily, and doesn't insulate as well as multilayer plastic. Polycarbonate is sold as single wall, twin-wall, triple-wall and even five-layer. Polycarbonate can be cut with a box knife or a circular saw, but the material is expensive. If you're planning to recycle used plastic glazing for your greenhouse, keep in mind that plastic degrades over time; most polycarbonate has a 10-year warranty. (See http://goo.gl/Xt5Fak for a discussion of greenhouse glazing options.)

**Free-standing vs. attached.** This design is for a free-standing greenhouse with the glazed wall facing south, and insulated walls on the east, west and north. With modifications, however, you

Len Churchill Illustration (3)

can attach it to the south wall of a barn, outbuilding, garage or house. You could even create an opening between the two structures, which would allow the greenhouse to release heat into the structure it's attached to, and vice versa. An existing wall can help support and insulate the back wall of the greenhouse, and you may be able to eliminate the back wall entirely. However, check your local building codes before you get too excited about the idea of joining a movable structure to an immovable one. Buildings such as houses are on footings that don't move, or aren't supposed to, whereas our greenhouse is designed to "float."

## 'Floating' foundation and side walls

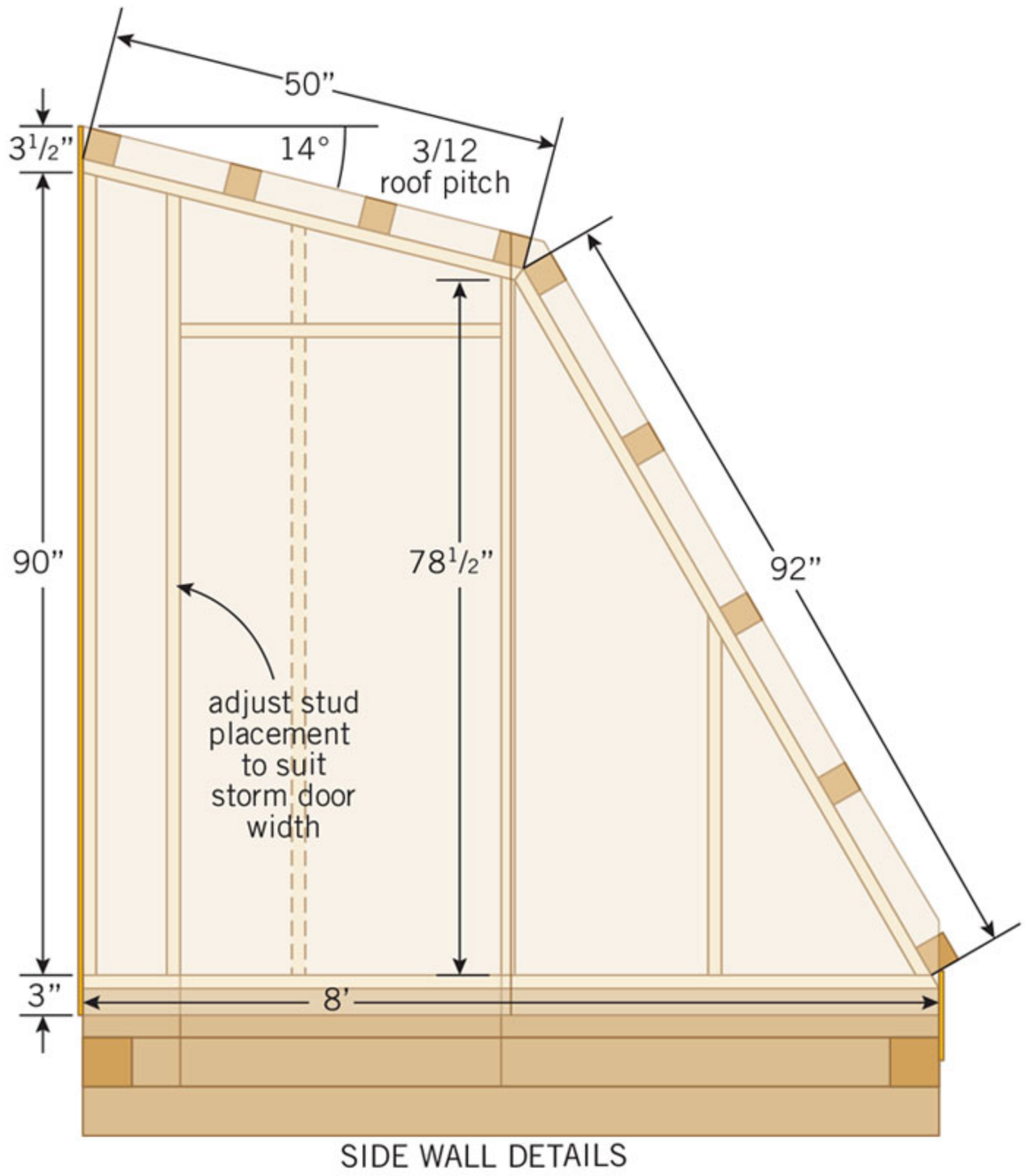
For your foundation, dig a trench that's 16 inches wide and 8 inches deep, with an outside footprint of approximately 8½ feet by 8½ feet. Fill this area with gravel. Use a 4-foot level taped to a long 2-by-4 to level the gravel.

You'll want to produce an 8-by-8-foot perimeter for the knee wall. Begin by installing and leveling the first row of treated 6-by-6 timbers. Nail the corners to one another, and measure diagonals to ensure the base is square. Add the next two rows of timbers, overlapping the corners as shown at right. Secure them with 12-inch timber screws as you go.

Next, find a separate, flat space to build the 2-by-4 side walls as shown in the illustration at right, spacing the studs to accommodate the size of your storm doors. The ends of most framing members will be angled, so be sure to adjust your saw accordingly.

Raise the side walls on the outer edge of the timber base and temporarily brace them with a couple of 2-by-4s, checking that they're plumb in both directions. Mark the timbers directly below the door opening, and use a reciprocating saw or handsaw to remove sections of one or two of the timbers (depending on the height of the storm door you'll be installing). Or, because you already know the exact size and position of your door, you can create this opening in the timbers as you build.

Knock together the back (north) wall with 2-by-4s; choose 2-by-6s if you want to include space for additional insulation. You can construct the wall in place, but it will be easier to build if it's lying



SIDE WALL DETAILS

on a flat surface, and then you can stand and position it. Nail the corners together. Install a temporary cross brace on the inside of the back wall to hold it plumb while you sheathe the walls.

Keep in mind that greenhouses are very humid environments and experience condensation regularly. Your least expensive option for sheathing the walls is probably exterior-grade plywood, but it may degrade in just a few years. Schiller recommends water-resistant siding materials, such as fiber cement wallboard, engineered wood products, and plastic or metal sheet paneling.

Sheathe the back wall, and then check the three walls one more time to make sure they're plumb before you sheathe the side walls. Make sure the sheathing extends about 3 inches downward beside the top timber to help tie the walls and base together. Also, your sheathing should extend 3½ inches beyond the top roof plate and the slanted front wall, as shown in the illustration above. The extra

### RESOURCES

Solar Greenhouse Basics (Ceres Greenhouse Solutions): http://bit.ly/2dzvh9v

How to Design a Year-Round Solar Greenhouse: http://goo.gl/tmJPDS

3 Free Methods for Heating Greenhouses: http://goo.gl/M87qgM

Cold-Climate Greenhouse (University of Minnesota Extension): http://goo.gl/xvYpFG

Solar Greenhouses (ATTRA): https://goo.gl/wCPnCE

Sunspaces and Solar Greenhouses (Build It Solar): http://goo.gl/gBWsQT

*The Year-Round Solar Greenhouse* by Lindsey Schiller with Marc Plinke, available at www.grit.com/store.

If you choose to build a greenhouse with a *vertical* south-facing wall, be sure to include a glazed roof to let in winter sunshine, as with this design by Ceres Greenhouse Solutions.

3½ inches will create a solid surface for securing the 4-by-4 roof purlins and slant wall girts.

## Girts, purlins and panels

Cut your 4-by-4 wall girts to length (in our case, 8 feet), and position them about every 2 feet along the top of the slant wall. Secure them by driving 4-inch timber screws through the 2-by-4 top plate and into the girts, and 16d nails through the sheathing into the ends of the girts.

Follow the same procedure for the roof purlins.

Install the front glazing, following the manufacturer's installation procedures and using the recommended fasteners (we used screws with neoprene washers). Orient the corrugations or ribs vertically so the glazing will slough off snow and rain. Insert foam closure strips on the ends and gable trim on the side edges of your greenhouse's glazed wall to minimize air and moisture infiltration.

Fix a length of outside gambrel break trim at the top of the wall glazing and install the roof panels, making sure they extend at least 2 inches beyond the front wall glazing.

Seal the joints with L-shaped eave trim where the roof meets the back wall, and with gable trim where the roof meets the side walls. (If you plan to add siding to your homemade greenhouse, remember to space the eave trim such that you'll be able to slip the siding underneath.) Keep out the elements by adding closure strips where needed.

## Put your house in order

Secure your storm doors using flat-head screws, and then install the handles and closer-piston hardware. Cut panels of extruded polystyrene insulation to fit between the back wall studs, side wall studs and roof purlins. Fill any remaining cracks and gaps with caulk, insulation and expanding foam. You can also insulate the interior of the timber knee wall with extruded polystyrene.

Most growers want a path inside their greenhouse. You can lay stepping stones, pavers, treated wood or other materials that will support your weight and handle some moisture. Homesteader Harvey Ussery suggests installing worm bins beneath plywood lids that serve as a path (learn more at http://goo.gl/h3B7sS).

No matter how you customize this structure, it's sure to lead to plentiful harvests during what used to be your off-season.

## SIMPLE WAYS TO BOOST YOUR GREENHOUSE'S EFFECTIVENESS

**Cold, cloudy weather can hinder your winter growing efforts. These simple additions will improve conditions inside your greenhouse.**

*Insulation.* In many growing zones, the temperature inside this greenhouse will not stay above freezing all winter. By increasing the insulation, however, you can avoid freezing temperatures and grow more than just cold-hardy greens, brassicas and other winter crops. To do so, line the foundation with polystyrene insulation, or bury foam board insulation all around the perimeter to prevent the cold from infiltrating your interior sun-warmed dirt floor. For several ways to insulate solar greenhouse foundations and create a warmer growing environment, see http://goo.gl/N9nsX4.

*Thermal mass.* A material's ability to store heat is known as its "thermal mass." You can add thermal mass to your greenhouse by finding some large containers – inexpensive plastic barrels work well – and painting them black. Place the containers in a sunny location inside your greenhouse, and fill them with water. The containers will absorb and retain the sun's heat during the day, and slowly release that stored energy into the greenhouse at night (see photo this page).

*Additional layers.* On especially frigid nights, an effective way to shelter plants inside an unheated greenhouse is to add an extra layer of protection in the form of a row cover. Think of this as a greenhouse within a greenhouse. Lightweight row covers will retain a few extra degrees of warmth around your plants, while extra-heavy row covers will boost frost protection by as much as 8 degrees Fahrenheit.

*Reflective material.* If a lack of sunlight is your problem, you can paint the greenhouse's interior white, or line the walls with reflective material to intensify the light the structure does receive. The foil-backed insulation sold in rolls at home improvement centers will do the trick.

*Automated ventilation.* Our design requires that you open and close the storm-door windows daily to prevent the greenhouse from overheating. If you'd rather not bother with manual venting, you can look into automated, solar-powered vents before you begin building.

Banks of water-filled, black barrels absorb the sun's heat during the day and then release the stored energy at night inside Colorado College's solar greenhouse in Colorado Springs.

LEFT TO RIGHT; CERES GREENHOUSE SOLUTIONS; WWW.PENNANDCORDSGARDEN.COM

Medium Project

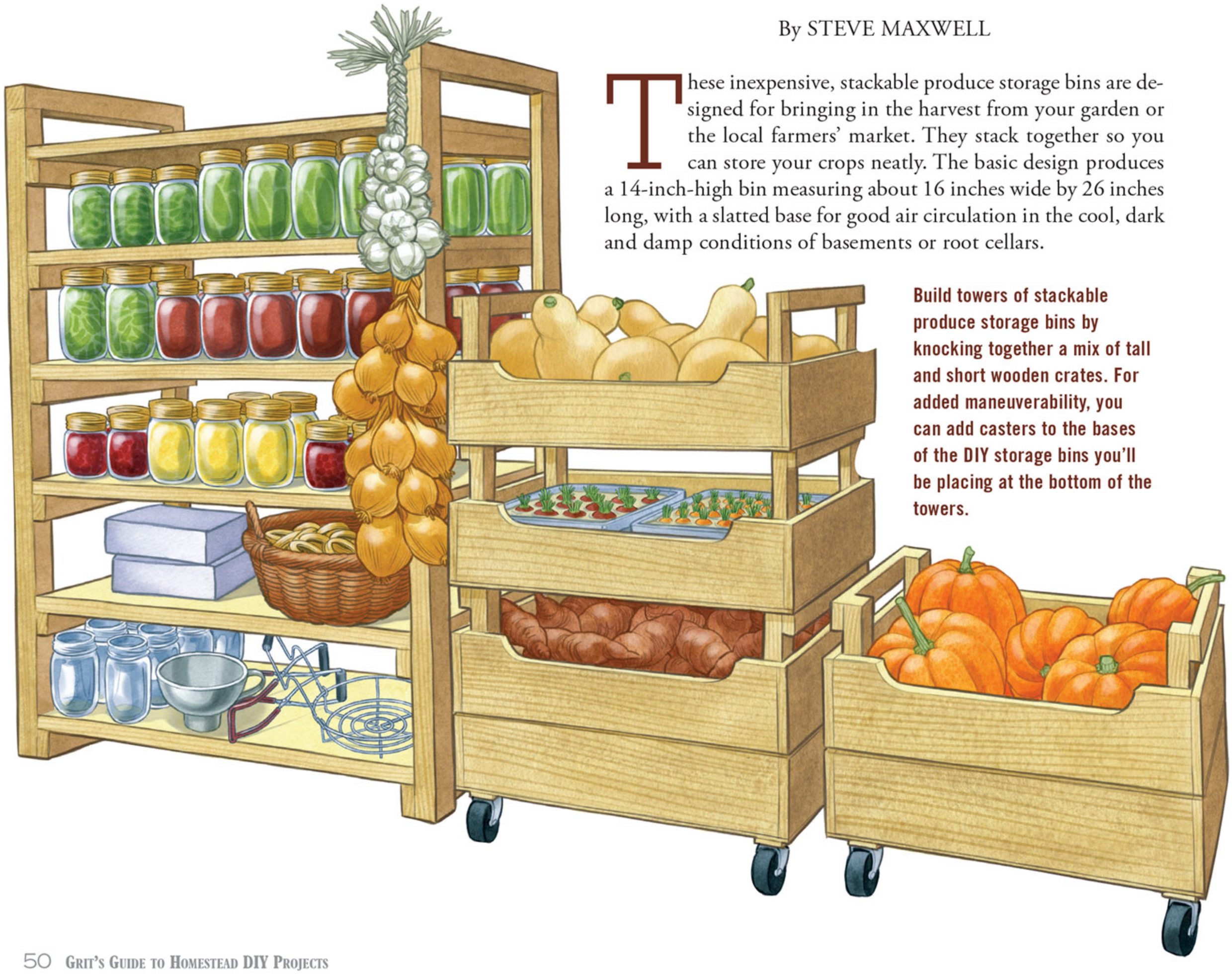
# DIY

# Produce Storage Bins

**Turn your pantry or basement into a portable storehouse with fresh crops stashed in these stackable produce bins.**

By STEVE MAXWELL

These inexpensive, stackable produce storage bins are designed for bringing in the harvest from your garden or the local farmers' market. They stack together so you can store your crops neatly. The basic design produces a 14-inch-high bin measuring about 16 inches wide by 26 inches long, with a slatted base for good air circulation in the cool, dark and damp conditions of basements or root cellars.



**Build towers of stackable produce storage bins by knocking together a mix of tall and short wooden crates. For added maneuverability, you can add casters to the bases of the DIY storage bins you'll be placing at the bottom of the towers.**

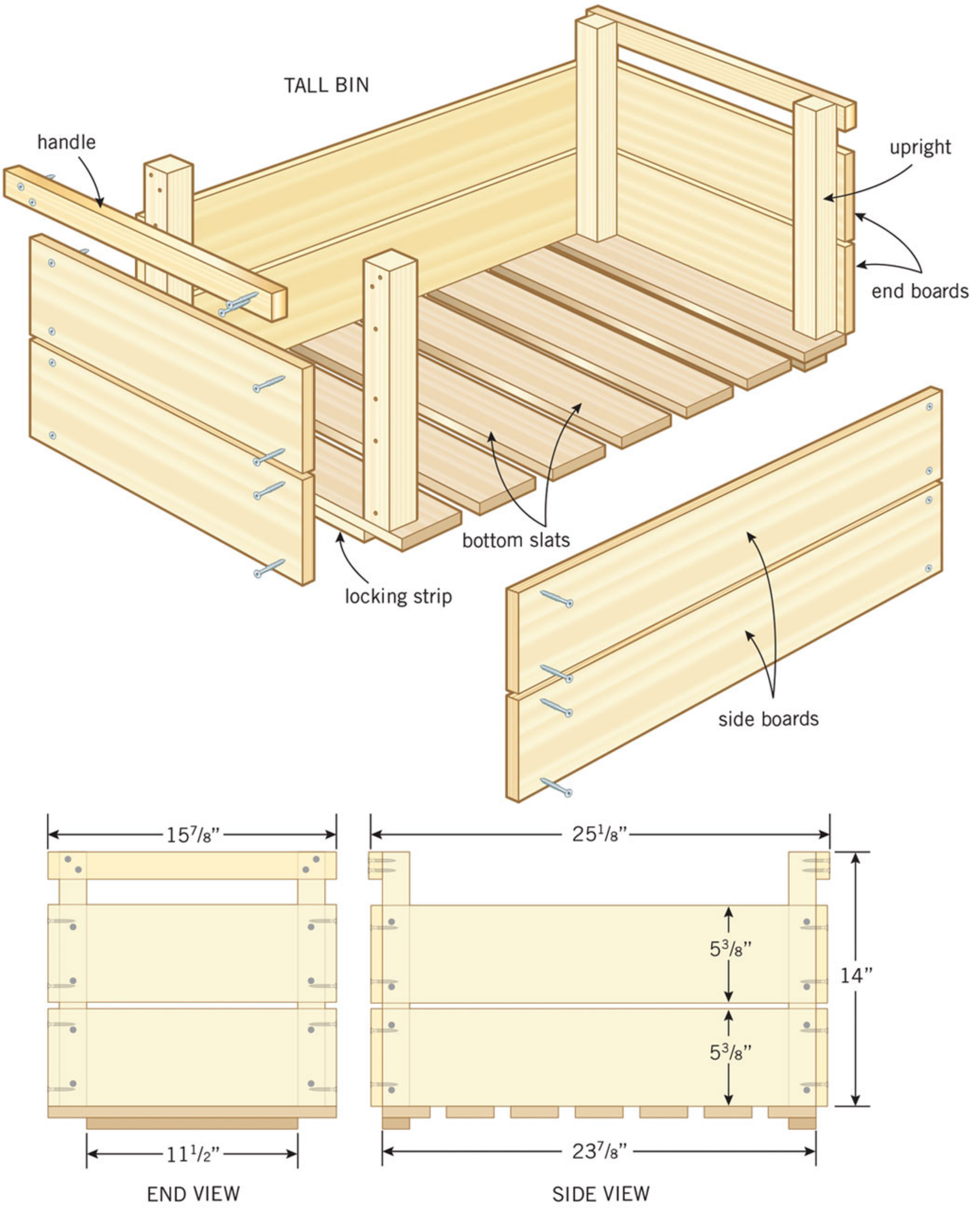
Also included are specifications for how to build a wooden crate that's shorter and more suitable for storing vegetables in a pantry or closet. Standing about 10 inches high, these bins are easier to move than the tall bins when fully loaded with produce. If you plan to use these DIY storage bins in your kitchen or pantry, you can opt to make them with solid plywood bottoms to prevent vegetables from dropping dirt as you carry bins of freshly harvested produce into your house.

Also, if you prefer a taller, all-in-one unit that's not stackable, check out the storage rack with pull-out shelves on Page 52.

## How to build a wooden crate

Simple tools, common materials, and basic building skills are all you need to make these produce storage bins. Lightness and strength are their standout features because they're made mostly of standard cedar fence boards. Stocked at every building supply outlet, such boards are lightweight, long lasting, and easy to work with.

Typically marketed as "three-quarters-inch thick," commercial cedar fence boards actually measure only ⅝ of an inch, which is perfect for this project. You can construct the uprights from 1½-inch square stock, and the handles from ¾-inch-thick hardwood.




**You can build tall produce storage bins by following these drawings closely, or build short bins by eliminating the upper side and end boards, and shortening the uprights.**

**Make your first cuts.** To begin, you'll need to cut all the side boards, end boards, slats, uprights and handles for as many pantry storage containers as you intend to build. The cutting lists on Page 52 provide measurements for individual pieces, as well as the total lumber needed for each size of crate. You can make them longer and wider if you prefer – just adjust the cutting list measurements.

Consider setting up a sawing assembly line in your home workshop to speed up the process. A stop block with a miter saw is one powerful way to cut all components to precise lengths. Prepare some kind of out-feed support or table, and clamp a block to the support so it will stop your wood at exactly the right point for crosscutting. Your setup time will be minimal, and you'll be happy with the results – fast, perfectly consistent cutting.

To create a pair of slats, simply cut standard 8-foot cedar fence boards into lengths of 15⅞ inches, and then rip them in half lengthwise. Each fence board will produce 12 slats.

LEFT TO RIGHT: KEITH WARD ILLUSTRATION; LEN CHURCHILL ILLUSTRATION (3)

## MATERIALS LIST

Use these lists to calculate how much material and hardware you'll need to build a collection of DIY storage bins. Note the lumber required for each bin type, and then follow the cutting list to trim all the pieces needed to assemble that bin.

Pay attention to the optional parts listed. The solid bottom panel could be installed on either bin instead of slats. Omit the locking strips if you install casters to create a rolling bin.

### Optional Parts

BOTH BINS:

- 1 bottom plywood panel, ¼" x 15⅞" x 25⅛"
- 4 swiveling casters with plate mounts, 3"

### Tall Bin (14 inches high)

SLAT BOTTOM

Total lumber and hardware required:

- 3 cedar fence boards, 8 feet long
- 1½" square stock, 57"
- ¾" x 1½" hardwood, 32"
- 40 No. 8 screws, 1¾"
- 18 No. 6 screws, 1½"

CUTTING LIST:

- 4 side boards, ⅝" x 5⅜" x 23⅞"
- 4 end boards, ⅝" x 5⅜" x 15⅞"
- 4 uprights, 1½" x 1½" x 14"
- 2 handles, ¾" x 1½" x 15⅞"
- 7 bottom slats, ⅝" x 2⅝" x 15⅞"
- 2 locking strips, ⅝" x 1½" x 11½"

### Short Bin (10 inches high)

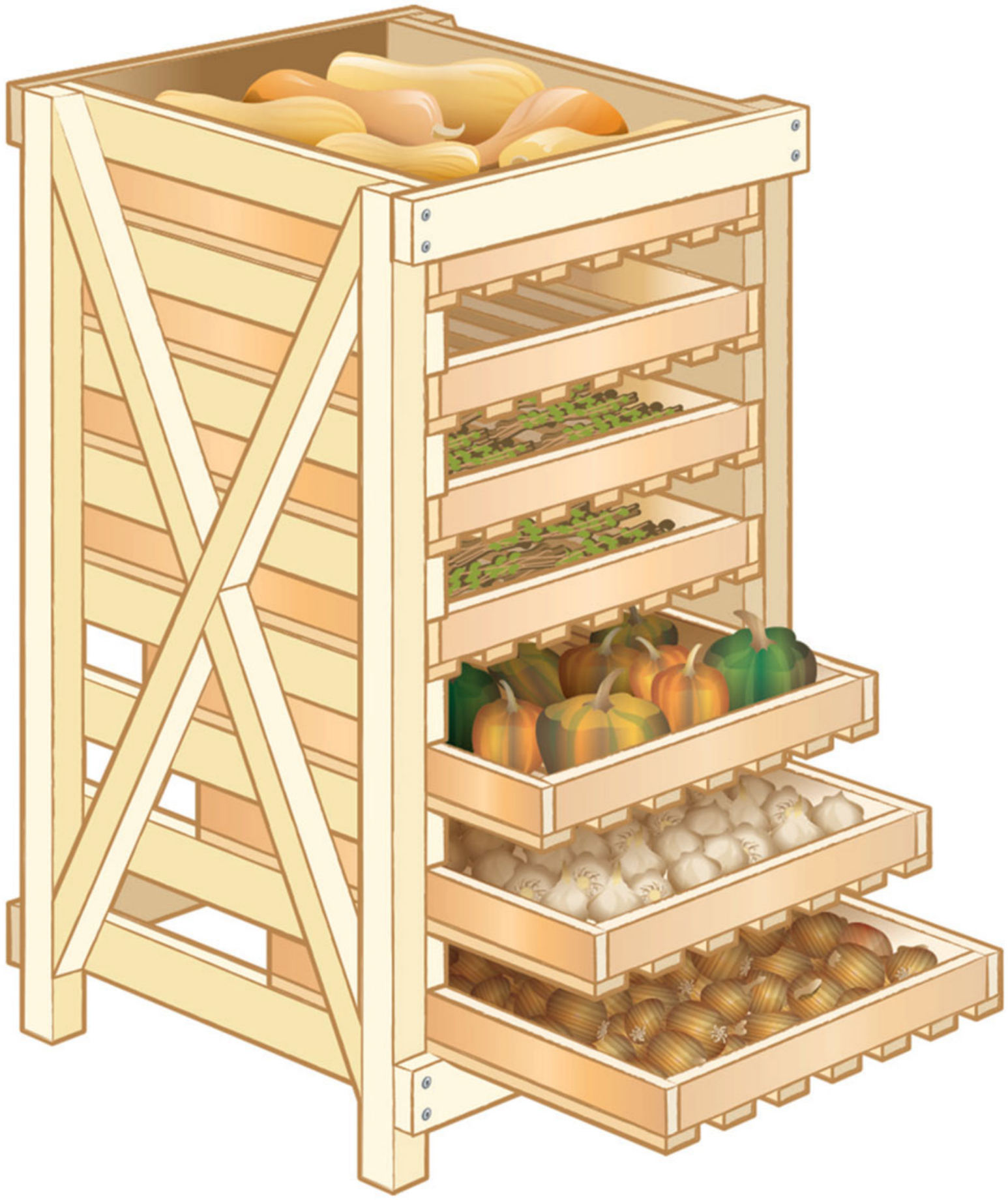
SLAT BOTTOM

Total lumber and hardware required:

- 2 cedar fence boards, 8 feet long
- 1½" square stock, 41"
- ¾" x 1½" hardwood, 32"
- 24 No. 8 screws, 1¾"
- 18 No. 6 screws, 1½"

CUTTING LIST:

- 2 side boards, ⅝" x 5⅜" x 23⅞"
- 2 end boards, ⅝" x 5⅜" x 15⅞"
- 4 uprights, 1½" x 1½" x 10"
- 2 handles, ¾" x 1½" x 15⅞"
- 7 bottom slats, ⅝" x 2⅝" x 15⅞"
- 2 locking strips, ⅝" x 1½" x 11½"



**Find directions for constructing this food storage rack made with pull-out shelves at http://bit.ly/1AUa8c0.**

You'll need seven slats to build a base for one slat-bottomed bin.

**Assemble the sides.** Although you could use a carpenter's square to ensure 90-degree corners when you assemble the sides of the bin, it's easier to use a sheet of plywood or wafer board with the original, uncut factory edges as a reference guide for creating a square assembly.

Place two of the uprights you've cut onto the sheet, aligning their bottom ends with one edge of the sheet, and positioning one of the uprights in a corner. Fasten a side piece cut from a cedar fence board across the top of the uprights with weatherproof wood glue and 1¾-inch No. 8 deck screws driven into pre-drilled holes. If you're building the taller crate, fasten a second board on the uprights next to the first one, with a ⅜-inch ventilation gap between them. Repeat the process to assemble the second side.

You don't need to wait for the glue to dry to complete the box. Stand both side assemblies upright on one end on a flat floor, and connect them with a single cedar end board secured with No. 8 screws and glue. Carefully flip this assembly, then add an end board to the opposite side of the crate. You'll

need to add a second board to both ends if you're building the tall bin.

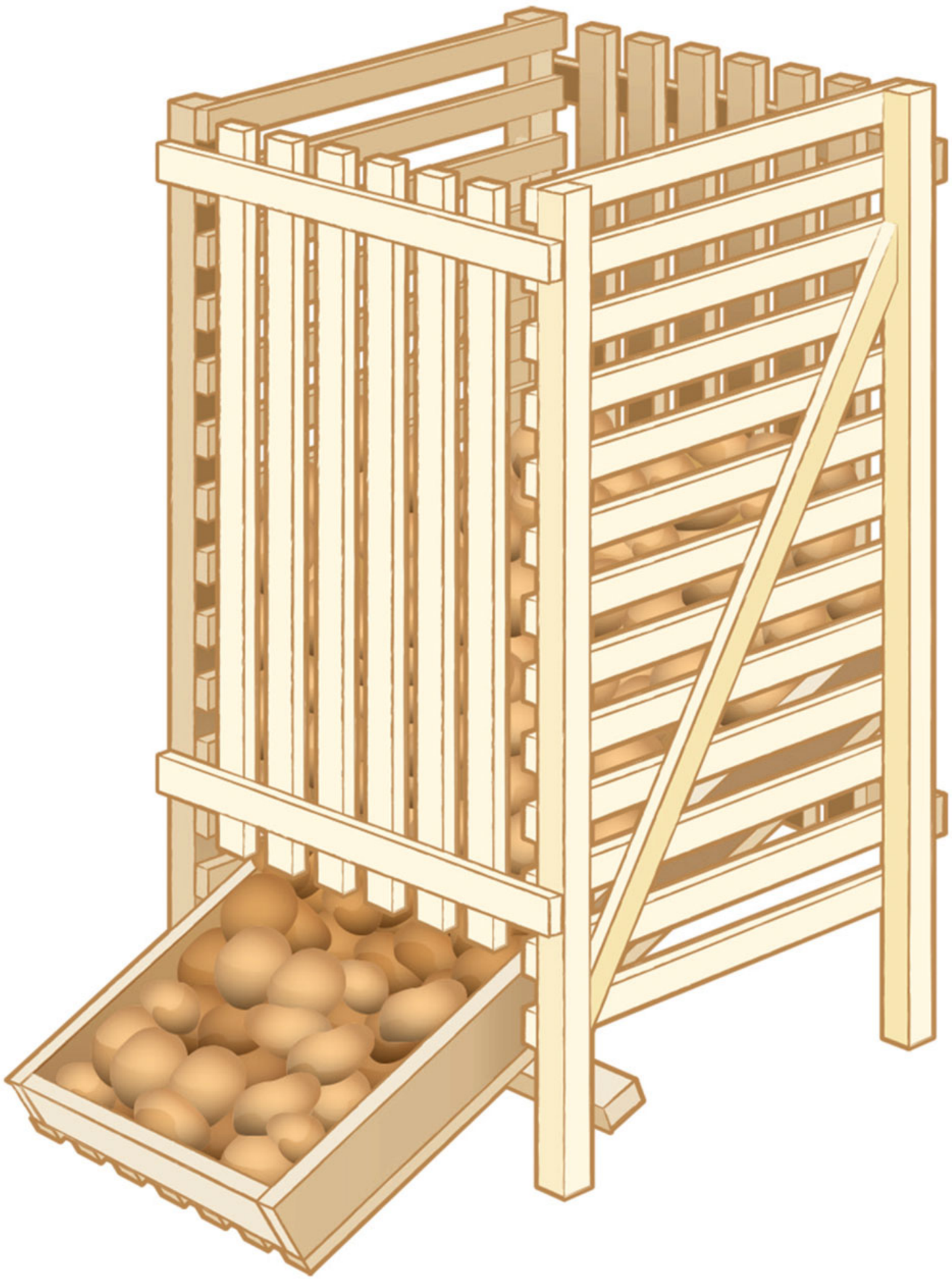
## Slatted or solid bottom?

The next step, no matter which height of container you're knocking together, is to install the bottom. These plans allow you to choose between two different styles of base: solid or slatted.

• **Solid bottom.** To install continuous wooden bottoms on your DIY storage bins, simply flip them upside down and secure a ¼-inch plywood base measuring 15⅞ inches by 25⅛ inches with glue and finishing nails. If you'd like the bottom to be replaceable, use 1½-inch No. 6 screws instead.

To make a rolling crate, skip the locking strips (described below) and screw the plate mounts of swiveling dolly casters to the corners of the base, but remember that this wheeled crate will always have to be placed at the bottom of a tower.

• **Slatted bottom.** A slatted base will provide better air circulation, which is helpful for most stored crops. Turn your crate upside down and lay out seven cedar slats, evenly spaced across the base. Fasten each slat to the bottom edges of the side boards with glue and 1½-inch No. 6 screws driven into 3⁄32-inch predrilled pilot holes.



Build this potato storage bin by modifying the plans found at http://bit.ly/1AUa8cO.

## How to make these produce storage bins stackable

**Locking strips.** Complete the bottoms of both the tall and short bins by adding two 1½-inch-by-11½-inch locking strips onto the base at the ends (see construction drawing on Page 51). When you stack your pantry storage containers, the locking strips will nest between the uprights of the crate below to create a secure tower. You can cut the locking strips from leftover cedar fence board. Use two No. 6 screws per locking strip.

**Handles.** Add the hardwood handles to the top of the crate's short ends by pre-drilling holes for two 1¾-inch No. 8 screws in both the handle and upright pieces, then fastening the handles to the uprights with glue and screws. Because the short bin is shallower and lighter, you could use 2-inch-wide pieces of cedar fence boards for the handles instead of the hardwood, if preferred.

Don't bother applying wax, varnish or shellac to finish these produce storage bins. Finishes would be difficult to apply due to the rough surface of the cedar, and even nontoxic options, such as boiled linseed oil, could affect the smell and taste of your produce. You don't want anything to taint the great meals that will be made from homegrown food stowed in wooden storage crates of your own making.

**Important Note:** Pre-drill all the holes to prevent splitting when you drive the screws.

LEN CHURCHILL ILLUSTRATION (2)

Medium Project

# The Ultimate DIY Backyard Chicken Tractor

## Let your chickens forage on fresh ground every day.

Article and photographs by ELIZABETH WILLIAMS

In a perfect world, our chickens would be able to free-range all of the time, eating grass, bugs and seeds to their hearts' content. Unfortunately, chickens are rather low on the food chain and prove easy targets for any number of predators. After losing a few of my birds to some foxes, I knew it was time to consider an enclosure for them.

I wanted an easy-to-build, inexpensive portable pen that would keep them safe from predators. It would need a nest box, roost, and a place to hang a feeder while providing them shade and protection from the elements. It would also need easy access in order to feed, water and collect eggs, and be easily movable for one person. I also wanted to be able to break it down for winter storage.

After piecing all of these requirements together, the resulting chicken tractor I constructed is based on a series of six panels and a nest box. The panels are connected with loose pin hinges for quick assembly and disassembly.

Give your flock room to range while keeping them safe from predators. This chicken coop is light enough for one person to move easily by herself. The nest box on the back allows for easy access for collecting eggs.

## Instructions

Gather and cut all wood according to the materials list.

## TOOLS

- Tape measure
- Wire cutters
- Table saw or Skilsaw
- Radial arm saw, jigsaw, or crosscut hand saw
- Screw gun with Phillips bit
- 6-inch speed square

## BINDERS & HARDWARE

- Exterior wood glue
- ¾-inch drywall screws – 1 pound
- 1-inch drywall screws – 1 pound
- 1¼-inch drywall screws – 2 pounds
- 2-inch drywall screws – 4
- 3-inch drywall screws – 4
- Exterior paint and primer
- 1 set of 2-inch hinges
- 1 hook and eye latch
- 9 sets of 3-inch loose pin hinges


Constructing a corner jig ensures that all frame pieces will end up square, and it can also help with construction of the J gussets.

### MATERIALS: JIG

(J1) 4-by-6-inch piece ½-inch plywood – 3
(J2) 1-by-4-by-6-inch plywood – 3

Make the corner and side assembly jigs. For the corner jig, take two (J2) pieces and hold ends to form a 90-degree angle. Fasten with glue and 1-inch screws. Next, attach two (J1) pieces so plywood extends ½ inch beyond bottom edge of the 1-by-4-inch panel (photo top right).

For the side jig, take one (J1) piece and one (J2) piece. Fasten the two pieces together with glue and 1-inch screws so one edge is flush with ends and the plywood extends ½ inch beyond the opposite edge of 1-by-4.

Exterior of a side panel, ready for paint. Note that the design accounts for shade and protection from harsh elements as well as fresh air and ventilation.

### MATERIALS: BODY

(A) 1-by-4-by-94½-inch side panel top and bottom rails – 4
(B) 1-by-4-by-29-inch side and end panel stiles – 10
(C) 1-by-4-by-45-inch end panel top and bottom rails – 4
(D) 1-by-4-by-38-inch end panel middle rails; roof panel stiles – 6
(E) 1-by-4-by-12-inch door panel – 2
(F) 1-by-4-by-46¼-inch roof panel rails – 4
(G) 1-by-4-by-48-inch roof panel overlap – 1
(H) 36-by-48-inch piece ¼-inch lauan side panel skins – 2
(I) 3-by-6-inch piece ½-inch plywood door panel gussets – 10
(J) 7-by-7-inch piece ½-inch plywood cut in half diagonally; triangle gussets – 20
(K) 6¼-by-6¼-inch piece ½-inch plywood; nest box panel bottom gussets – 2
(L) 6-by-9⅜-inch piece ½-inch plywood; nest box panel top gussets – 2
(M) ¼-by-1½-by-46½-inch side panel strips (from 2-by-4) – 4
(N) ¼-by-1½-by-33-inch side panel and door panel strips – 4
(O) 48-by-48-inch piece ¼-inch lauan; roof panel skins – 2
(P) 36-by-48-inch piece ¼-inch hardware cloth; side panels – 2
(Q) 36-by-45-inch piece ¼-inch hardware cloth; door panel – 1
(R) 9⅜-by-38-inch piece ¾-inch plywood; door panel, top filler – 1

The nest box frame and the nest boxes themselves are designed so that a person can collect eggs and access the nest boxes for cleaning without entering the chicken tractor.

Outside of door panel (not shown in illustration on Page 58): Two (S) pieces are at the top of the door frame, and two vertical (N) pieces on the sides.

(S) ¼-by-1½-by-45-inch strips; door panel top and bottom – 2

(T) 12-by-12-inch piece ¾-inch plywood; door – 1

## SIDES

Build side panels. Use wood glue and 1-inch screws for all frames unless otherwise noted.

Lay two (A) pieces on the ground, parallel to each other and 30 inches apart. Place one (B) piece at each end, between (A) pieces, forming a rectangle. Using the corner jig, square up one corner of the panel. Position a gusset (J) in the corner. Attach (J) gusset with glue and 1-inch screws. Repeat for the three remaining corners.

Measure 47¼ inches from the ends of top and bottom rails to find center, and place another (B) piece in the middle of the rectangle. Using the side jig, position (J) gusset, then attach it. Repeat for the opposite end.

Flip the frame over so that it rests on the gussets. Position one (H) piece so that one end is flush with the right end of the frame, and the other end rests on the middle (B) with the top and bottom flush with the frame. Check for proper fit, remove the plywood, and apply glue to the frame, stopping 4 inches from the center. Reposition plywood, and screw to the frame with ¾-inch screws, stopping 4 inches from center. That's one side panel ready to paint. Repeat for the other side.

## END PANELS

Build the nest box end panel and door end panel. Using two (C) pieces for the top and bottom, two (B) pieces for the sides, two (L) gussets for the top, and two (K) gussets for the bottom (using the corner jig), make a frame. Add (D) piece to the bottom, just above the (C) bottom rail so that it fits flush with the top of the (K) gussets. Add another (R) piece just below the (C) top rail, again flush with the gusset (top photo).

To make the door end panel, use two (C) pieces for the top and bottom rails, two (B) pieces for the sides, and four (I) gussets. Next, place one (D) piece near the bottom of the panel, parallel to the (C) bottom rail, leaving 12 inches between the top of the bottom rail and the bottom of (D) piece.

Use two (I) gussets on either side of (D) piece. Place two (E) pieces be-

Wheel assembly orientation of the wheel handles and stop blocks can be done one of two ways, see photos Page 54 and 59.

The end blocks of the dowel handle will be attached from the inside with 3-inch screws, and you can position the handle to accommodate varying heights, whatever is most comfortable.

Stout branches make solid roosts for your birds, and can be easily attached to the mesh with washers and screws.

tween the (C) bottom rail and the (D) piece, perpendicular to (C). Use one (I) gusset on each end of each (E) piece.

You will have a 12-by-12-inch hole left for the door opening.

### ROOF PANELS

Build two roof panels separately. Using two (F) pieces, two (D) pieces, and four (J) gussets, make a frame measuring 46¼-by-45 inches. Position one (O) piece on top of panel, leaving a ¼-inch overhang on all sides. Attach with glue and ¾-inch screws. Repeat for second roof panel. These panels are held together by (G).

### MATERIALS: NEST BOX

(N1) 12-by-12-inch (rear) and 12-by-15-inch (front) pieces ¾-inch plywood; ends and dividers – 4

(N2) 12-by-37¾-inch ¼-inch lauan; bottom and back – 2

(N3) 3-by-37¾-inch piece ¾-inch plywood; top strip – 1

(N4) 11-by-37¾-inch piece ¾-inch plywood; top panel – 1

(N5) 3-by-37¾-inch piece ½-inch plywood; kick plate – 1

(N6) 1-by-2-by-36¼-inch batten – 1

(N7) ⅗-by-1-by-37¾-inch scrap wood; bottom stop block – 1

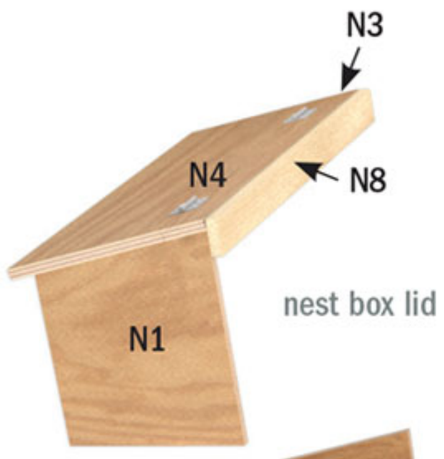
(N8) ¾-by-2½-by-37¾-inch scrap wood; cleat – 1

To build the nest box, the ¾-inch plywood end pieces are 12-by-15 inches in front and 12-by-37¾ inches in the rear. Attach the (N2) bottom to the end (N1) pieces. Attach the back (N2) to the end pieces. Position (N6) in inside bottom rear corner and attach back and bottom to it. Attach (N5) to the bottom front. Attach (N8) at the top front, leaving 1½ inches sticking up above the top of the end pieces. Place (N3) across the slanted top so that it touches (N8), and attach. Place (N4) just below (N3) and install hinges. Attach (N7) to the bottom of the nest box 1½ inches from the front edge. Install two (N1) dividers at equal distances from the ends to make three nest boxes. Notch the corners to fit over the batten.

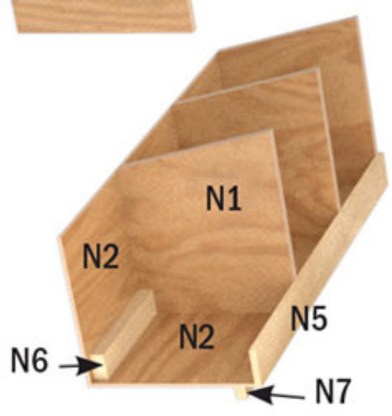
## Putting it all together

Paint all pieces with primer. When dry, apply a coat or two of exterior latex paint.

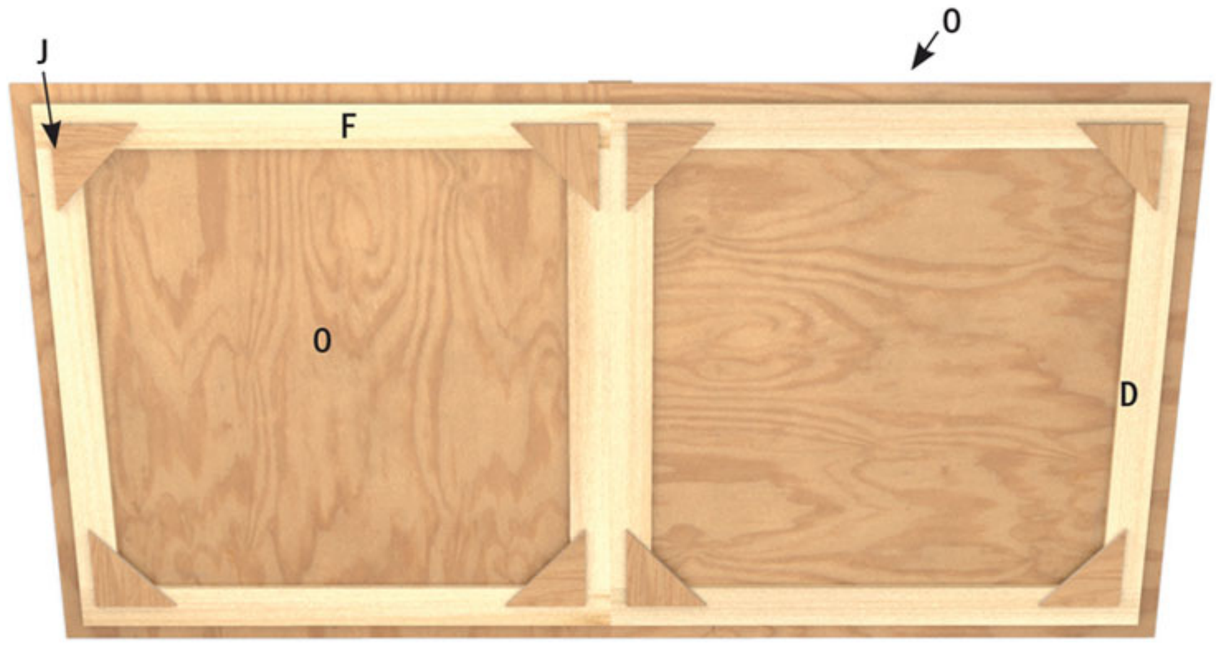
Install hardware cloth. Lay one side panel flat, gussets down, so the wood skin is to your left. Lay hardware cloth (P) over right side of the



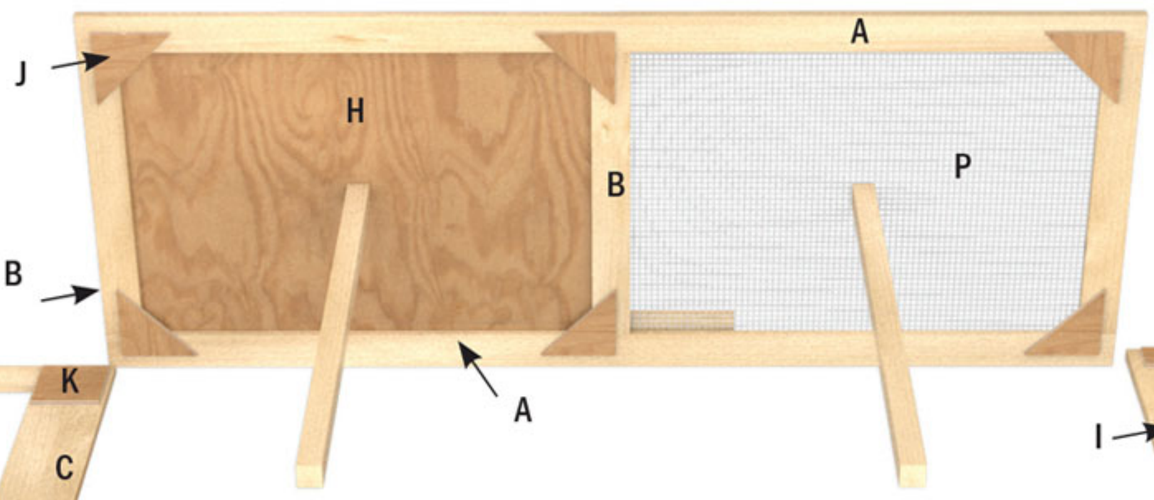

nest box lid




nest box attachment

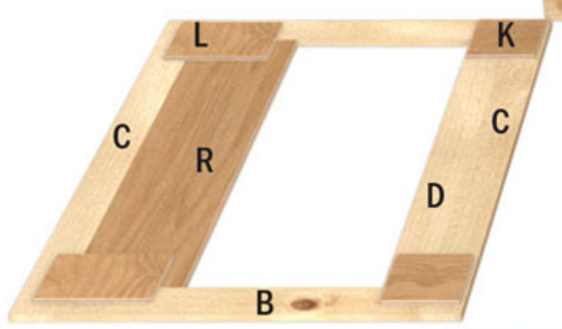



top/roof panel

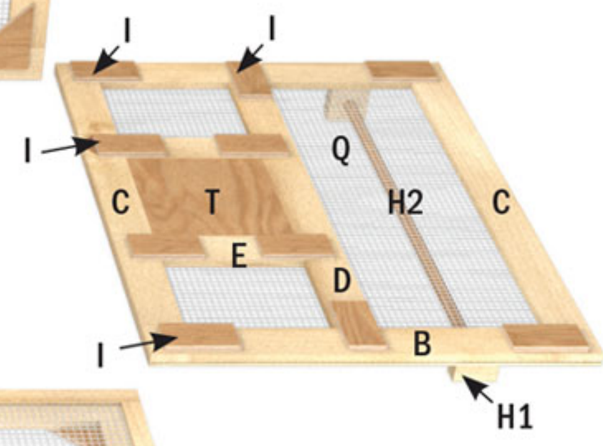



side panel

roost attachments




nest box panel




door panel with handle


panel so it is flush with frame edges. Tuck the end of the wire under the edge of (H) on center piece (B), and screw the edge of (H) down with ¾-inch screws.

Place one (M) strip on the top of the panel and another (M) strip on the bottom of the panel.

Using 1-inch screws, attach strips to the panel, sandwiching the wire between the frame and the strip. Attach one strip (N) to the end of the panel, same as above. Repeat for second side panel (see above).

Lay the door panel flat, gussets down. Lay (Q) hardware cloth on top so it is flush with the edges of the panel. Attach (S) top strip, sandwiching the wire as above. Cut out a 13-by-13-inch square for the door.

Attach bottom (S) strip and (N) side strips. Staple door opening to frame (photo Page 59). Attach (T) door to the door frame with 2-inch hinges. Install hook and eye latch.

## MATERIALS: WHEEL ASSEMBLY

(W1) 6-inch lawn mower wheels – 2
(W2) 1-by-4-by-24-inch handles – 2
(W3) 2-by-4-by-3½-inch stop blocks – 2
(W4) ½-inch nyloc nuts – 4
(W5) ½-inch bolts – 4
(W6) ½-inch washers – 14
(W7) ⅝-inch nuts for spacers – 2

Attach the wheel assembly. (*Editor's Note: Orientation as shown in the illustration is recommended, although orientation as shown in photos – with handles W2 facing rear – also works. Note photo on Page 59 compared to Page 54.*)

Place one (W2) flat horizontally. Make a mark 1 inch from the top edge and 2 inches from the left end. This is for the axle. Make a second mark 1 inch from the bottom edge and 3½ inches from the left end. Drill a ½-inch hole through the handle at each mark. Place a third mark on the bottom of side panel 36¾ inches from the nest box end and 2½ inches from the bottom edge. Drill a ½-inch hole at your mark. Flip the handle up on edge so that the axle hole is on top.

Place one washer on a ½-inch bolt, and insert bolt through the hole from the back of the handle. Place another washer on the bolt from the front of the handle, followed by a spacer nut. Place the wheel on the axle bolt, another washer, and a nyloc nut. Tighten.

Place a ½-inch washer on a bolt. Insert the bolt through the second hole on

the handle, this time from the front. Place a washer on the bolt, then a ⅝-inch spacer nut, then another washer. Insert the bolt through the hole in the tractor. Place a washer on the bolt, followed by a nyloc nut and tighten.

Flip the handle so that the top of it faces the rear of the tractor. Attach one (W3) stop block at the bottom edge of the tractor.

The exact placement will be 21½ inches from the nest box end of the tractor and 2½ inches from the bottom edge. The block will be at an angle to match that of the handle at the point at which the wheel just touches the ground.

Use 2-inch screws and glue. Repeat the above steps for the opposite side of the tractor. This assembly will be a mirror image of the first one.

Assemble the tractor. The end panels must fit inside the side panels, and all gussets should face toward the inside of the tractor. Position door end panel inside the hardware cloth end of side panels. Install the hinges 3 inches from the top and 3 inches from the bottom. Repeat for the remaining corners.

Install nest box by sliding it in at an angle, top first, followed by the bottom. Level it until the top cleat and the bottom stop block hit the panel.

## MATERIALS: HANDLE

(H1) 2-by-4-inch end blocks – 2
(H2) 1-inch dowel – 1

Install the handle on the door panel at a height that is comfortable for whomever will be moving the tractor. Pre-drill two ¾-by-½-inch screw holes in each block, and a 1-inch hole, centered in the side of each block, for the dowel.

Place the end of one (H1) block against the panel in the desired position, then screw it from the inside using two 3-inch screws. Slide the (H2) dowel into the holes in both blocks. Place the end of the second (H1) block in position and screw from the inside with two 3-inch screws (photo top right on Page 57).

Place the roof panels side by side on top of the tractor. The frames of the panels should fit inside the tractor so that the roof panels fit tightly against the sides. Reinforce two panels together with piece (G) on top of roof panels.

Install the roosts. Cut two 46½-inch branches (between 2- and 4-inch diameter). Install branches in desired locations using one 2-inch screw and two washers on each end (photo on Page 57).

If you do not have access to branches, 2-by-2-inch lumber will also work. Cut one 44-inch branch and install it just below the roof in the center of the tractor to hang the feeder from.

Your chicken tractor is now ready to roll! It should accommodate six chickens, or 10 Bantams. Keep them on fresh ground for best results.

Medium Project

# CREATE Tools That Help

**Readers of FARM SHOW offer advice for projects such as a pothole patcher, duo compost tumblers, and a firewood rack using pallets.**

From our friends at FARM SHOW®

## Chisel plow turned pothole patcher

Anyone who can weld can turn the frame of an unused chisel plow into a useful heavy-duty "pothole patcher," says Perry Easley, owner of Easley Welding, Kirksville, Missouri.

He uses the 10-foot-wide pothole patcher on his Kubota skid loader to smooth out gravel driveways.

He removed all the shanks, leaving a rectangular frame. Then he cut 120 4-by-1½-inch rectangular "teeth" out of ¼-inch-thick steel plate. They mount horizontally on the crossbars, spaced about 6 inches apart and staggered between bars. To mount the unit on his skid loader, he made a cardboard pattern and then welded three lengths of 2-by-4 steel tubing at an angle running from the frame to a mounting plate that's equipped with quick-attach brackets.

"It does a good job of loosening the surface and smoothing out any clods and rocks," says Easley. "One time I used it at a local tractor pull where they fell in love with it. When the tractors spin their tires, they pile up a lot of dirt, but my pothole patcher did a great job of dragging the dirt back into the holes.

"On gravel roads it rattles around some, but it does a good job of loosening the gravel and filling in the potholes. After a pass or two, it looks like I've put new gravel on the entire driveway."

From chisel plow frame to pothole patcher for the skid-steer.

For more information on the project, contact Perry Easley and Easley Welding at 660-626-3730.

## Double-barreled composter

Warren Dick is a super active gardener who needs a lot of compost for the huge gardens around his home. "It didn't make sense for me to haul in several

Fast-working double compost barrels are easy to fill, turn and empty.

truck or trailer loads a year, so I built a double-barreled composter to make compost faster," says Dick, who runs a bed and breakfast with his wife, Verna, on Vancouver Island in Canada.

Dick used scrap lumber, two 50-gallon plastic barrels, and a 1-inch-diameter stainless-steel rod. "I used stainless because I knew that compost could be corrosive to rolled steel. In the two years I've used the composter, there isn't any corrosion on the bar at all."

Dick's double barrel setup is mounted about a foot off the ground on a rectangular frame. The verticals are 4-by-4 wood posts stabilized by 2-by-4 diagonal braces on the bottom.

The braces and posts on each side rest in 4-foot-long pieces of channel iron that provide plenty of stability. A 2-by-4-inch cross brace extends across the top with corner gussets to prevent side sway.

Mounting the barrels was simple. Dick drilled 1-inch holes on the sides of each barrel and through the center of the posts about 30 inches off the ground. The stainless bar holds the barrels upright, and spacers on both sides and between the barrels keep them from sliding or wedging when they're turned.

"The compost barrels are easy to fill, easy to turn, and easy to empty," says Dick, who turns the barrels twice a week. It takes five to six weeks to finish each batch.

For more information from Warren, send an email to *beachsidegarden_bb@shaw.ca*.

## Labor-saving firewood system

"My pallet-based firewood system was inspired by other firewood pallets I've seen in FARM SHOW. Some of them were quite fancy, but I made mine on the cheap," says Dennis Strahle, Eagle, Michigan.

The firewood pallets he builds are closed at one end and open at the other. A home-built, 3-point-mounted fork is used to move them around.

He uses four pallets – one for the bottom and three for the sides.

The sides are wired to each other at the top and bottom corners, and also to the bottom pallet. A single wire strand extends across the top at the open end to keep the sides from springing out too far.

"I use electric fence wire because it's tough, yet easy to handle," says Strahle. "It takes a little practice to wire the pallets securely."

For more info, contact Dennis at *dendiesel66@gmail.com*.

*Reprinted with permission from FARM SHOW Magazine, www.farmshow.com.*

**Using wood pallets and fence wire creates an easy-to-make system to contain firewood.**

Medium Project

# Build With WOOD

## Use upcycled free materials to create one-of-a-kind projects.

By CHRIS GLEASON

Author and craftsman Chris Gleason uses sound woodworking techniques and trendy designs in his crafts. In this excerpt from his *Wood Pallet Projects*, learn how to scavenge for wood pallets and make things that you can incorporate inside and outside your home.

### How to be an effective scavenger

Pallets offer a great opportunity to obtain free materials for little or no money, and this fact alone makes them worth considering as a resource. However, not all pallets are created equal or are suitable for your project. Here are my tricks of the pallet-scavenging trade.

#### 1. PERMISSION: ALWAYS GET IT

It's the golden rule of scavenging pallets: Always ask permission first. Many businesses that use pallets actually recycle them. They may use the pallets repeatedly, or the supplier might pick up the pallets and reimburse the business for returning them. So before you help yourself to what you think may be free, remember that if you don't

# PALLETS

have permission, it could be viewed as theft. Just ask. Some businesses will be delighted to have you take extra pallets off their hands.

## 2. SAFETY: KNOW WHICH PALLETS TO USE AND WHICH TO AVOID

Most pallets are perfectly fine to work with, but some aren't. Chances are that the pallet you're working with is safe, but what if it was treated with some kind of chemical earlier in its life? I've also been emailed a story in which someone got a nasty sliver from a pallet that introduced infection, requiring hospitalization.

So, just be picky. Always wear gloves and choose wisely. When in doubt, leave it out. But how can you tell?

Fortunately, it is straightforward. Common sense is your best starting point. Skip any that:

- Are unusually heavy
- Are wet
- Appear greasy
- Have stains
- Smell
- Display too many twisted nails
- Otherwise look unsavory

Beyond that, what else can you look for? Many pallets are stamped "HT" for heat-treated, a good sign that the pallet is newer and was kiln-dried to remove moisture, which could otherwise turn into a problem.

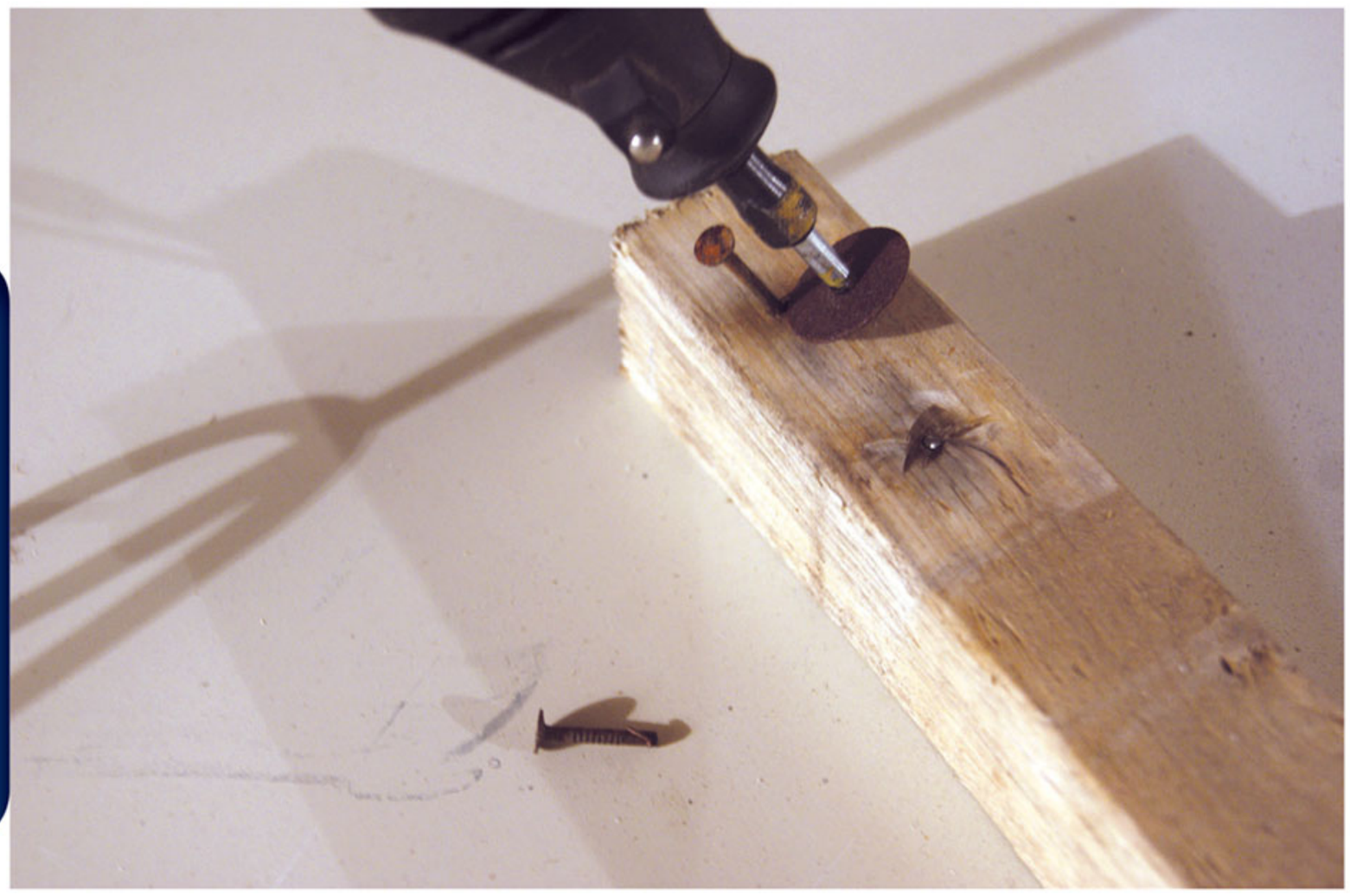
Remember, if a pallet isn't dry, it'll be a pain to work with, and it could harbor bacteria, so give it a pass.

Some pallets are even stamped with a website or a toll-free phone number that lets you know about the pallet's origins. You probably don't need to get on the phone or fire up a web browser: The mere presence of an indicator

Unruly stacks may hold treasures to create great projects. Always ask permission first before you delve into a stack. The business may recycle, reuse or be reimbursed for the pallets.


Pedigree stamps are a good sign, often indicating that a responsible company has produced the pallet to be as safe as possible.

CLOCKWISE FROM LEFT: JOANN BILLIGMEIER; COURTESY FOX CHAPEL PUBLISHING (2)



Manufacturers like spiral-cut nails, but pallet scavengers could do without them. A rotary tool equipped with a metal-cutting disc is a fast and easy way to cut the nails flush.

like this is a good sign that the pallet was produced as carefully as possible. These pallets are probably good candidates for your projects, provided they meet your other basic criteria (i.e., clean, dry, good condition, etc.).

### 3. BEWARE BACTERIA

Even if a pallet was clean, dry and safe on the day it was manufactured, it could have been exposed to undesirable bacteria sometime during its lifetime. To play it safe, scrub the wood with bleach and soapy water. Rinse well, and allow to completely dry. Remember, wood is porous, so there's a chance the bacteria is embedded. Don't use pallet wood for food-related items, children's toys, or children's play furniture. It just isn't worth the risk.

### 4. SUITABILITY: IS IT A GOOD MATCH FOR YOUR PROJECT?

The key to working with pallets is strategy. Having wood pallet project ideas will guide your assessment. The first question is, does this pallet merit a second glance or should I move on? If it looks promising, you'll want to ascertain the following.

- Is it safe?
- Are there any especially appealing boards (due to species, interesting character, or useful dimensions)?
- How much usable material does it contain?
- How easy will it be to disassemble? For example, softwood runners are easier to get nails out of than hardwood ones. With a little practice, you'll be able to see the difference at a glance.

The answers to these questions, in aggregate, will determine which pallets are worth your time and effort. Sometimes I will only take one board from a pallet, as I don't have infinite time and energy to spend on tasks that only offer a marginal yield. Is this the optimal level of upcycling? Maybe not, but I don't try to take on the responsibility of reusing every piece of material in all of the world's pallets; once you view the situation through this lens, it is easy to see that even partial reuse is certainly better than none at all. In other cases, I can use the whole thing.

When it comes to pallet disassembly, a methodical approach pays off. Take a minute to decide which parts of the pallet are the most important to you. You may not have a premium use for all of the wood, due to damaged pieces, odd sizes, or the presence of way too many nails in a given spot.

## Pallet sizing

Wood pallets come in all shapes and sizes, and depending on where you live, you will encounter pallets of many different dimensions. In North America, for example, some common pallet sizes include 48-by-48 inches, 48-by-20 inches, and 36-by-36 inches. The great thing about pallets, however, is it doesn't matter what shape or size they come in, as long as you can harvest wood of the dimensions you need from them. All the others can be made from wood harvested from pallets and cut to size.

**CHECK A PALLET FOR SYMBOLS:**

| LABEL | MEANING |
|---|---|
| HT | Heat-treated |
| KD | Kiln Dried |
| MB | Methyl bromide treated |
| DB | Debarked |
| S-P-F | Contains spruce, pine, or fir components |

## Dealing with nails

Pallets are usually built with nails, because it is a low-tech but strong approach. If you take a close look, you'll see that many of the nails are spiral-shaped; this is because their unique shape helps them resist backing out and allowing the boards to loosen over time. Spiral nails are good for constructing pallets, but can create a challenge for someone who is actually trying to remove the nails to get at usable lumber. My standard approach is to pull the nails using a crowbar or similar tool if it isn't too time-consuming, and to leave them in when removal isn't feasible. This latter approach usually means cutting around the nail-infested areas and harvesting shorter, but still useful, lengths.

Occasionally, I'll have nails that refuse to budge from a piece of wood that I still really want to use: In cases like this, I cut the nails back as far as possible using a hand-held rotary grinder, angle grinder or pliers. I then use a belt sander to ensure the nail heads are flush to the surface. This approach is neat because the polished nail heads gleam nicely and recall the wood's origins as a humble pallet.

Learn to recognize the inherent limits of some pallets. Occasionally, I'll come across a pallet that features

really pretty wood, but the nails are just torture to remove. In this case, cutting out the largest nail-free sections of wood possible is the best decision. It may mean settling for shorter lengths of wood than you'd ideally like, but it will allow you to work safely with the material.

If you need larger pieces, find a pallet that will allow you to harvest them more easily, and save the short pieces for another day. You'll eventually find a project that they're better suited for. It is also worth noting that changing your design and/or construction techniques might allow you to use the shorter pieces right away, too.

Sometimes the nails themselves aren't the only problem: Boards are sometimes prone to splitting in the areas where nails have been inserted, especially if the nails are close to the end of the board. In this case, I usually just cut off the cracked portion so I have a clean end to start with. If cutting off the end isn't an option – i.e., you really need the extra length for a given project – you might be able to force glue into the crack and clamp it shut.

While this method isn't guaranteed to work, it can be worth a try, and it doesn't take very long, so you're not out a lot of time and energy if the crack reopens.

The good thing about nails in pallets is that they are placed fairly predictably: You won't generally find random nails occurring in random places. Manufacturers have no incentive to place nails at irregular intervals. So, if you got all of the nails out of the obvious places, you can generally feel fine about sending a board through a planer, jointer or table saw.

Don't be afraid to move things around when you're working with pallets; use the floor, a workbench, or whatever else works. Finer tasks like pulling nails are often most easily accomplished on a bench, whereas larger-scale tasks like tearing apart pallets will probably occur with the pallet on the ground. Jump right in, and you'll get a feel for it in about five minutes.

A simple yet charming project, this movable table can fit anywhere you need it – even outdoors.

For an accent wall like this one, you may need up to 25 pallets. Construction adhesive and a nail gun attached the pallets, and the TV is anchored to a wall stud.

## Wood pallet project ideas

### ▪ EASILY MOVABLE TABLE

It doesn't get much simpler than this, but the result is still utterly charming. Bolt a set of large casters (they look to be about 4 inches in diameter to me) to the bottom of a pallet, and you've got an instant, low-to-the ground, easily movable table. The rough, weathered quality of the wood on this pallet makes it ideally suited for outdoor use. It could be a perfect way to transport garden or yard tools around the backyard as you do some mulching or pruning.

### ▪ WOOD PALLET WALL

An enterprising mom took some pallets home from work and used them to create an accent wall in her living room. It took about 25 pallets to cover the wall. She used construction adhesive and a nail gun to attach the pallets, and then anchored the TV to a stud. The wood pallet wall is completely unfinished, without stain or polyurethane.

CLOCKWISE FROM LEFT: COURTESY FOX CHAPEL PUBLISHING; EREN [SEA+PRAIRIE]; MOM AND HER DRILL

Change up this design for an outdoor loveseat by making the design of the back your own and adding cushions and pillows in different colors.

BELOW: A simple design adds charm to a pallet porch swing. Hang the swing outdoors, indoors or from a tree.

### ▪ OUTDOOR LOVESEAT

This outdoor loveseat is the perfect mix of fun and fashion, with a funky back pattern and cushions and pillows in refined colors.

### ▪ PALLET PORCH SWING

A simple pallet design adds charm to this porch. You could also suspend the pallet porch swing from a tree, or even an indoor ceiling.

### ▪ WOOD PALLET COFFEE TABLE

Paint and stack a few pallets, and you have a new wood pallet coffee table for your family room. Use a paint or a finish that will match the décor and style of your home. If you redecorate, simply sand the pallet down and start again.

*Reprinted with permission from* Wood Pallet Projects *by Chris Gleason and published by Fox Chapel Publishing, 2013. For DIY books and other great titles, visit the* GRIT *Bookstore at www.grit.com/store.*


TOP TO BOTTOM: LAURA DISTIN; SHERYL SALISBURY

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Large Project

# The Burning Ring of Fire

## Create your outdoor cooking feature, and make it the focal point of all your backyard gatherings.

By PAUL GARDENER

Simple log-and-plank benches give this stone fire pit a nice look.

Maybe it appeals to your primal instinct, or you simply enjoy being outdoors. Maybe it's even that you get better results for a variety of reasons, plus cleanup is easy. Whatever the case may be, everyone seems to love cooking outdoors. It seldom gets any better than firing up the grill and tossing on a couple of quality burgers or steaks and maybe roasting up some fresh veggies from the garden. Whatever your culinary passion, savory smoke and fresh air just seem to make food taste better. Many of us dream of adding to the tradition of charcoal or gas grill on the back patio, and taking it a step further by building an outdoor space – where family and friends can gather, laugh, cook, eat and share. It may be as simple as a sturdy backyard fire pit for cooking hotdogs and s'mores and for warming the gathered bodies on cool fall evenings. Or you might be looking for the full accompaniment of grill, fireplace or pizza oven and outdoor dining area. Luckily you're only limited by your imagination and willingness to do a little research and hard work.

### Location, location

Any of these projects can be built to just about any size and shape desired, and out of any sturdy fireproof materials. That's the easy part. Deciding which to use and where to place it may be more difficult. From my experience of moving a fire pit because it just wasn't working where it was, I learned that the first and foremost thing to do in getting started, with any of these projects, is to determine where you'd like to locate it on your property.

Most cities have ordinances regarding minimum setbacks from yours and your neighbors' homes and structures, so make sure to talk to your local ordinance officer or fire department before digging in. You also may be required to submit a diagram for approval before building.

It helps my wife and I to do a little brainstorming whenever we try to determine where we want to locate a new structure or feature item in our yard, considering all the ways we intend to use our property in the future. Do you want a getaway fire pit that's away from the house and, figuratively, away from all concerns of the world, or are you look-

ing for a social gathering place right off the main entertaining area? Is your space limited, or do you have young children who still want to be able to kick a soccer ball around the yard? Perhaps you need the pit offset, or covered so as to make as much yard available as possible.

Walk the property and imagine you're entertaining friends and family. Now try to imagine the flow around your proposed installation. It also helps when you try to imagine any future structures you may have in mind, such as a pergola or a deck. You may not plan for them in the next few years, but if they are an option, keep them in mind at least.

As I mentioned earlier, these projects can be built from nearly any fireproof material. From stone to clay to steel or brick, the options for materials that can be used to build your outdoor fire pit, fireplace or oven are never-ending. Most commonly you will find rings made of steel, rock or prefabricated concrete pavers of some sort, but that doesn't mean you can't get creative. Maybe you have access to recycled concrete or urbanite (broken pieces of unwanted concrete) from a driveway that was torn out, which makes perfect building material. Another quick fire pit can be made from the cutoffs from large 2- to 3-foot-diameter concrete piping, and construction companies are usually very generous with this waste material.

Recycled bricks can also be used to create a beautiful rustic fireplace that will stun everyone. Depending on where you live, you may even be able to use your own soil – if it's heavy enough with clay – to build a durable and functional clay oven. The point is, thinking a little outside the box can not only save you a few dollars, it can help you create a functional and unique outdoor focal point.

If it's going to last, going all out for an outdoor fireplace is a worthwhile investment.

A well-fabricated fireplace and rustic chairs combine to make the perfect focal point in the rural backyard. Using brick adds a nice touch.

## Design and build

While you're designing your outdoor fire-feature, think of how you want to be able to use it. If cooking is going to be a consideration, and really it should be, then this is a good time to plan out how you will want to do that. As with campfires, there are a number of simple solutions available that can be placed over a pit to allow for grilling or cooking. Some are removable, others permanent and adjustable, but all should meet the requirements that you most commonly will be using them for.

I always like to look into a recycled, reused or homemade option when I am planning a project like this. Frequently you can find used barbecues at thrift stores or in community bulletin boards online that come with perfectly serviceable cooking grates. With some simple

CLOCKWISE FROM LEFT: JERRY PAVIA; DAVID LIEBMAN; KEVIN FOGLE

Simple tripod fabrication transforms a nice campfire into an outdoor kitchen.

A below-ground fire pit is ideal for slow cooking in cast-iron Dutch ovens.

modifications, these can make for perfect removable cook surfaces for a number of outdoor cooking applications. A simple tripod constructed of ½-inch rebar could easily be used to suspend a grill or cast-iron pot for instance, transforming your fire pit into a vintage "western" cowboy cookery.

If a fireplace is the option that you've chosen to go with, there are designs and products available that allow you to insert a grill for use in cooking that can be removed afterward to allow the fireplace to be used purely for ambience and enjoyment. You may even want to design your fireplace to be used more as a stone, brick or even clay oven for cooking pizza, breads or overnight slow cooking of meats or beans. Because these methods and materials have been in use for thousands of years, there is a wealth of information available for many methods of constructing them. (Turn to Page 38 to find our article for plans for an outdoor oven.)

Probably the single most popular feature of this sort is the fire pit or outdoor fireplace. These serve as a focal point of any backyard get-together and can easily be taken to the next level and become an enjoyable addition to an outdoor cooking area.

Creating one can be as simple as repurposing an old cast-iron manhole frame (I've done this, and it works wonderfully) or as elaborate as a masonry or slate pit with intricate designs; the details are limited only by your creativity.

After determining what material you will use, you'll naturally be guided to the correct way to begin your installation. Simple ring-over-earth fire pits like my manhole frame require little more than ensuring the ground is level and the site is a safe distance away from flammable objects. No special treatment is required of the ground beneath the fire area; it will essentially just become a permanent campfire of sorts and will require only the occasional shoveling out as ash begins to pile up.

On the other hand, a brick, rock or paver type construction – because it is built from many pieces – requires a somewhat more intense approach to ensure that it is built on stable ground so it will last for many years to come.

Much like laying pavers, you will want to trench out a ditch and line it with a course drainage grade rock. In this case, dig to approximately 12 inches deep and the width of your pavers or bricks, and then fill the bottom of the ditch with a good 6 inches of rock. This allows for drainage around the stone base, preventing settling in rainy areas or winter heaving in cold climates, as well as giving you a stable base to build the first layer of bricks on below-ground level. This will help to maintain the form and shape of the pit or fireplace as you continue to build. You could also choose to pour a cement base rather than laying your first course of stone below ground level. This is generally a good guideline for starting most outdoor hardscape construction, but more detailed instructions can be

CLOCKWISE FROM BOTTOM LEFT: MAYNARD STANLEY JR.; ISTOCKPHOTO.COM (3)/PRILL, MONAP, SIETO

Even sturdier, welded platforms and grates turn out excellent food and atmosphere.

found at your local hardware store or online – it all completely depends on your budget and skill.

What if you don't have room for a large feature in your yard space, or you simply don't want to dedicate the space you do have to something permanent, but you do want to take advantage of cooking outdoors or enjoying a fire with friends and family on occasion? There are always a number of portable fire pit options available for fairly reasonable prices. While they do easily solve the problem, all of the ones that I have come across are either lacking in size, durability or cooking features. That said, there's no reason you couldn't build a temporary fire pit or outdoor cook area that could easily be stored until needed.

Bricks can make great small, open fireplaces or fire pit rings by simply stacking them in a safe area. Even old 55-gallon drums can be cut down to 12 to 15 inches high, layered with brick or rock on the bottom, and used as temporary fire pits, and standard circular barbecue grills can easily be placed over the top to cook on. By elevating the ring on double bricks placed on three or four sides, you can even use it over your lawn with little if any damage to the grass.

Watering the area below is a good idea as well to keep the ground from overheating. I've even seen old wheelbarrows used as fire pits by placing a layer of bricks across the bottom (not recommended unless fixed to prevent tipping). Talk about multi-use!

So as you can see, there are numerous ways to go with an outdoor fire feature: large or small, permanent or temporary, and limited only by your desire and creativity. Whichever way you choose to go – fire pit or fireplace, granite or urbanite – as long as you take the time to plan thoroughly and you think about the ways you want to use the feature, and then build appropriately for the materials being used, you are sure to enjoy your outdoor cooking area for many years to come.


Extend your growing season by months with an inexpensive do-it-yourself hoop house.

# Helpful Hoop Houses

By STACY TORNIO

You don't have to have a big, expensive greenhouse to extend your garden's growing season. Thanks to a lovely invention called the hoop house – and its varying styles – gardeners and farmers all over the country can enjoy homegrown fruits and veggies well after the growing season ends without spending a lot of time or money.

When you begin researching hoop houses and how to build one yourself, it might seem like all the designs are the same.

At a glance, they have the same basic frame, but don't be fooled. One hoop house design might be perfect for one gardener, while it doesn't work at all for the next.

To help you sort through all the designs and options out there, I've put together instructions for four different hoop house styles, all tried and tested. One design takes minutes to set up, while the others are a bit more involved. All of them can be scaled to fit the available space.

## The traditional hoop house

Bonnie Plants, based in Union Springs, Alabama, is one of the largest vegetable and herb producers in the United States. Freeman Agnew is horticulturist and head grower for Bonnie, and he says hoop houses help them extend their growing season, and he uses them in his own backyard gardening. He shares easy hoop house instructions from Bonnie, along with a few tips of his own to save money.

"For your hoop house cover, you can use old blankets, sheets or drop cloths," he says. "You can also check with a nearby greenhouse facility in

To close up the ends of the hoop house, simply twist the plastic and tuck under a secured rubber tarp tie-down.

Adding height with extra baseboards to one or all sides of the frame will help protect seedlings and plants from wind damage. This design is good for tall or bushy garden vegetables, including tomatoes and peppers.

Aluminum tracking and wiggle wire keeps the plastic in place around the frame of the hoop house. A length of conduit is helpful when rolling back the plastic sheeting on a nice day. Recycled materials will help keep costs low for any hoop house design.

CLOCKWISE FROM LEFT: COURTESY BONNIE PLANTS; COURTESY JARREN KUIPERS (3)

your area. If they are re-topping their houses, they will often give you the plastic tarp they removed."

Following are the instructions for making the "Bonnie hoop house," which you can also find on www.bonnieplants.com.

**MATERIALS**

**½-inch flexible PVC pipe**
**Rebar stakes, 10 inches long**
**Row cover material**
**Twist ties or twine**
**Bricks or heavy rocks**

1 Lay out the design of your bed, determining the desired length and width.

2 Space sections of the PVC pipe a couple feet apart, and lay them across the bed. Cut the sections of PVC pipe to length (depending on width of the garden bed and preferred height) using a pipe cutter or hacksaw.

3 Hammer a rebar stake into the ground at each end of the PVC sections, on both sides. Leave 4 to 6 inches of each piece of rebar sticking out of the ground.

4 Place one end of the pipe over one of the stakes, and gently bend the pipe enough to slip the other end of the PVC over the opposite stake. This creates the hoop frame. Repeat until all the hoops are in place. If you're having trouble bending the PVC, try applying heat, but be sure to research the proper way to do it safely and without kinking the PVC tubes.

5 To add support, cut a piece of PVC the length of the bed and tie it to the top of each hoop, making a ridge pipe, using twist ties or twine.

6 Drape your row cover material over the structure, leaving enough excess around the edges to place bricks on the material.

These same basic instructions can also be applied to raised beds. To harvest or ventilate the plants inside, simply remove the bricks from both ends of the hoop house, and roll the cover back.

## Hoop house extreme

Jarren Kuipers really knows how to take a basic hoop house to the next level. He lives in Cody, Wyoming, which can have a short and challenging growing season – around 120 days. He estimates his hoop house extends his season by nearly 60 days.

Kuipers used a traditional hoop house design to start with, but made several modifications to

The $10 hoop house takes minimal time, effort and materials, but don't expect minimal yields. A simple hoop house can keep your plants producing well into fall.

strengthen it overall. He also got lucky recently when the local baseball field was replacing the wooden bleachers, and he offered to take them off their hands. By upcycling the wood, he constructed a 4-by-28-foot greenhouse space for under $200.

The following dimensions are good for housing larger garden plants like tomatoes.

**MATERIALS**

Wooden stakes, 3 feet long
Baseboards
2-by-4, 4 feet long
½-inch PVC pipe, sold in 10-foot lengths
PVC T-connectors
PVC elbow connectors
Adhesive suitable for outdoor use
Wood screws
Aluminum channels
Garden plastic
Staples
Galvanized electrical conduit

**1** Level the ground as much as possible in your garden bed. This is an important step for long-term success of the hoop house, so don't skip it.

**2** Drive 3-foot-long stakes 2 feet into the ground at every corner of the bed, and every 10 feet along the perimeter.

**3** Attach your boards to the above-ground part of the stakes to create walls, stacking them one or two high, depending on what works best for you. Two boards will provide extra wind protection, if needed.

**4** Once the baseboards are fastened and leveled, attach one 4-foot-long 2-by-4 upright at each end of the bed.

**5** Create the "ribs" of the hoop house with the PVC, placing one section every 4 feet. On the end of each rib, attach a T-connector for the interior ribs and an elbow for the ribs on each end.

**6** Cut PVC to fit between each of the ribs. (This is a good time to exercise the "measure twice and cut once" rule.) Glue the joints together, and attach PVC structure to the top of the bed boards with wood screws.

**7** Run one long pipe the length of the bed down the middle for the "spine" or "ridge." Drill holes through the top of each 2-by-4 and run the PVC spine through.

**8** Attach aluminum channels around the perimeter of the bed with wood screws, and use wiggle wire to secure the plastic in the channels down the long sides of the bed.

**9** Stretch garden plastic over the bed. Close the ends by stapling the corners of the plastic to the corners of the bed walls. Attach a rubber tarp strap between them on the short ends of the bed. Then twist the garden plastic on the ends, closing it like a huge loaf of bread. Use wiggle wire to fasten everything down.

**10** To make it easier to roll the plastic back, I use a length of galvanized electrical conduit along one side of the bed, and roll it up in the loose plastic, then clip it with a 1-inch binder clip that you find at office supply stores. With the conduit connected to one side of the plastic, you can easily remove the clips before attempting to roll up the plastic.

**11** The length of galvanized conduit is 6 inches longer than the beds. At each end, attach an elbow and a 6-inch length of conduit to form a crank. That way you can leave the plastic connected to the wiggle wire on one side of the bed and roll it up and over the ribs using the handles on each end.

The advantage to making your own hoop house is that you can customize size and materials to fit your budget and yard space. This hoop house was made to fit over a raised-bed garden.

## The $10 hoop house

Halle Cottis of WholeLifestyleNutrition.com tells people she can extend their growing season by up to four months, for only $10, in less than 10 minutes. She was living in Wisconsin when she came up with this design, and now she's sharing her step-by-step instructions on how she did it, using PVC pipe, cement pavers and plastic sheeting. I used one piece of 3 millimeter clear plastic sheeting, and it only cost me $3.

**MATERIALS**

½-inch PVC pipe

Clear plastic sheeting

Cement pavers

1 Cut your PVC to 7-foot-long sections, give or take, depending on the size of your garden. Place them every few feet down the length of the bed.

2 Push the ends of the PVC about 4 inches into the soil on opposite sides of the bed.

3 Drape plastic over the PVC to create the domelike structure.

4 Place cement pavers around the perimeter of the bed to securely hold down the plastic. Be sure to leave enough plastic around the edges to keep cool air out, so the air inside can create the proper humidity. While cement pavers are less than $1 each, you could also use rocks you might have lying around.

## UMBRELLA HOOP HOUSE

Stephanie Rose is a clever gardener based in Canada and the voice of Garden Therapy.ca. She understands what it means to have a short growing season, which is why she came up with a miniature greenhouse idea to get seeds started early in the season. You don't even need a yard to pull this off. A patio will work just fine for this umbrella hoop house.

1 Choose a large wooden container or planter, like a wine barrel planter or something similar.

2 Fill with a good mixture of soil and compost. Cover the top with a light, moisture-retaining material, like seedling mix, peat moss or coconut coir.

3 Plant your seeds. If it's early in the season, plant them densely.

4 Here's where you turn it into a greenhouse. You can either use an old see-through umbrella, or search online for "umbrella greenhouse cover." You can pick one up for $20 to $40. The best designs can fold up when not in use.

LEFT TO RIGHT: COURTESY HALLE COTTIS, WHOLELIFESTYLENUTRITION.COM (3); COURTESY STEPHANIE ROSE, GARDENTHERAPY.CA

Large Project

# A Cedar Log Bed Fit for a King

**You don't need to be an expert woodworker to fashion yourself a homemade bed frame out of the timber on your acres.**

Article and photographs by BRANDON HODGINS

King Blackledge is a man of many talents. Hailing from the heart of Michigan's backwoods, King is a retired bricklayer who spends his days doing. If he isn't growing food, carving wooden morel mushrooms, trapping snapping turtles, or making homemade wine from his backyard fruit orchard, he's likely inside his woodshop making masterpieces out of the most abundant natural resource he has available to him. During the winter months, he tinkers the days away inside the shop, magnificently marrying form and function with striking beauty and heavy-duty, life-long lasting quality.

For the first time ever, King has made his one-of-a-kind bed design available to readers of Grit. But he's not offering to build one for you. If you want one of these king-sized beds designed by King, you're going to have to go out to the cedar swamp to get it. But, the work of art you achieve might just be worth all the trouble.

## Selecting your supplies

The materials used to build this bed should be sourced from a cedar swamp or swale nearby. Look for logs with character while choosing your head posts. If you've always wanted some hooks on your headboard to hang a robe or what have you, choose a head post with a few extra branches. The same holds true for your headboard arches and spokes. As long as you can make it all fit together, there are no limitations to the character you can impart into your new bed. Pick spokes and arches with knots and wayward limbs. You can even choose trees that are dead or dying for beautiful dark tones and added charm. Choose balsam firs that are as straight as a gun barrel, or perhaps Osage orange lumber that's abundant and a signature of your region and farm.

### MATERIALS

- 2 cedar head posts – 72 inches tall
- 2 cedar foot posts – 40 inches tall
- 5 cedar headboard spokes – 46-50 inches tall
- 4 cedar footboard spokes – 30-36 inches tall
- 1 cedar headboard arch – 80 inches long
- 1 cedar footboard arch – 80 inches long
- 1 cedar headboard bottom brace – 80 inches long
- 1 cedar footboard bottom brace – 80 inches long
- 4 balsam fir side rails – 84 inches long, 4-5 inches in diameter
- 4 balsam fir bed rails to carry mattress – 80 inches long, 4-5 inches in diameter
- 6 cedar side rail truss supports – 10-12 inches long, 5 inches in diameter
- 2½-inch wood screws – 1 50-count box

### TOOLS

- Drill and drill bits for wood screws
- 1½-inch tenon cutter
- 1½-inch forstner bit
- 6-by-48-inch table belt sander
- 3-by-21-inch handheld belt sander
- Draw knife
- Table saw
- Side grinder with wire wheel attachment
- Tape measure
- Chainsaw
- Rubber mallet

## Preparing your logs

Each log that you choose needs stripped and sanded smooth. A good old draw knife works well for stripping both cedars and balsam firs – the types of lumber I used, but which is completely up to you. Freshly cut

cedars can usually be peeled with nothing but a couple of strong hands. But the trees that have been dead or down for some time won't part with their bark so easily. This is where the draw knife and grinder with wire wheel will come in handy.

Use the wire wheel to get down into the tight nooks and crannies of the spokes and branches on your head and foot posts.

The handheld belt sander and the table belt sander will help greatly to smooth things out. This is also a great time to level out the bottom of your head and foot posts too. Sand the bottoms down to a smooth, even surface that sits firmly and flatly on the floor.

## Understanding tenons and measurements

This entire bed comes together by inserting 1½-inch-by-2-inch-long – measured at the outer diameter (OD) – tenons into 1½-inch-inner-diameter-(ID)-by-2-inch-deep holes. A king-sized mattress measures 76 inches wide by 80 inches long. The bed frame only needs to be big enough to slide a box spring and mattress into snugly. Therefore, you must add 4 inches to every log that runs the length and the width of the bed, including your bed rails, side rails, headboard and footboard arches, and headboard and footboard braces. The extra 4 inches will allow the tenons to slide into the 2-inch-deep holes on both ends.

For example, your side rails are cut to 84 inches long. You'll cut 2-inch-long tenons into each end. One tenon will slide 2 inches into the head post, one will slide 2 inches into the foot post, leaving 80 inches of exposed side rail. That's perfectly fit for a king.

## Building the headboard

Start by laying your hefty head posts down on the shop floor. You should be looking at what will be the inside of the headboard. On the face of each head post, measure 8 inches from the floor and make a mark. Make another mark at 16 inches from the floor on both head posts, perfectly in line with the bottom hole. Using your 1½-inch forstner bit, drill 2-inch-deep holes at all four marks. The bottom hole should be 8 inches from the floor on center; the top hole should be 16 inches from the floor on center.

A wheel brush sander takes care of the crevasses.

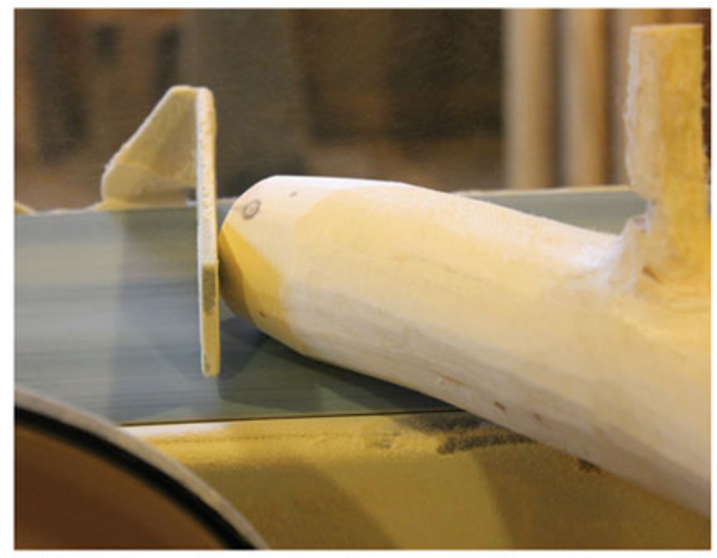
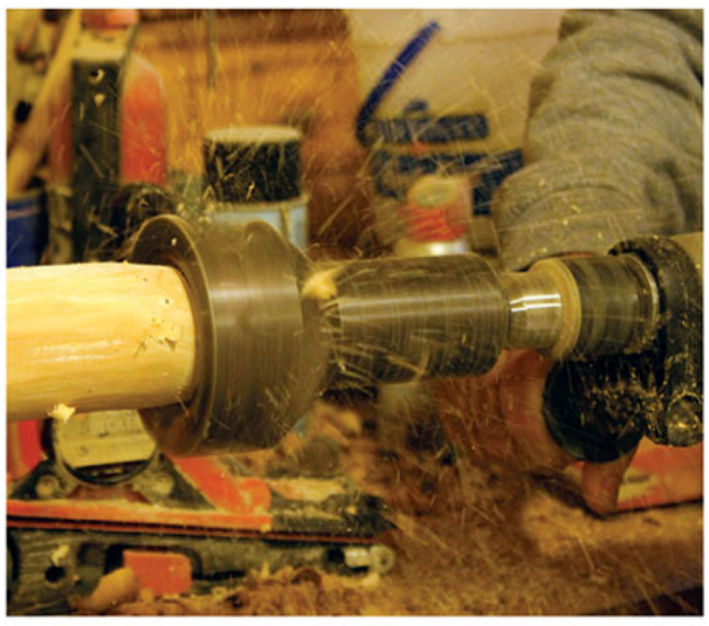


Table belt sanders make short work of a tedious task.



Tenon cutters help get it done safely and accurately.

Add unlimited character to your headboard.

All tenons are 1½ inches around and 2 inches long.

These two holes that are now on the face of each head post will host the side rail tenons. So, to establish the proper width of the bed, make sure your posts are laying so there's 80 inches between the centers of the holes on the left and right head posts.

On the inner edge of each head post, measure 20 inches from the bottom of the head post (or the floor, if the post is standing up), and make a mark. Drill a 1½-inch hole at this mark on each head post for the headboard bottom brace tenons to slip into. Now measure 8 inches down from the top of both head posts and make a mark on the inner edges. Drill another 1½-inch hole on each head post for the headboard arch tenons to slide into. Again, each hole should be 2 inches deep.

Set your headboard arch near the top and your headboard brace near the bottom to make sure everything will line up once the tenons are cut.

Before cutting tenons into the headboard arch and brace, you may have to use either the table belt sander or the handheld belt sander to taper the logs down to fit the 1½-inch tenon cutter onto the end. The table belt sander is preferred. Just gently roll the end of the log on the belt while the sander is running, holding upward on the opposite end until the necessary taper is achieved.

To cut the tenons, place the headboard arch in a sturdy clamp or vice. Using a 1½-inch tenon cutter on a powerful drill, cut a 2-inch-long tenon on both ends of the headboard arch. Repeat the tenon cutting process on the headboard bottom brace. Slide the tenons of the headboard arch and brace into the newly cut holes on each head post. Use the rubber mallet to gently help the tenons seat firmly in the holes.

It's time now to start laying out your headboard spokes. This is where most measurements go out the window. You just have to lay them in place and see what fits and what you like the most. When you've arranged the spokes to your liking, mark them where they need cut, and cut tenons on the end of each spoke. Some spokes will need three tenons if they come in contact with the brace and arch in three places. Mark where the holes need to be on the head posts, bottom brace and arch, and drill using your forstner bit. It's going to


take a bit of persuasion for all of the spokes to fit into the holes. Use your rubber mallet carefully to make it all come together. When the headboard is assembled, run a 2½-inch wood screw into the bottom brace, arch and head posts, and through each tenon to secure the headboard.

## Building the footboard

The process of building the footboard is nearly identical to building the headboard. The only difference is the height, which changes the location of the footboard arch and footboard bottom brace. The holes on the footboard that will hold the side rails use the same measurements from the floor as the headboard to keep the side rails level. But the holes for the bottom brace are only 6 inches off the ground, and the holes for the arch go 6 inches from the top of the foot post. The same tenons are used and the same method of lining up your spokes will work wonderfully for your footboard. The tenons are once again held in place by 2½-inch wood screws.

## Building the side rails

The side rails are the trusses that tie everything together and carry a bulk of the weight. Each side rail of my timber bed frame is built with two 84-inch balsam firs and three 10- to 12-inch-long cedar truss supports. To build a side rail, cut 2-inch tenons on the ends of both balsam firs, and 2-inch tenons on the ends of all three cedar truss supports. Lay the rails and truss supports out and evenly space the truss supports between the two balsam firs. There should be 21 inches between each truss support, with the first and last truss support falling 21 inches from either end of the balsam firs.

The important measurement to remember here is the distance between the centers of both tenons on either end of the firs. They need to slide into the two holes you've already drilled on the face of your headboard and footboard, which are 8 inches apart on center. Therefore, you may need to trim the tenons on the truss supports down a bit to ensure that the tenons on the end of the balsam fir side rails remain on 8-inch centers.

Mark and drill three holes on each side rail. Slide the truss support tenons into the holes on the side rail. Measure the ends of the side rail tenons again to ensure that they'll fit into the holes on the headboard and footboard before securing the truss support tenons with 2½-inch wood screws. Repeat this process on the second side rail.

## Mattress rails

There are four balsam fir bed rails that will carry the mattress. They're each 80 inches long, and they span the width between the two completed side rails. They should be spaced evenly along the bottom balsam firs used in the side rails and connected to the trusses with the same hole-and-tenon system used to assemble the rest of this bed.

After locking into place, it may be necessary to sand down the top face of the bed rails to level them out so your box spring can sit firmly and flatly on the rails.

You're now ready to assemble your bed and make sure it all fits together.

Even if everything is measured perfectly, you'll need to use the rubber mallet for some extra persuasion. That's the nature of working with nature's materials.

The side rails slide into the headboard and footboard on both ends, and the bed rails slide into the side rails to complete assembly. When you're sure it all fits together nicely, take it apart and generously apply a stain or polyurethane of your choice if you wish.

When the bed is reassembled at its new forever home, run 2½-inch wood screws through the head posts and foot posts, into the tenons of the side rails. Top off the bed with a box spring and mattress.

Rise with the sun. Cut the wood, mend the fences, hoe the rows.

You've just earned yourself a night of sleep that's fit for a king, from King Blackledge.

Large Project

# The Backyard DIY Smokehouse

## Smoke meat in your own smokehouse for a lifetime of good eating.

Article and photographs
by MATT GILARA

I've always wanted to build a backyard smokehouse – primarily for smoking sausage, but also for smoking bacon, ham, cheese, poultry and venison. My goal was to construct a smokehouse with a lot more room than the smaller ones you can buy from big-box stores.

After spending some time talking to local farmers and collecting ideas on the construction process, and reading about different designs, I rolled up my sleeves and set about building a cement block smokehouse.

Following are the general steps I performed to make an 80-inch-by-96-inch cement block smokehouse on my property.

## Step 1: Prepare ground for the footer

The area I selected for the smokehouse was filled with roots and rocks. I dug the footer by hand, and mixed my own footer cement. Make sure your footer is a little longer and wider than the finished area you require. (This will give you room to square up the bottom row of cement blocks.) I mixed 3 shovels gravel, 2 shovels sand and 1 shovel Portland cement in a wheelbarrow – just add enough water to get the consistency you desire – which made for easy pouring in tight areas. The footer was approximately 16 inches wide and 6 to 8 inches deep. The bottom of the footer was sitting about 24 inches below grade.

### TOOLS

- Chalk line
- Level (2-foot or 4-foot)
- Tape measure
- Square
- Trowel
- Corner plastic line blocks
- Wheelbarrow/mortar board
- Hammer/nail gun
- Circular saw
- Drill
- Speed square

### MATERIALS

- 200 – 6-by-8-by-16-inch cement blocks
- 1 ton sand
- 1 ton gravel
- 5 bags (94 pounds each) Portland cement
- Hydrated lime
- 8 – 6-foot 2-by-6s
- 5 – 10-foot 2-by-6s
- 10 – 10-foot 1-inch-by-whatever-width (for nailers to hold the metal roofing)
- 4 – 10-foot 1-by-10s
- 6 – 10-foot 1-by-4s
- 2 – 10-foot 1-by-8s
- 2 – 8-foot 1-by-10s
- 2 hinges
- 1 handle
- 6 sheets metal roofing (3-feet-by-55-inches)
- 9-foot metal ridge cap
- Metal screws, Tapcons and nails
- 8 – ½-inch L bolts with washers and nuts

## Step 2: Square up the first layer of cement blocks

After the footer was set up, I used a chalk line, tape measure and square to determine where the bottom layer of blocks should be laid. The bottom layer should have an outside dimension of 80 inches wide by 96 inches long.

On top of the footer, measure the length of each wall. Get the rough layout as close as possible with some sort of mark for each of the four corners (before any blocks are laid). Measure from one corner to the other corner (diagonally opposite of each other), and record that measurement. Then repeat this on the other set of opposite corners. These two measurements should be the same.

When those measurements are the same, you can chalk a line on top of the footer to show you where to lay your first layer of block.

## Step 3: Layer cement blocks

Apply a layer of mortar cement on the footer for the first layer of block.

I mixed my mortar cement by using 2 parts sand, 1 part Portland cement and ½ part hydrated lime. Add just enough water to get the mortar to the consistency of mashed potatoes.

If the mortar starts to set up before you apply it to the cement block, you can mix in a very small part of water to get it back to the consistency you need. Run the blocks along the chalk line that you snapped in Step 2. Apply mortar to the horizontal joints, and lay the first layer. After getting the first layer square and cemented in place, I continued to lay blocks a few layers at a time. I would have the corners built up a few layers higher than the rest of the blocks so I could run a mason line (corner plastic line blocks) from corner to corner and make sure I was staying straight, level and square.

I used a 2-foot level to check each

block after I placed it. Alternate block placement so that vertical joints are never directly on top of each other.

## Step 4: Build form and pour header

Instead of building a wooden header, I thought a cement header would look better and be stronger. I built a form out of some wood I had around the farm. The form was built to the same height and width as the blocks I was using. I added a few pieces of rebar horizontally in the form after I mixed the cement. I used the same mix I used for the footer: 3 shovels gravel, 2 shovels sand, and 1 shovel Portland cement. I also added a few pieces of rebar vertically that would go down through the top row of cement blocks. I core poured the cement blocks on the top row where the header would sit, and placed the vertical rebar down through the core poured cells. My neighbor's front-end loader was used to lift the header.

## Step 5: Build roof structure

After the header was installed, and the remainder of the top row of blocks, it was time to build the roof. I core poured the four corners about a block or so deep. I pushed crushed newspaper down inside the cores I was pouring to hold the cement from going the entire way down through the blocks. After the blocks were poured, I installed some ½-inch L bolts that will be used to hold down the top plate. The top plate was rough-cut 2-by-6s cut to the length of the walls and drilled where the L bolts were. The top plate was slid over the L bolts and held in place with nuts. The rafters were cut out of rough-cut 2-by-6s at a 7:12 pitch. A speed square was used to calculate the 7:12 pitch. Once the rafters were cut, they were nailed to a ridge board that was supported by two short 2-by-6s (one in front and one in back) and nailed to the top plate. Then I nailed 1-by-whatever-width boards (five per side at varying widths) to the rafters so there was something to allow the metal roofing to be attached.

## Step 6: Finish roof

After the main roof structure was built, I added six sheets of metal roofing with roofing screws. The boards that the roofing was screwed to had a 1-foot overhang. This worked perfectly for three sheets (at 3 feet in width) of metal roofing per side. After the metal roofing was installed, I added the metal ridge cap.

Then I cut 1-by-10s to finish off the gable ends (I wanted to use rough-cut siding boards so my smokehouse would resemble my barn). I trimmed off the facia with 1-by-4s to give it a nice finished look. The eves were blocked off with 2-by-6s (just leftover cutoffs) to seal off between the trusses.

I cut the 2-by-6s to the width between the trusses, and nailed them on the top plate. This will help keep the smoke in the smokehouse and keep critters out.

## Step 7: Build and add the door

The door for the smokehouse was built out of two rough-cut 1-by-8s and two 1-by-10s (to give me 36 inches in width). The trim around the cement blocks, to which the hinges will be screwed, was held in place with Tapcons. Once the trim was in place, the door was installed.

Since building the smokehouse during the summer of 2014, we have smoked sausage and bacon from pigs we raise, and have had success smoking a variety of cheeses. In the future we would like to try smoking chicken and venison. We have also been asked by neighbors and friends about using our smokehouse. I have thought about having a community smokehouse day(s) for people to bring whatever items they want smoked and do it all at the same time.

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# How to Build a Small Garden GREENHOUSE

**Treat your plants to a safe transition and extend the growing season.**

By TOM LARSON

When I decided to build my first greenhouse, I wanted a place for my vegetable plants to continue growing after they had become too large for the lighted shelves where I started them. I wasn't sure I wanted a greenhouse at all and didn't, therefore, want to put much money into one to use for a trial. Buying a kit or a complete structure involved more than I wanted to spend, so I decided to build my own.

Since I wasn't sure where I might locate the greenhouse, I made it light and sturdy enough to move around, and covered it with an elaborate array of laminated arc-shaped beams supporting two layers of hardware store plastic. These plastic-covered laminations have survived winter storms, thunderstorms and some small hail, but creating the beams was tedious and time consuming so I designed a more conventional structure for this project. I also chased pieces of the cheap plastic I used as a cover (the first time) all over the neighborhood one winter, so I recommend using film made for greenhouses – it will last for several years.

When I leave my plants in the greenhouse at night, a small thermostatically controlled electric heater keeps the temperature above 50 degrees Fahrenheit. During the day, heat is always a hazard so ventilation is essential. On a cold but sunny day, the temperature in the greenhouse tops out at 140 degrees Fahrenheit

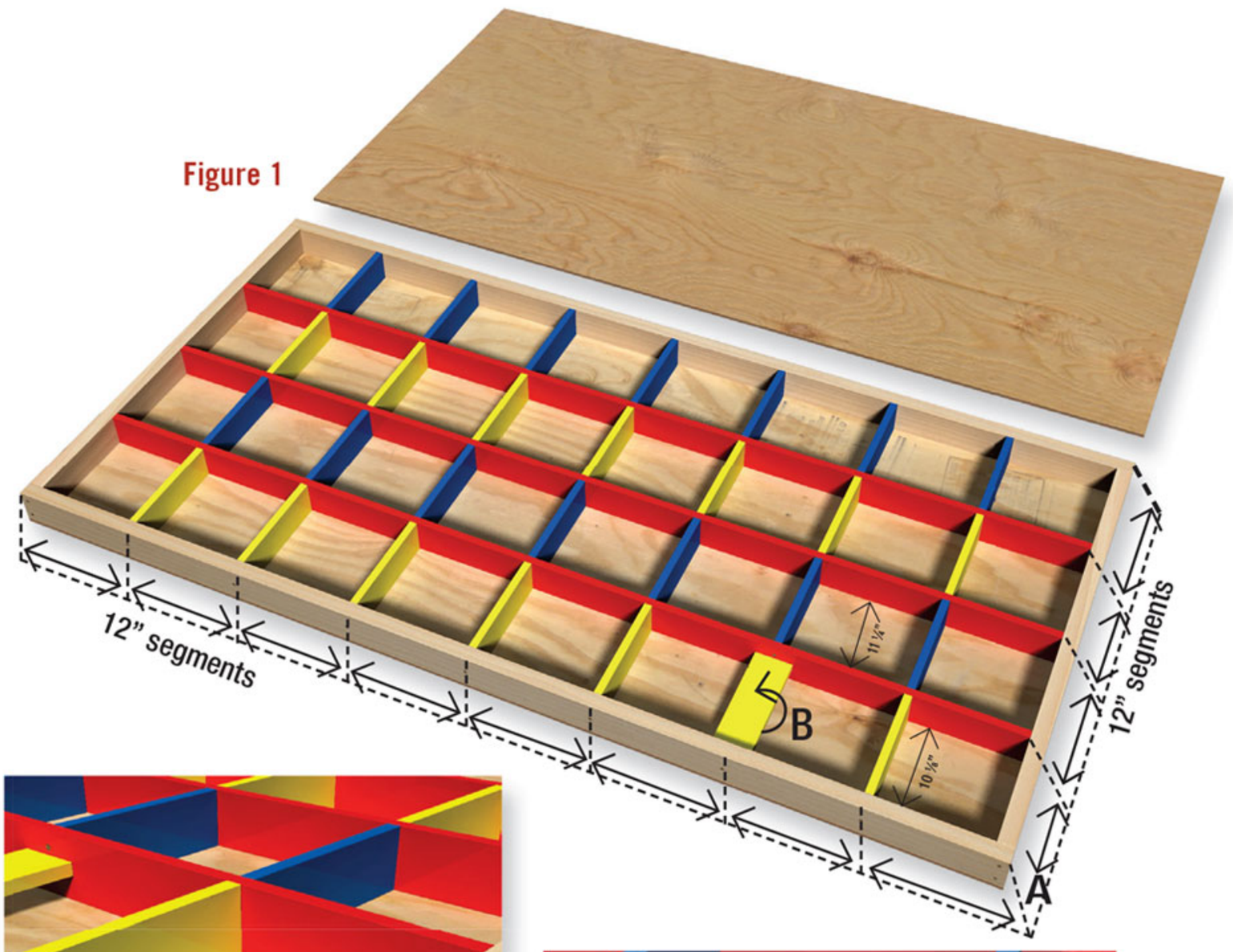
Nate Skow Illustration (17)

## MATERIALS LIST

- 1 4-foot-by-8-foot sheet of ¾-inch lattice (plant shelf)
- 1 30-inch wooden screen door
- 2 4-foot-by-8-foot sheets of ⅜-inch plywood (top and bottom of base)
- 3 8-foot 2-by-4s (perimeter of base)
- 7 8-foot 1-by-4s (interior of base frame)
- 5 8-foot 1-by-3s (support frame for plant shelf)
- 40 8-foot 1-by-2s (sort carefully at the lumberyard or buy several extras)
- 12 8-foot 1-by-2s (back wall)
- 8 8-foot 1-by-2s (end walls)
- 11 8-foot 1-by-2s (rafters)
- 6 8-foot 1-by-2s (plates)
- 3 8-foot 1-by-2s (window frame)
- 1 10-foot 1-by-2 (ridge pole)
- 2 10-foot treated 2-by-4s (skids)
- 2 3-inch eye bolts with nuts and washers
- 2 tubes construction glue
- 1 heat-activated opener
- 120 linear feet of batten tape
- 10-foot-by-30-foot greenhouse plastic

Approximate numbers of screws:

- 100 1½-inch exterior screws
- 50 2-inch exterior screws
- 100 3-inch exterior screws
- 20 3½-inch exterior screws





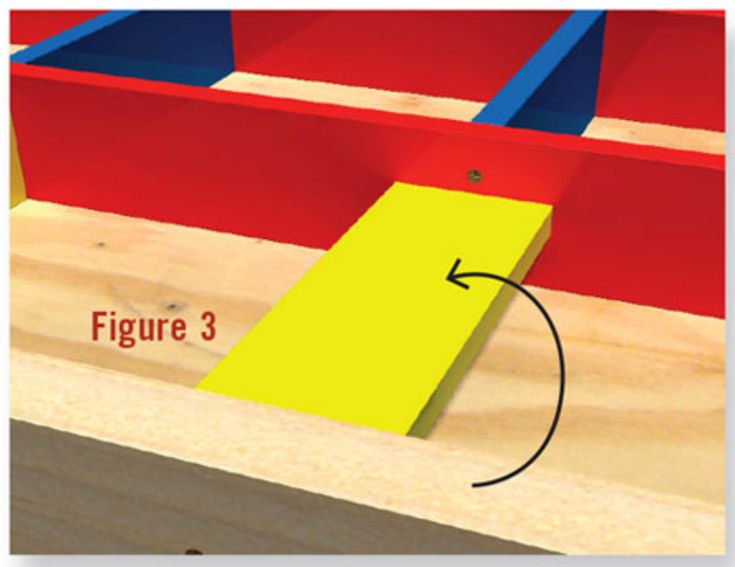



**Figure 1: The key to the torsion box's strength is the honeycomblike internal framework that's glued to both external surfaces. The yellow and blue pieces need only be fastened to the red and outer pieces sufficiently to hold them for gluing. Getting screws into the internal cross members is facilitated by rotating the outer cross members (Box B). Locating the internal frameworks is as easy as marking the outer frame at 12-inch intervals and centering the pieces. Once the two plywood skins are glued to the frame, you have a rigid, durable and relatively lightweight foundation. Box A detail in Figure 2: The 45-inch-long 2-by-4 is to the right; the full 8-foot-long piece is to the left. The 2-by-4 frame should be squared up with one piece of plywood before installing the internal frameworks. Box B detail in Figure 3: Rotate loosely fastened cross members for gluing.**

with the door closed. I try to keep the temperature below 80 degrees by propping the door open, but during my first house's second spring, I accidentally left the door shut at noon. After lunch and a brief nap, I returned to plants that looked as if they had been sprayed with brush killer the day before. Opening the door and watering didn't revive them. To help prevent that happening again, I've included a window and a heat-activated opener in this design. Commonly available radio-transmitter systems have alarms to alert you if the temperature inside the greenhouse gets too hot or cold. I'm going to set mine up this spring.

The wall and roof framing used in this greenhouse is appearance-grade 1-by-2 pine. The base is untreated construction grade plywood and pine 1-by-4s and 2-by-4s. The skids are 10-foot treated, construction-grade 2-by-4s. If you intend to water by general spraying, you should consider using treated or naturally rot-resistant lumber, such as cedar, redwood or walnut heartwood. Other possibilities are Osage orange, mulberry and black locust. I'm not concerned about rot because I moisten flats by pouring water into a corner I have lifted, and pots I water just enough to keep the soil damp.

I used a 4-foot-by-8-foot piece of wood lattice as the shelf in my first greenhouse; I replaced it a year later with plastic lattice. Both proved too flimsy. In this design I used ¾-inch thick cedar lattice. I like lattice because it allows some light to shine through, and spilled water doesn't puddle on its surface.

## Construction notes

The strength and rigidity of the torsion box that forms the base of the greenhouse require only that the frame pieces fit snugly together and provide a level base for the plywood until the glue sets. The completed base weighs about 140 pounds, so you might want help moving or tipping it to attach the plastic and skids to the underside. The upper frame is amply strong for its intended purpose, but it is best not to use it as a lever to tip the base.

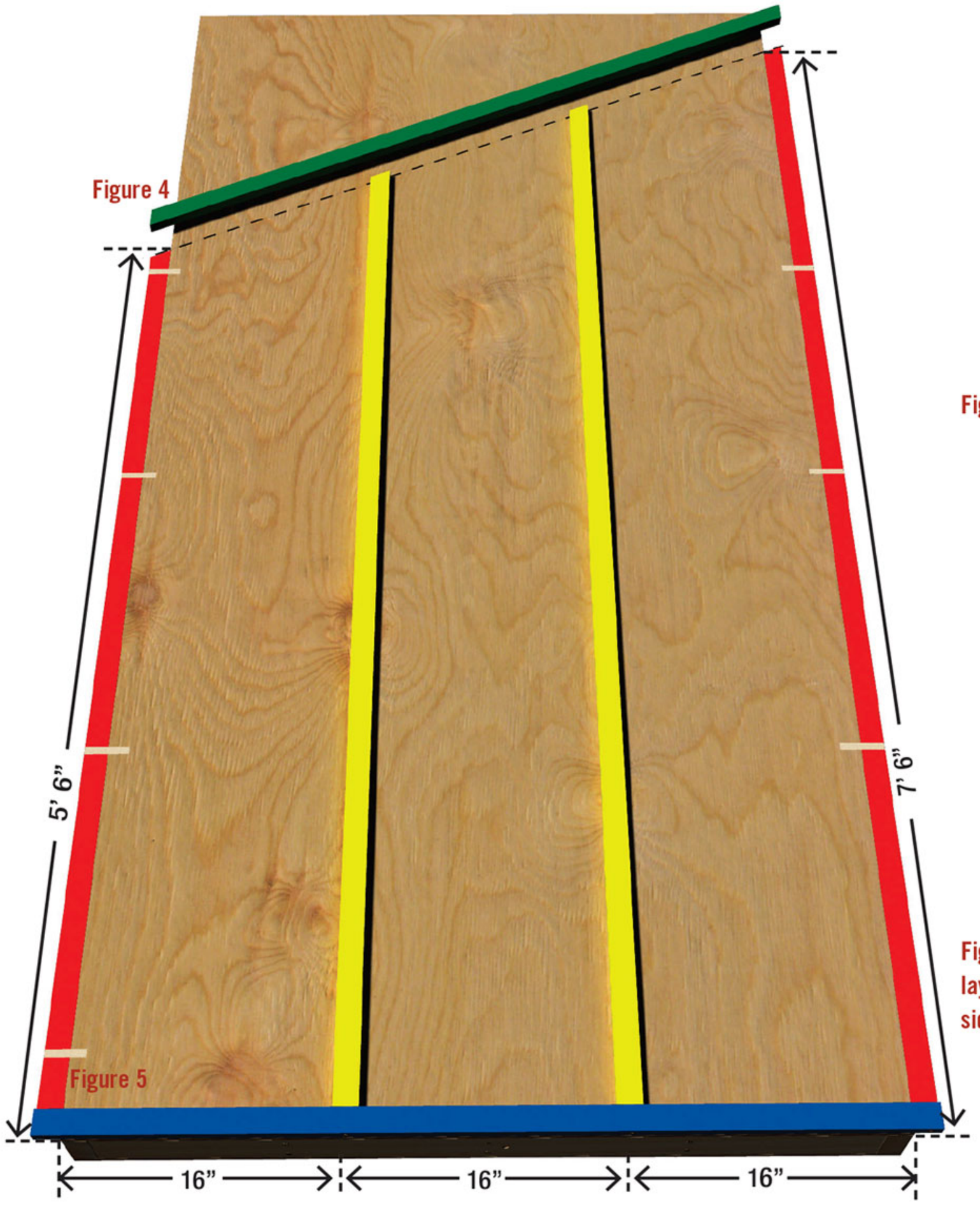



Figure 6: The completed base makes a perfect surface for laying out the greenhouse's sidewalls, and makes it easy to mark angled pieces for cutting.

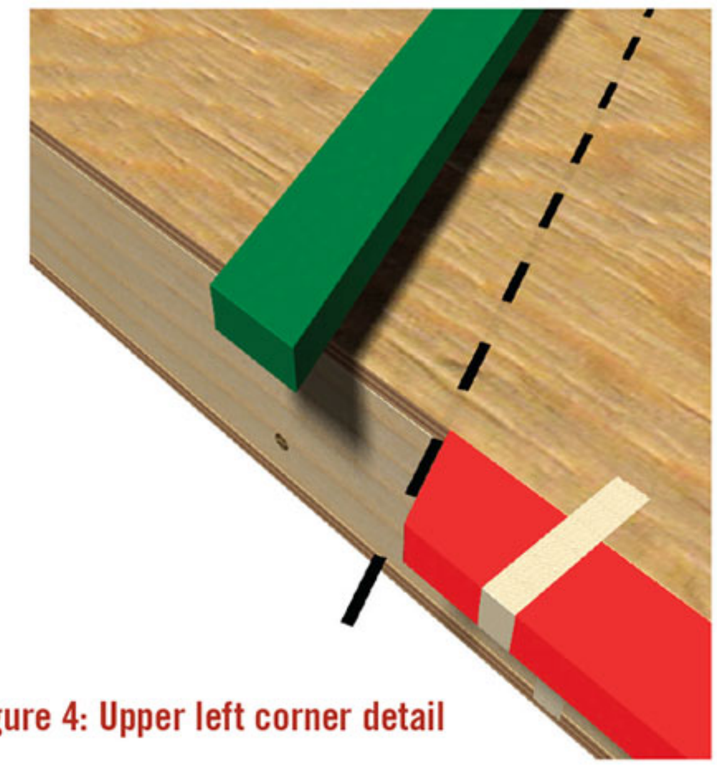


Figure 4: Upper left corner detail

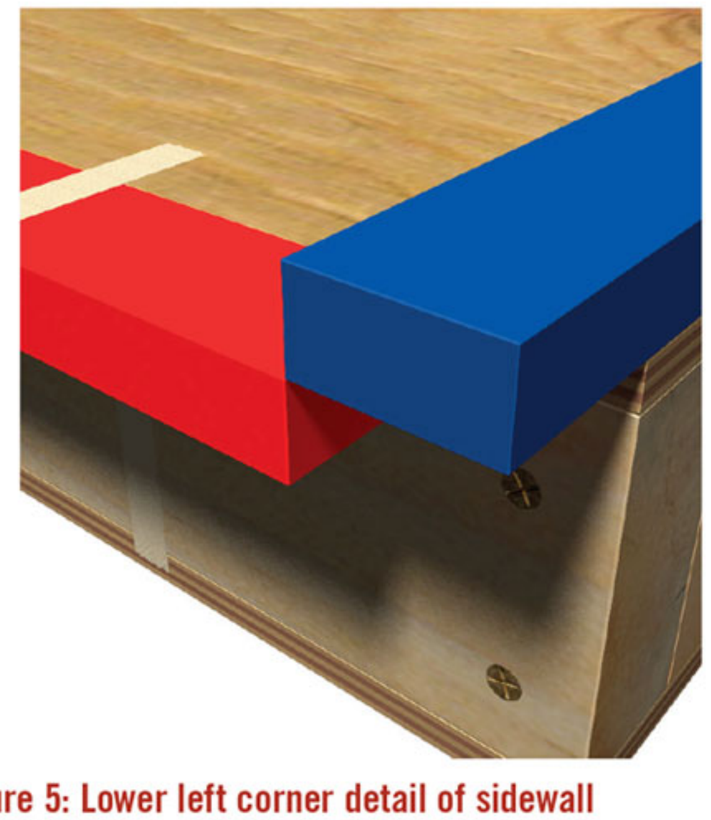


Figure 5: Lower left corner detail of sidewall layout. The red stud is taped to the base's side flush with the top, while the blue bottom

The upper frame's joints are "crowded" with screws. If you hit a screw while drilling a pilot hole, adjust the angle of the bit until it clears.

Greenhouse plastic is damaged by oil-based paint; use latex coatings only.

## Base construction

First, make a frame by cutting two 45-inch 2-by-4s and fastening them to two 8-foot 2-by-4s (shorter ends between the longer sides) using two 3½-inch deck screws at each corner (Figure 1). Next, mark three 93-inch-long 1-by-4 stringers shown in red and fasten them inside the frame at points marked on the ends using two 3-inch deck screws at each joint.

Measure the distance from the inside of one side to adjacent red stringer (10⅛ inches in our box). (Because of minor deviations in the thickness of lumber, a direct measurement is best.) Cut 14 1-by-4 blocks to that length. Measure the distance between two of the red stringers (11¼ inches in our box) and cut 14 1-by-4 blocks to this second length.

Fasten seven of the shorter blocks to the first of the red stringers using one screw at the marks. For now, leave the other end of these blocks unfastened (the end that would connect to the outside 8-foot frame). Next fasten seven of the longer blocks between the second and third stringer using one screw at the center of the stringer. Rotate these two rows of blocks (in yellow) 90 degrees as shown in Figure 3. Fasten the remaining blocks (in blue) in place using two screws at each joint. Then rotate the other two rows of blocks back into position and fasten the first row to the frame. Drill a hole in each end 2-by-4 for a 5/16-inch eye bolt 2 inches long. Locate these holes just far enough off center to miss the red stringer centered on the inside. Put the eye bolts in the holes and put washers and nuts on the inside.

Next, fasten ⅜-inch thick plywood sheets to both sides of the frame using 1½-inch screws in each corner and at the center of each side. Remove the screws on one piece of plywood and set it aside as shown. Run beads of construction glue on the top edge of all the frame pieces. Lower the plywood onto the frame; be careful that the plywood drops directly down onto the frame. Replace the screws. Place weight on the plywood.

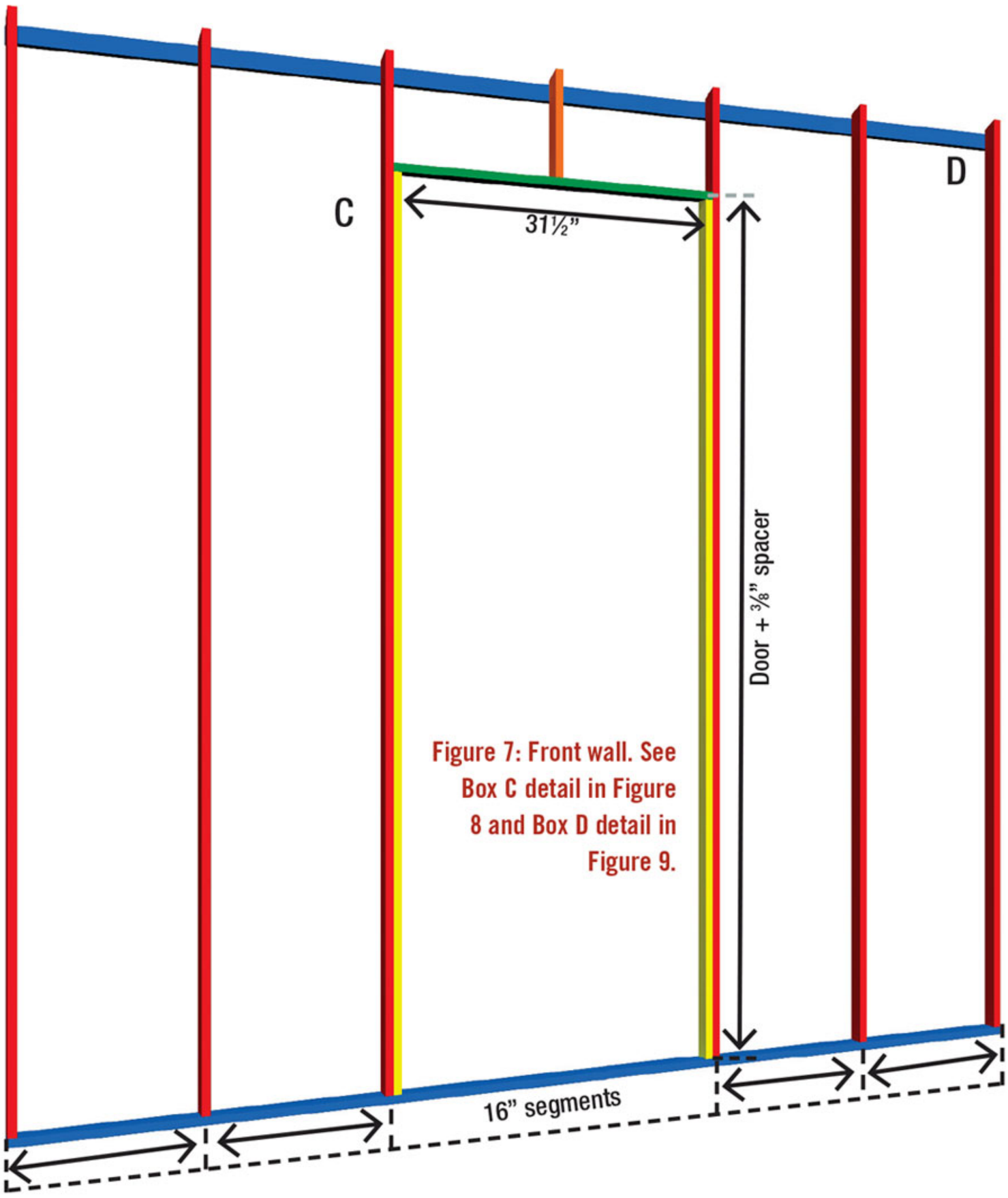



Figure 7: Front wall. See Box C detail in Figure 8 and Box D detail in Figure 9.

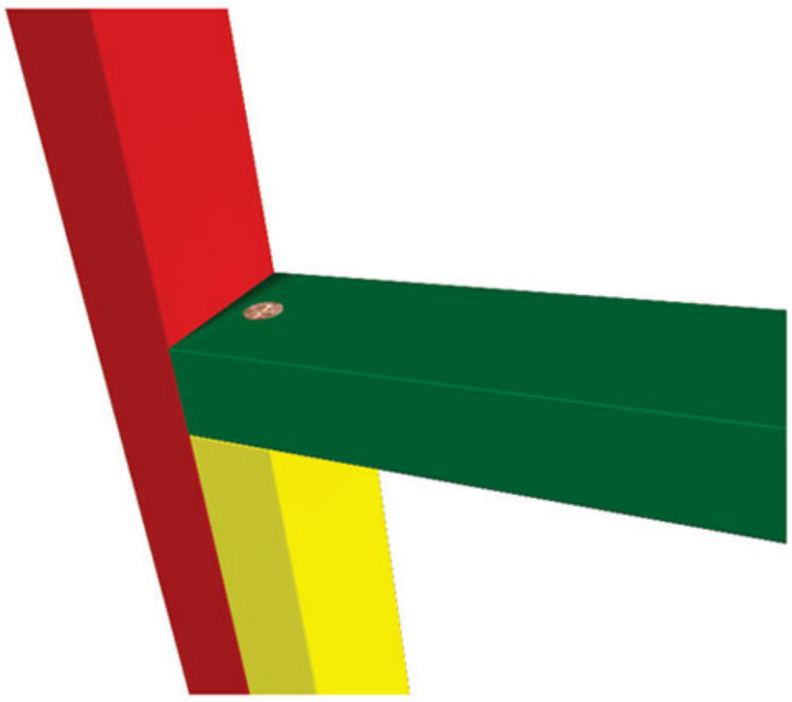


Figure 8: Attaching the door header.



Figure 9: Fine tuning the position of the front wall's top plate.

Remove the weights after the glue has cured. Turn the box over and repeat the process with the other piece of plywood.

## End wall framing

The completed base will now become a place to lay out the wall frames. Set it on a couple of sturdy sawhorses. See Figure 6 for details on the following. Make a mark on the base's edge 7 feet 6 inches from one corner. From the adjacent corner make a mark at 5 feet 6 inches. Temporarily fasten (with tape) two 8-foot 1-by-2s (future end wall studs shown in red) with lower ends 1⅜ (long dimension in 1-by-2 cross section) inches from the lower edge of the base as shown. Lay a straight edge from one mark to the other and draw a line that extends across each of the temporarily fastened future end wall studs.

Temporarily attach an 8-foot 1-by-2 (future end-wall bottom plate shown in blue) along the base opposite the diagonal line you just drew – be sure that it fully overlaps the two end-wall studs already attached to the base's sides (Figure 5). Measure 16 inches from each of the base's edges and mark the bottom plate. Position two 8-foot 1-by-2 studs (shown in yellow) on the 16-inch centers using the bottom plate as a guide, mark them for cutting using the diagonal line to determine the angle.

Lay a fresh 8-foot 1-by-2 (shown in green) with its lower edge on the 5-foot 6-inch and 7-foot 6-inch marks. Mark the 1-by-2 at both edges of the temporarily attached end wall studs (shown in red) – this will be the end-wall top plate.

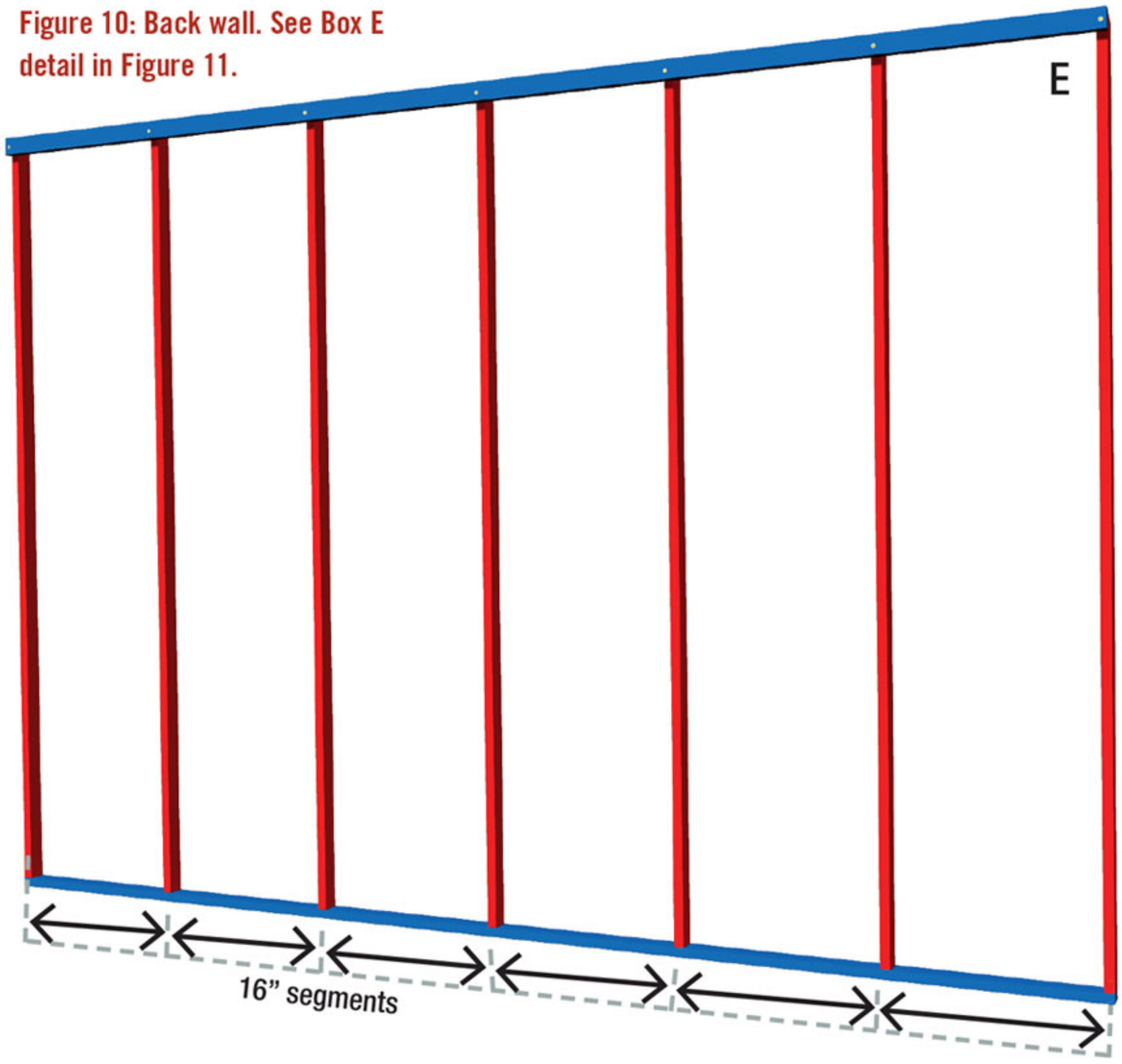
Cut the four red and yellow studs and green top plate where you have marked them. Cut blue bottom plate to length (50¾ inches) and fasten the red end wall studs to its ends using 3-inch deck screws. Drill pilot holes for all screws used to fasten the frame together. Fasten the upper ends of the red studs to the ends of the green top plate. Fasten the two yellow center studs between the upper and lower plates. Repeat this process to build the other end wall frame.

## Front wall framing

I arbitrarily assigned the taller wall with the door and window as the front and the shorter solid wall as the rear.

Lay an 8-foot 1-by-2 on the longest stud on one of the end wall frames (built in the previous section) and position one end ¾ inch (the smaller dimension of your 1-by-2) from the bottom edge of the end wall's bottom plate. Mark the top end of the 1-by-2 on both edges beneath the side wall frame's top plate and draw a line connecting the marks to pick

Figure 10: Back wall. See Box E detail in Figure 11.



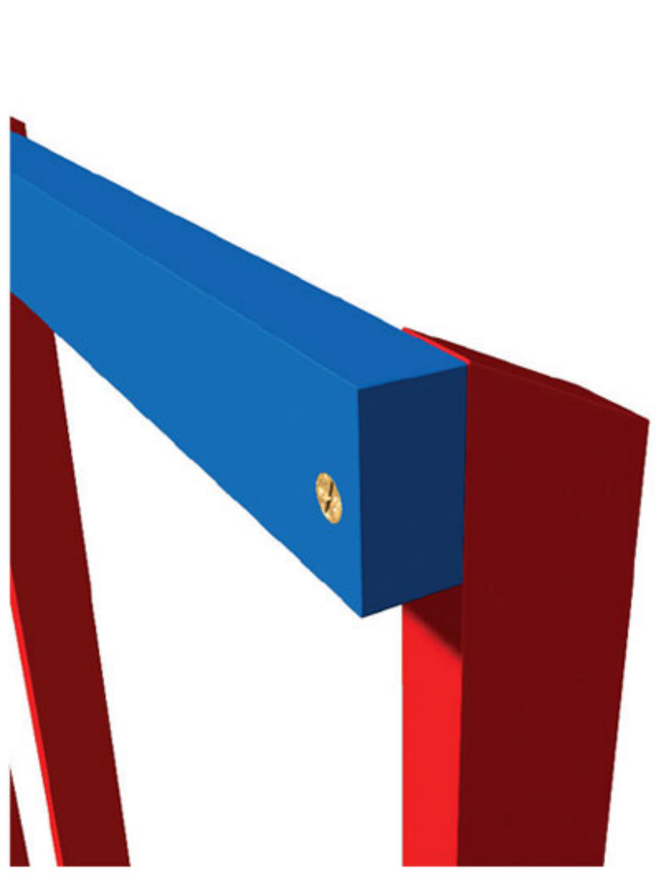



Figure 11: Top plate of back wall.

up the angle. Cut this 1-by-2 on the line to make the first front-wall stud. Using this stud as a pattern, mark and cut five more studs (shown in red in Figure 7).

Take two fresh 8-foot-long 1-by-2s and mark them at 16 inches on center. One will be used for the front wall's top plate and the other for the bottom plate (shown in blue in Figure 7). Cut a 31½-inch piece of 1-by-2 for the door header (shown in green in Figure 7). Screw the six red front wall studs to the blue bottom plate. Center your 30-inch door between the middle two – insert an approximately ⅜-inch-thick spacer between the door and the bottom plate.

Next, insert a 1-by-2 between the side of the door and an adjacent stud – be sure one end is snug against the bottom plate. Mark this 1-by-2 at the door's top and cut it and another 1-by-2 to length. Remove the door (and spacer) and fasten these 1-by-2 trimmers (shown in yellow in Figure 7) to the inside of the studs on both sides of the door opening and install the 31½-inch-long door header (shown in green in Figure 7, detail in Figure 8) on top of them. Now take a short piece of 1-by-2, set it on the door header's upper surface and against one of the adjacent studs. Mark the 1-by-2 to match the stud's angled end, cut to make a cripple stud (short studs placed between the header and top plate or between a sill and bottom plate; shown in orange in Figure 7) and screw it in place, centered above the door header.

Complete the front wall framing by attaching the top plate to the inside surface of the studs. Use a short 1-by-2 scrap positioned on the beveled end of the studs to ensure the top plate won't interfere with the rafters (Figure 9).

## Back wall framing

Lay an 8-foot 1-by-2 on the shortest stud in one of the end wall frames (see Page 86) and position one end ¾ inch (the smaller dimension of your 1-by-2) from the bottom edge of the end wall's bottom plate. Mark the top end of the 1-by-2 on both edges beneath the side wall frame's top plate and draw a line connecting the marks to pick up the angle. Cut this 1-by-2 on the line to make the first back-wall stud. Using this stud as a pattern, mark and cut six more studs (shown in red in Figure 10).

Take two fresh 8-foot-long 1-by-2s and mark them at 16 inches on center. One will be used for the back wall's top plate and the other for the bottom plate (shown in blue in Figure 10). Screw the seven back wall studs to the bottom plate as shown. Attach the top plate to the inside surface of the wall studs flush with their pointed ends as shown in Figure 11.

## Assemble the wall frames to the floor

Fasten the front and back wall frames to the base with the bottom of the wall frames even with the bottom of the base using 3½-inch-long deck screws. Fasten the end wall frames to the base, and front and back wall frames using 1½-inch deck screws (as shown in Figure 12).

Mark the inside of all wall studs at 36 inches from the floor. Measure and cut lengths of 1-by-3 to fit inside the greenhouse and screw them to the frame with their upper edges on the marks as shown in purple (Figure 12). The 1-by-3 framing will support the shelving. Square up the front wall frame with 1-by-2 diagonals shown in yellow (Figure 13).

Next, construct the vent window frame by screwing two 52⅞-inch-long 1-by-2s to one 13½-inch 1-by-2 and one 13½-inch 1-by-3 (as shown in Figure 14).

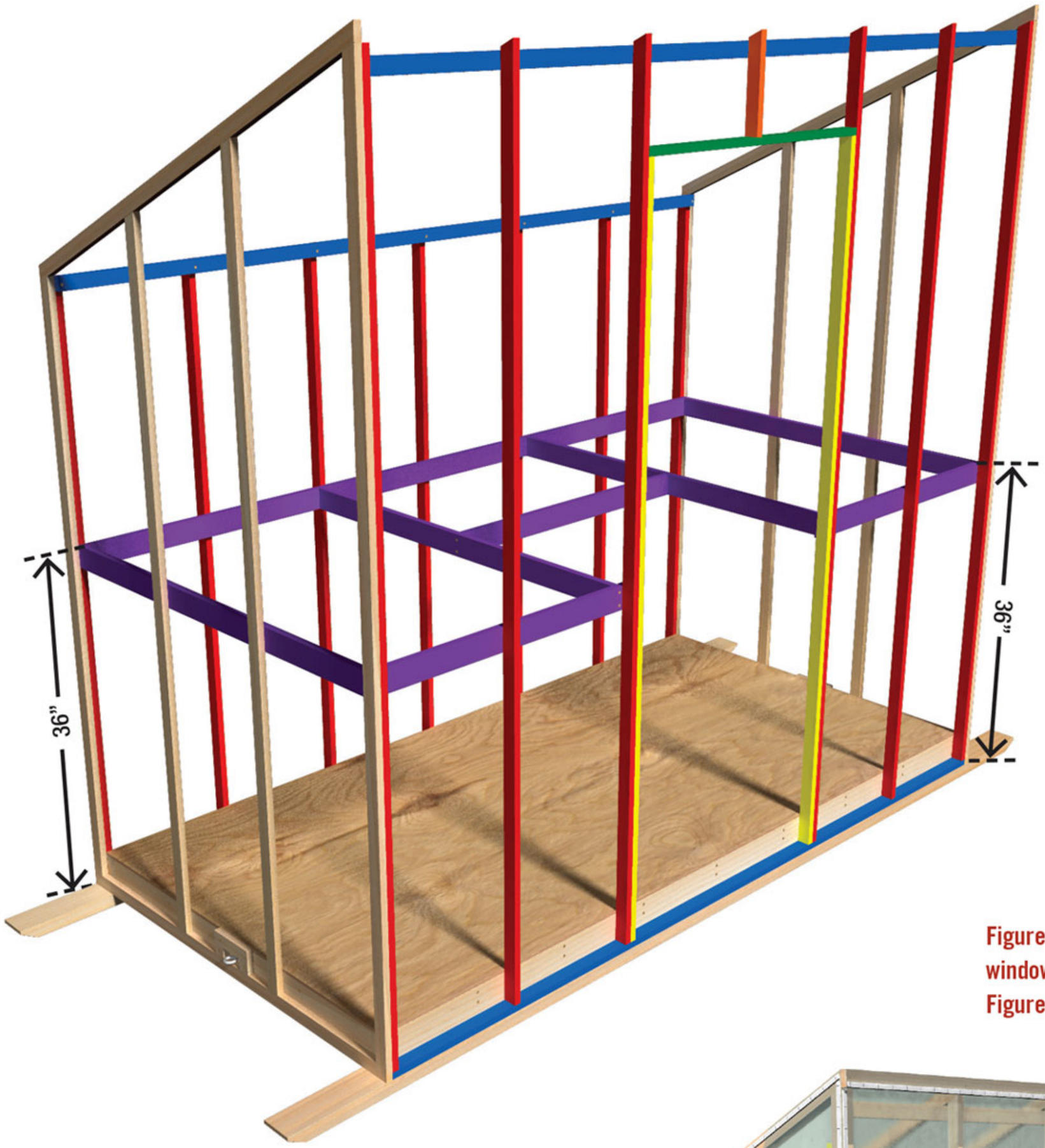
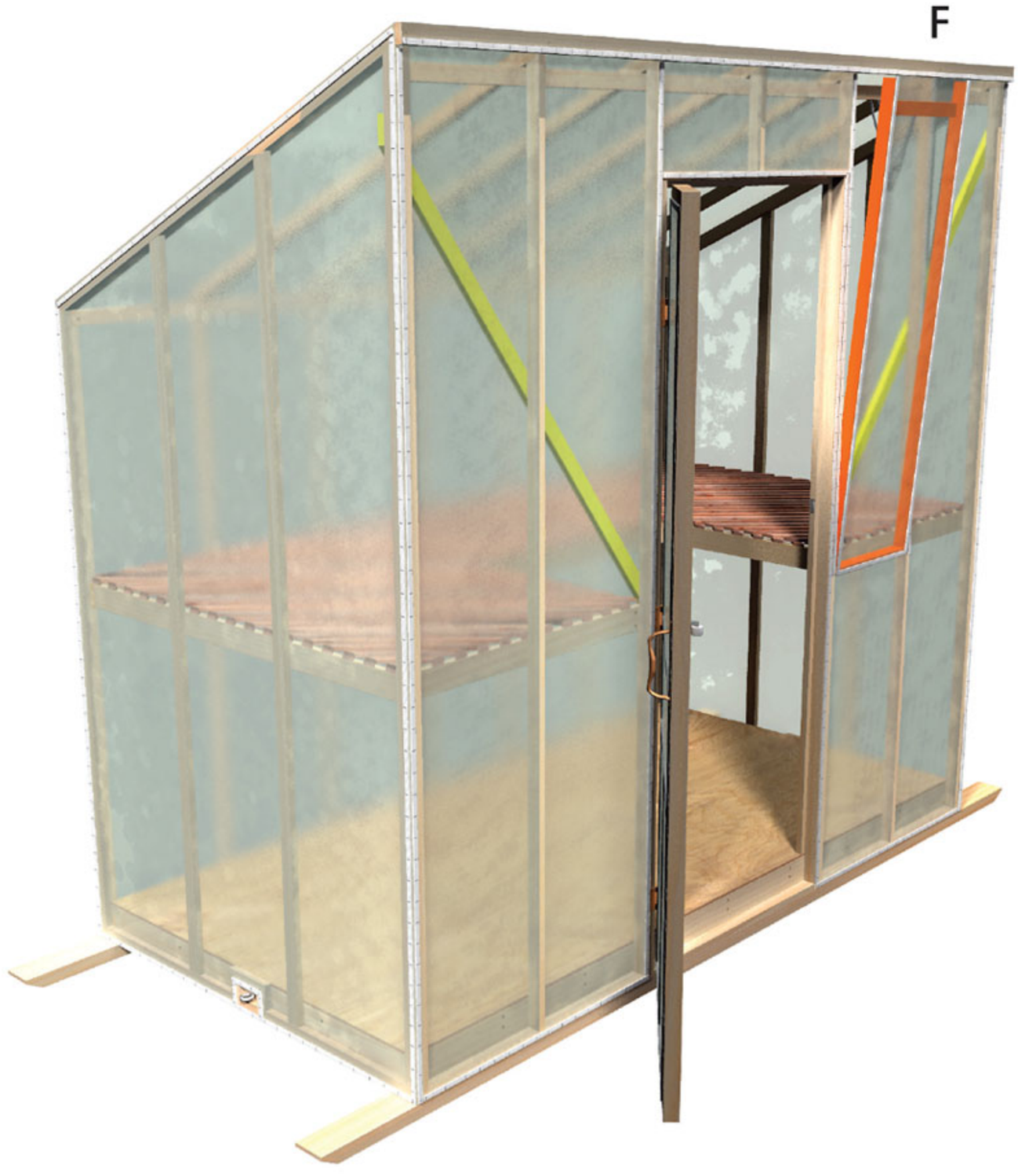



Figure 12: Walls attached and support frame in place.

Figure 13: Diagonal braces, installed vent window, and cut lattice. See Box F detail in Figure 14 on Page 89.




Place the frame in one of the openings on the latch side of the door. Fasten two hinges on the underside of the window frame and the underside of the 1-by-3 shelf support (Figure 13). Install the vent opener to the top of the window frame following the manufacturer's directions. You might need to position some blocking to complete this step.

Place the 4-by-8 piece of lattice on the support frame and cut it to fit (Figure 13). Fasten the lattice to the frame with No. 8 1¼-inch deck screws.

To create a surface for the door to seal against, measure and cut a piece of 1-by-2 that will extend from the outside of one trimmer to the outside of the other at the top of the door frame. Attach this to the inside of the frame so that it extends below the header ¾ of an inch. Measure, cut and install two 1-by-2s in a similar fashion on the inside surface of the trimmers.

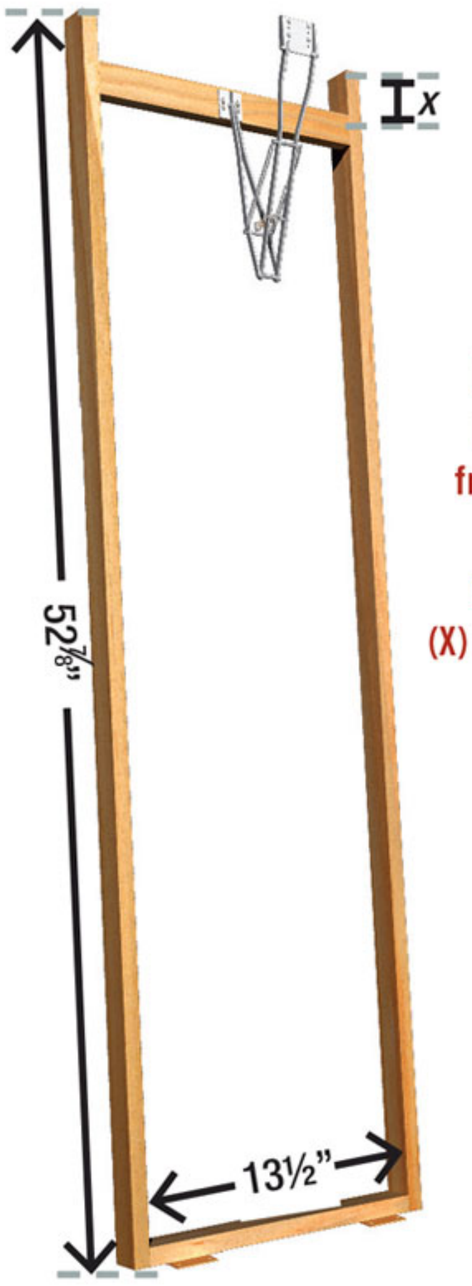
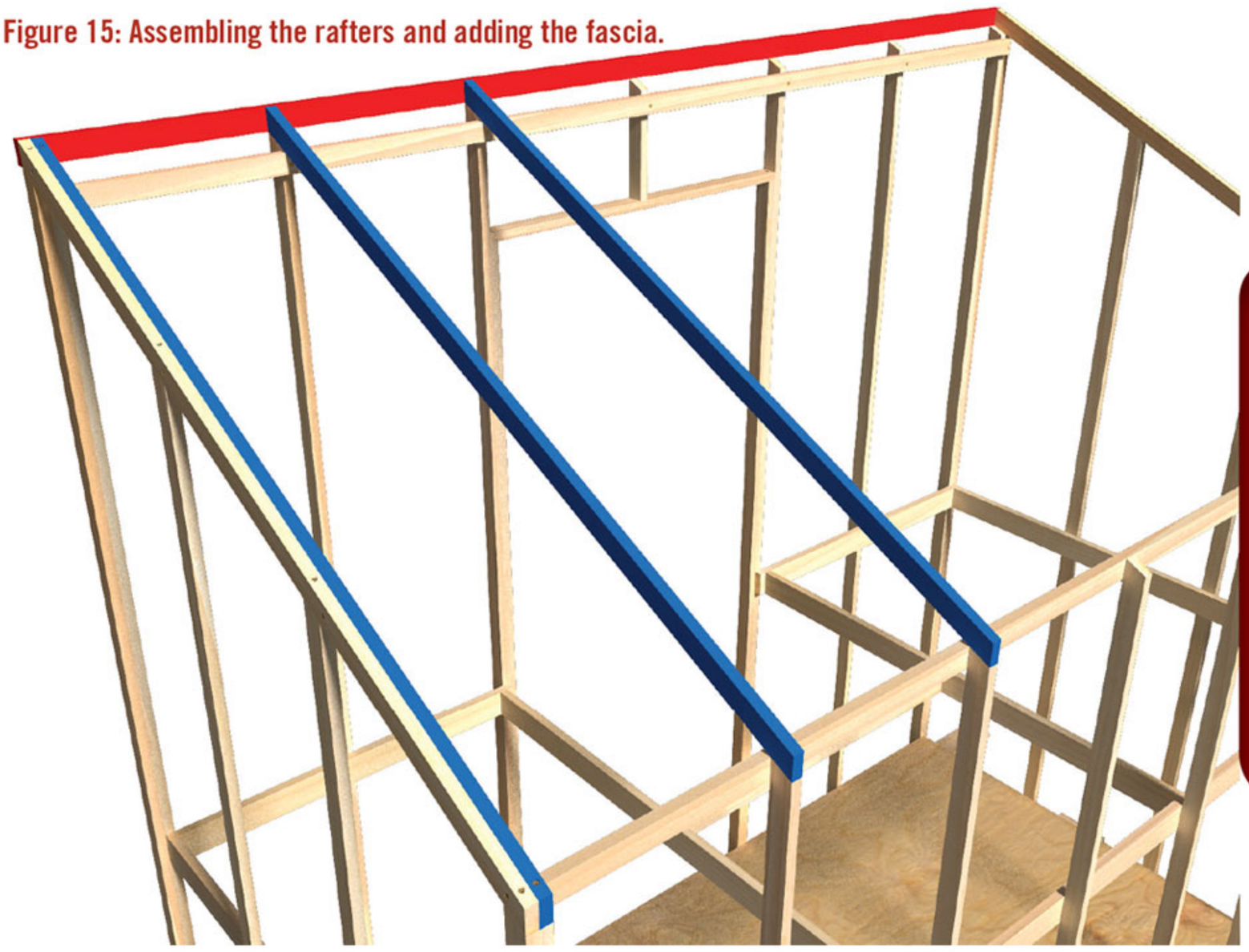



Figure 14: Box F, vent window frame. Distance of first cross piece from top (X) determined by hardware.

Figure 15: Assembling the rafters and adding the fascia.



Install your door following the manufacturer's instructions. Don't be surprised if you have to do a little trimming to get the door to fit, swing and latch correctly.

## Assemble the rafters

Position a piece of 1-by-2 directly inside and along the top plate of one end frame and trace the bevel at both ends. Cut this and six others to make the rafters. Fasten two rafters (shown in blue in Figure 15) alongside the end frames' top plates using No. 8 1½-inch deck screws.

Fasten the ends of the five interior rafters to the tops of front and back wall studs with 2-inch deck screws. Fasten a 1-by-2 8-foot-1½-inch long 1-by-2 fascia (shown in red in Figure 15) to the front ends of the rafters with 2-inch deck screws.

## Attaching plastic

Cut two pieces of plastic (about 5 feet by 9 feet) that will cover the end frames generously. Staple (sparingly) the plastic to the frame, being careful not to stretch it so tightly that the frame is distorted. Leave the excess plastic for now.

Cut a piece of plastic about 9 feet by 20 feet. Mark the center of the 9-foot dimension every 3 or 4 feet along its length. Carefully tip the greenhouse onto its front. Center the bottom edge of the plastic on the bottom of the greenhouse with the edge covering about 5 inches of the bottom (skid must be removed). Staple at the center of the bottom edge of the plastic. Then adjust the plastic so the center marks are over the center stud and the center rafter. Staple at the top of the center rafter and then sparingly along the bottom edge.

Fasten a skid to the bottom with 3½-inch screws 1 foot apart and 2½ inches from the outer edge. Gently stretch the plastic over the greenhouse and staple onto the end frames, alternating sides to pull the plastic evenly.

Tip the greenhouse in the other direction far enough to make the other bottom edge accessible. Gently stretch the plastic over the edge of the bottom and staple. Fasten the other skid to the bottom. Finish fastening the plastic; wrap it around the corners and staple on the end wall.

Staple batten tape around the perimeter of the end walls (Figure 16). Then carefully trim the excess plastic. Staple batten tape on both sides of the perimeter of the door and window. Slit the plastic along the outer edge of the door and window between the two sets of batten tape and add a slit for the door handle (see Figure 13).

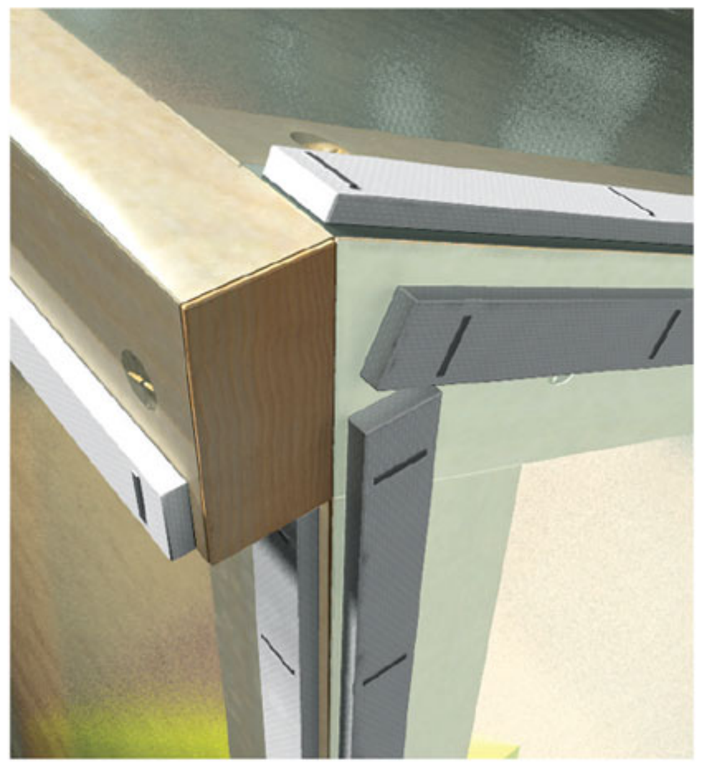


Figure 16: Batten tape installation detail on front right corner.

## Good growing

Once completed, your greenhouse will supply years of service with little maintenance, and you can use it to extend your growing season at both ends. Since it's mounted on skids, you can move the greenhouse around the yard or garden with ease, and slide it into your barn or shop for winter or to replace the plastic and touch up the paint. My greenhouses have given me plenty of good growing. I know yours will, too.


# Build a ROOT CELLAR

**These unique plans show you how to build a root cellar for food storage by adapting a new concrete septic tank.**

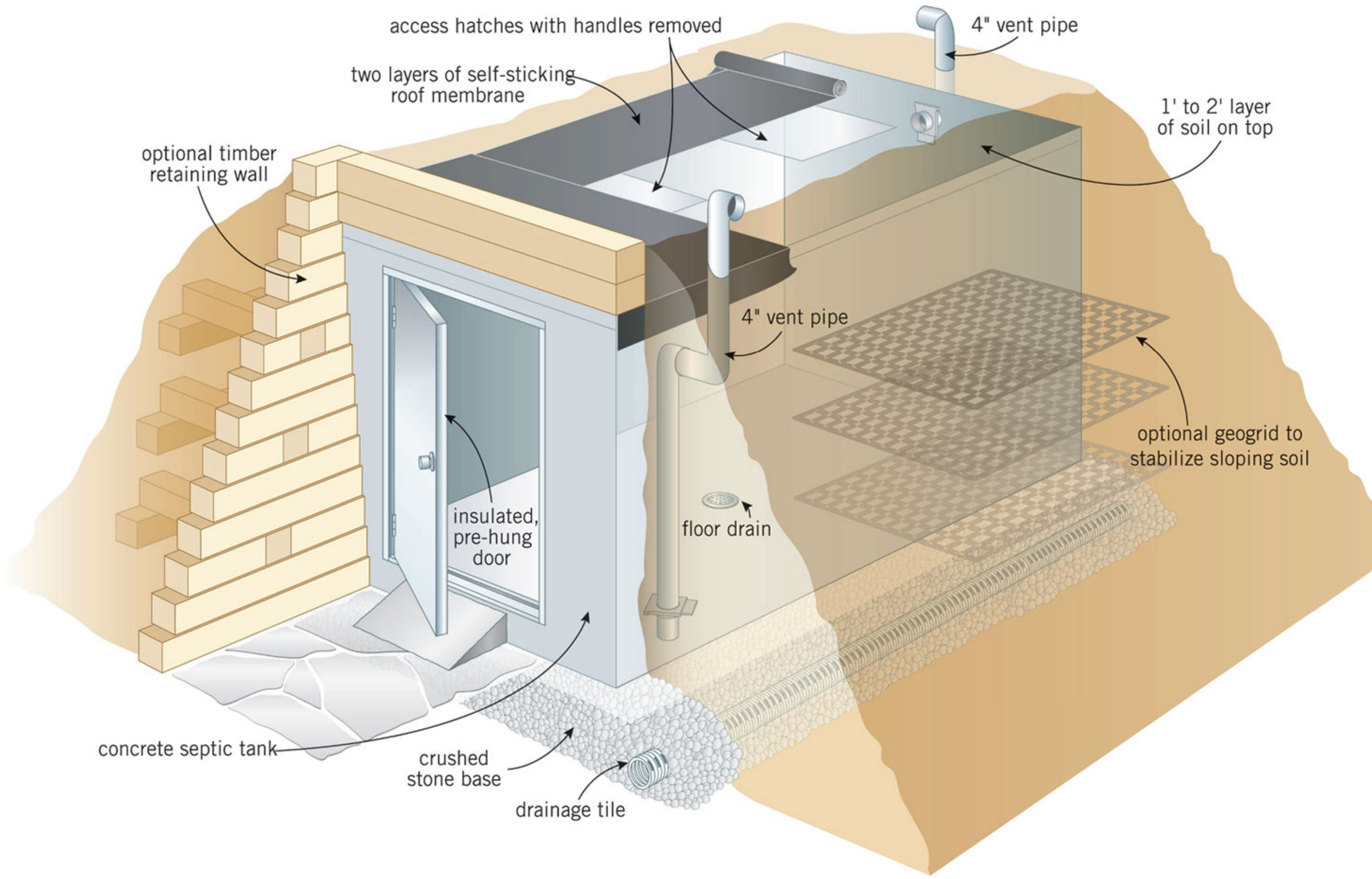
By STEVE MAXWELL

The cool, moist and dark conditions of a root cellar make it the perfect place to keep many fruits and vegetables crisp, fresh and delicious for weeks – even months – of storage. And while there are myriad ways to store vegetables, our innovative root cellar plans show you how to build a root cellar by modifying a new, precast concrete septic tank.

By following these plans, you'll cut an entrance, install a door, add a pair of vent pipes and cover the tank with soil to bring an old-fashioned, walk-in cellar into your modern life – just outside the back door – for any number of storage purposes.

## Choose a concrete septic tank

You'll want to buy an unused septic tank for this root cellar design, but look for a deal to avoid paying full price. A percentage of all precast concrete septic tanks end up with small manufacturing defects that prohibit them from being used for sewage treatment. Suppliers sometimes offer discounts on these flawed tanks. As long as the tank is solid and sound, a chipped edge or a patchable hole won't prevent it from being a root cellar. You won't need the plastic fittings or effluent filter found inside most septic tanks, so ask the supplier to remove these before delivery.




**Keep your root cellar dry with roofing membrane on top and a perforated drain pipe to direct water away from the base. OPPOSITE: Make this root cellar by burying a new concrete septic tank into a hillside.**

Tank size is another detail you'll need to consider when planning how to build a root cellar from a septic tank. The capacity of septic tanks is measured in gallons, with different models being taller or shorter. While you might be tempted to buy a 1,000- or 1,200-gallon tank because they're common, you'll get more food storage space and headroom with a tank that's 1,500 gallons or larger. Standard 1,500-gallon tanks typically measure about 5½ feet wide by 5½ feet tall by 10 feet long, while a 2,500-gallon tank provides more than 6 feet of interior headroom. Don't choose a low-profile tank because it will be much too short to work in. Prices for new, undamaged 1,500-gallon tanks start at about $1,100, and 2,500-gallon models can be found for as low as $1,600. Discounts for damaged tanks may be as much as 50 percent.

Most septic tanks have an internal partition that must be opened or removed to build from these root cellar plans. Try to find a tank without a partition, or ask your supplier to remove it before delivery. You can also punch through the partition yourself as part of the doorway-cutting process.

## Best sites for root cellars

The perfect location for a root cellar is nestled into an existing soil bank in a well-drained location 10 to 20 yards from your house. Ideally, the door should face north to keep out the sun's heat. You'd be fortunate indeed to have all of these conditions, and most people have to modify their sites. Expect to pay from $50 to $100 per hour for a backhoe and operator to excavate your site for three or four hours.

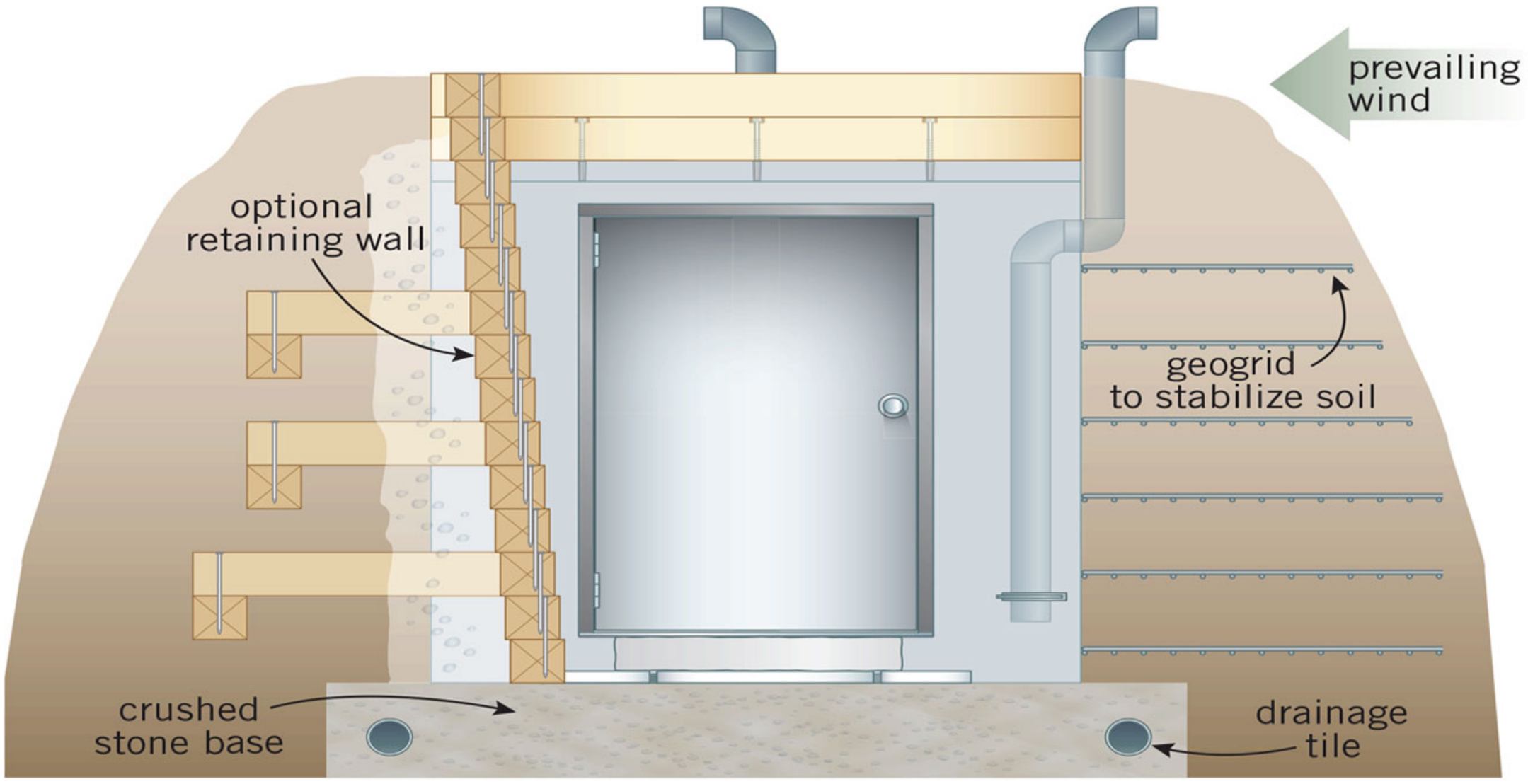
Spread a 1-foot-deep bed of ¾-inch-diameter crushed stone beneath the excavated tank site and the planned entryway to support foot and wheelbarrow traffic. Crushed stone is easy to move around to make a level surface for your tank. Suppliers usually offer a delivery service using a boom truck to set down the tank wherever you want. Check the tank with a 48-inch level after the boom-truck driver has set it into place. If the tank isn't level, have the driver lift the tank so you can get a rake underneath to move the crushed stone. Keep setting, checking, adjusting and replacing the tank until it sits flat and level.

## Install a door and vents

The tank should be in its final position before you cut the door opening, because removing concrete could weaken the tank enough to cause damage if it were moved again. Use a level and pencil to mark a rough opening on the end opposite the effluent pipe hole. Locate the bottom of the door 4 inches above the floor to keep dirt and rainwater out of the cellar.

A concrete-cutoff saw is the tool of

LEN CHURCHILL ILLUSTRATION (2)




FRONT VIEW

Stabilize soil at the root cellar entrance with a timber retaining wall anchored by T-shaped tiebacks, or with horizontal bands of geogrid.

Building a root cellar, no matter the design, helps you preserve more food for your family.

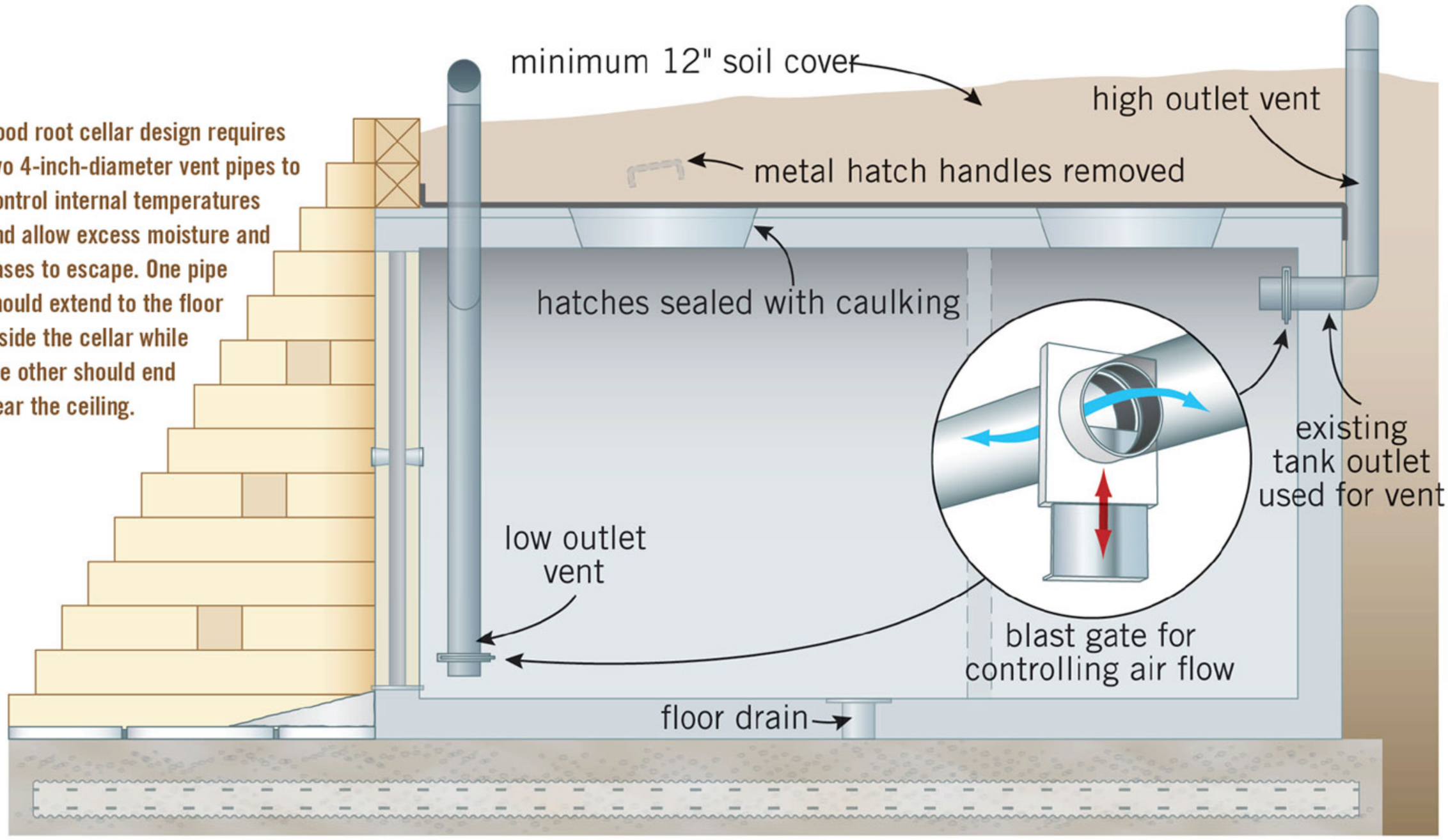
choice for making a door opening (see "Cutting Concrete" on Page 93). Set up a large work platform a couple of feet lower than the tank's top, don eye and ear protection, and recruit a second pair of hands to hold the masonry saw from above as you move along the top horizontal cut line. Make the two vertical cuts next, then tackle the horizontal cut across the bottom. Leave a small amount of concrete uncut in the upper corners to hold the slab in place until you're ready to bust it into the tank with a sledgehammer. Repeat this process to remove the inner partition if your tank still has one.

You can make your own root cellar door out of wood, but getting it to seal well will be difficult. Consider using an insulated steel residential door pre-hung in a frame. Exterior steel doors provide exceptional seals. Choose one without a window because darkness is essential for maximizing the storage life of produce.

Good root cellar design requires two 4-inch-diameter vent pipes to control internal temperatures and allow excess moisture and gases to escape. One pipe should extend to the floor inside the cellar while the other should end near the ceiling. This difference in height encourages air circulation. All septic tanks have a hole for a 4-inch pipe at one end, which will work for a ceiling vent, but you'll need to bore a hole somewhere else for the longer vent that extends down to floor level – just inside the door is best. While you're at it, bore a 4-inch drain hole in the floor so you'll be able to hose out your root cellar.

## Finish the roof and backfill

The tops of concrete septic tanks have access hatches that must be sealed. Apply




SIDE VIEW

a generous bead of polyurethane caulking around the perimeter of the hatch openings and close the hatches for the last time.

Next, use a hand-held grinder to cut off the hatches' protruding metal handles.

Now that the tank is flat on top, you'll need to apply a watertight barrier to prevent roof leaks. Use a heavy, self-adhering water-and-ice shield designed to be used as roofing underlay.

The best shields are thick and have a peel-and-stick adhesive backing – my favorite products include Blueskin self-adhesive water-and-ice barrier, and Grace water-and-ice shield. Apply two layers of shield that extend over the top in overlapping sheets and fold down the sides 4 inches lower than the joint where the tank's top and sides meet.

Because your tank will be tucked into the earth, you'll need a secure way to hold back the soil at the entryway. The illustrations show how to build a root cellar retaining wall using 6-by-6 timbers, with a lintel across the top to stop backfilled soil from falling down over the door.

Find instructions on building a timber retaining wall anchored by T-shaped tiebacks in the article, "How to Build a Retaining Wall With Crossties" (http://bit.ly/1g8zI9U).

Another option is to construct a retaining wall using interlocking concrete blocks. Retaining walls ensure the best cellar performance in cold climates because they maximize the amount of soil contact on both sides of the door, and soil's insulating factor is what stabilizes the temperature inside a root cellar and makes it suitable for storing vegetables.

If your climate doesn't experience severe winters, an easier alternative involves banking up the soil as steeply as possible on both sides of the doorway while leaving some of the front wall exposed.

Instead of building a tall retaining wall, you could install horizontal layers of geogrid (a polymer material used to reinforce soils) in the dirt as you backfill around the door, building as steep a slope as possible.

Haul in soil and spread it around the sides and top of your tank. Because backfilling by hand is hard work, you'll probably want to hire the backhoe and operator for several more hours. Sandy, light soil is best for backfilling because it reduces soil pressure on the sides and top of the tank, drains better, and is easier to shape and contour. Aim for a layer of 1 to 2 feet of soil on the roof.

Plant grass on the backfilled soil, build shelves and bins inside your cellar, load 'em up with your healthy, homegrown foods – and you're finished with these root cellar plans. Money can't buy the feeling of security and satisfaction you'll get from a winter's worth of good eating sheltered by your own root cellar.

*Author Steve Maxwell co-authored* The Complete Root Cellar Book, *available at www.grit.com/store.*

## CUTTING CONCRETE

**These root cellar plans require you to cut through the walls of concrete septic tanks. To do so, you'll need to rent or borrow a gas-powered masonry cutoff saw spinning a 14-inch-diameter diamond wheel to make the door opening, and an electric rotary hammer with a 4-inch carbide coring bit to bore vent and drain holes. Be sure to use a saw that accepts a garden hose because water injection will tame the clouds of dust. The rotary hammer with coring bit needs no water. Septic tanks usually have reinforcing rods embedded in the concrete, so ask for a coring bit and masonry blade that can handle metal.**

CLOCKWISE FROM LOWER LEFT: FOTOLIA/TAMAS ZSEBOK; LEN CHURCHILL ILLUSTRATION (2)

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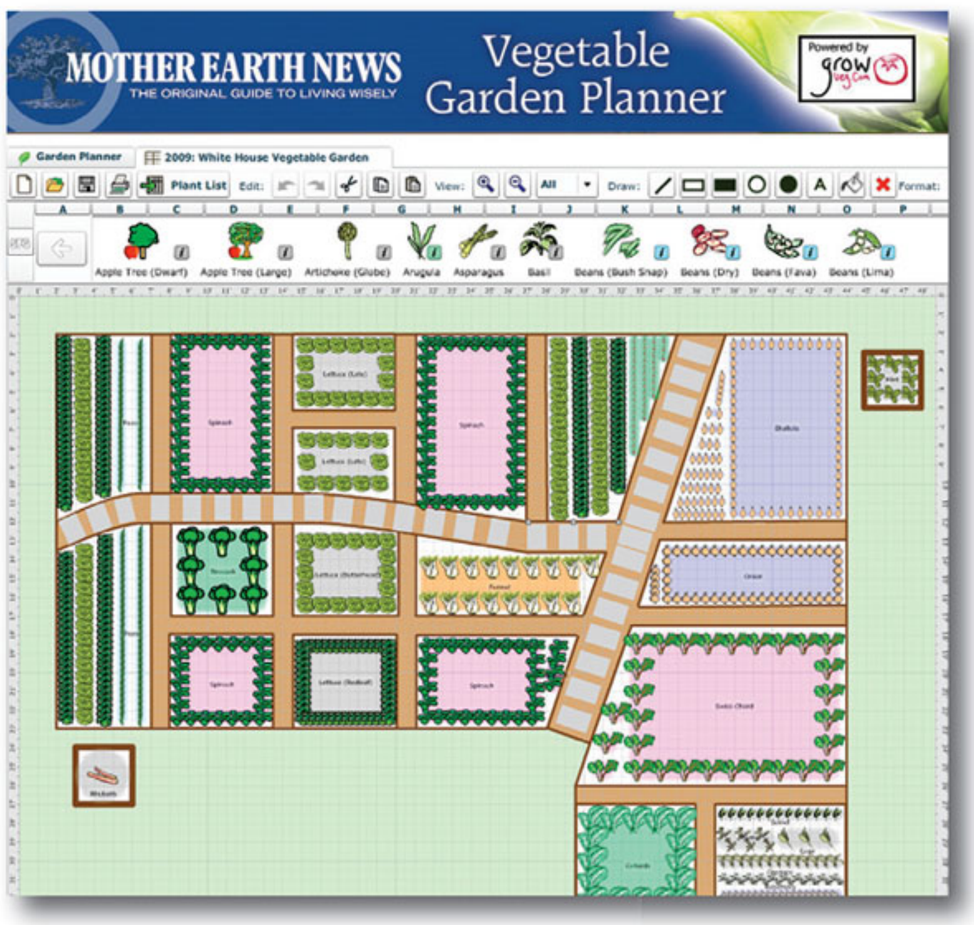



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Large Project

# Homemade Wind GENERATOR

## Providing your own power with a wind generator might not be as complicated as you think.

By ROBERT D. COPELAND

Are you headed for the beach or going camping in the mountains? Maybe you live on a boat, often visit a remote cabin, or you're living off-grid. Electricity is yours for the taking as long as the wind is blowing .... and you can get it on the cheap with an easy homemade wind generator. Light up that storeroom or barn, or use the generator to keep all your vehicle batteries charged as well.

My off-grid cabin's electricity comes from solar and wind power, stored in 6-volt golf cart batteries. A charge controller and battery minder keeps my system from under- and overcharging. The whole shebang cost less than $1,000, and I have lights, fans, television, stereo, refrigeration, and a disco ball for special occasions.

If you can turn a wrench and operate an electric drill, you can build this simple generator in two days: one day of chasing down parts and one day assembling the components.

The four basic components include a GM pickup truck alternator ($40 new), a GM fan-clutch assembly ($35 used), the bracket for mounting the generator on a tower or pole ($25 galvanized pipe and fittings version), and a tower or pole ($20 for 15 feet of 2-inch tubing, used).

If you're a Ford guy or a Mopar gal that's fine, just make sure the alternator has a built-in voltage regulator.

You'll also need some electric cable or wires to hook it up to your storage battery. I used 8-gauge, three-strand copper wire pilfered from the oil patch. (And they said the transition from fossil fuels to renewables would take years. Pfft!)

### My wind generator parts list

**Car/Truck Alternator** – GM 1988, 350 motor, alternator with built-in regulator (used in illustration). Almost any alternator with a regulator will work, but use a new one. It should have a warranty.

**Car/Truck Fan Clutch Assembly** – GM 1988, 350 motor – used.

### Bracket assembly for mounting alternator/fan

If you have a welder, making a bracket is simple. I used 1-inch square tubing for all the bracket pieces and a 2-foot-long piece of 1-inch pipe for the rotating stem that fits inside the pole. If you don't have a welder, fear not. The Bracket Assembly can be fitted up with ½-inch galvanized pipe and fittings. Here's a list of the pipe fittings you'll need:

- ½" tee (5X)
- ½" elbow (2X)
- ½" x 12" nipple (2X)
- ½" x 6" nipple (2X)
- ½" x 1½" nipple (2X)
- ½" x 2" nipple (2X)
- ½" x Close (2X)

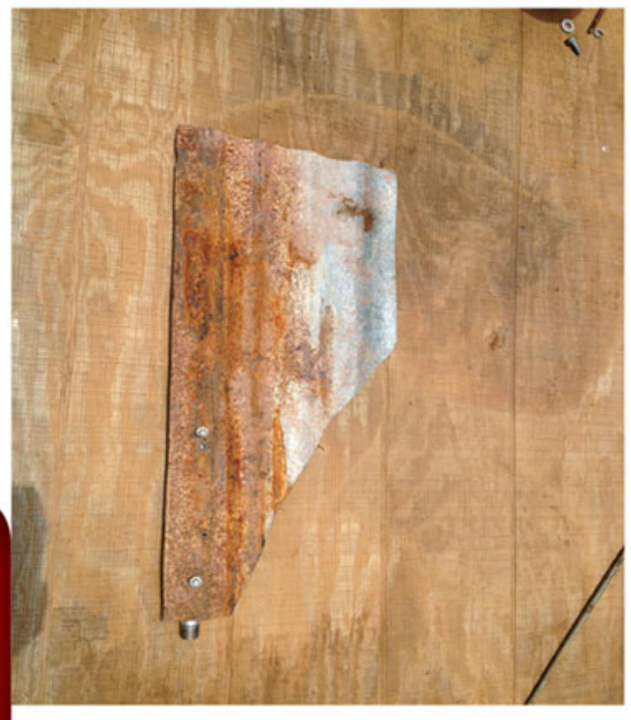
A tail fan to spin the generator around to line it up with the wind's direction must be attached to the 12-inch nipple at the back of the bracket. Cut a fan out of old tin siding or roofing with tin snips or a cutting torch. A right angle triangle shape works best. Drill three holes in the nipple.

Use self-tapping screws (steel roofing screws work well) to affix the tail to the nipple. (See photos on Page 96.)

### Tower/pole

I used an old TV television antenna tower 20-feet tall with a 2½-inch-diameter pipe top piece. You'll also need a stop at the top of the tower which lines up with the stop on your bracket assembly. This can be welded or bolted onto the tower. The stops will only allow the generator to turn 360 degrees clockwise and counterclockwise so your cable doesn't get twisted around and around the pole/tower.

A joint of 2⅜-inch oil field tubing anywhere from 10 to 20 feet in length (height) attached to a building or bolted to your truck bumper makes a good tower. Make sure it is secure, and you may need to use guy wires. If you aren't sure how to mount the generator,



CLOCKWISE FROM TOP LEFT: Use self-tapping screws to affix the tail to the nipple; a lock washer needs to be added for each bolt in the assembly for the alternator shaft; a car/truck fan clutch assembly is needed for the generator; along with a car/truck alternator; the completed wind generator; and a view of the assembly from the back, before the tail has been added.
PREVIOUS PAGE: The completed wind generator in place on the tower.

send me a message and I'll try to help (*rdcopelandjr@yahoo.com*).

## Fan clutch to alternator attachment

The fan clutch hub can be welded directly to the alternator hub, just make certain the fan is perfectly straight and in line with the alternator shaft. Make sure the alternator's built-in wire plug ins are located on what will be the bottom of the generator.

If you don't have access to a welder, create a union from the 3-inch washer and four bolts, which will fasten the two major components together.

Drill four holes to match the holes in the fan clutch. Use a ¼-inch tap to cut threads in the holes. Unscrew the alternator pulley nut, and remove the pulley and small fan. Slide the union over the alternator shaft – bolts pointing away from alternator – then reattach the alternator fan and nut onto the shaft (leave pulley off). The large nut will hold the union in place.

Attach the fan clutch assembly to the bolts now protruding from the alternator. Tighten nuts with lock washers in place.

## You'll need:

- 3" washer, 3⁄16" thick, 5⁄8" hole
- Electric drill
- ¼" steel drill bit
- ¼" thread tap
- ¼" x 1½" to 2½" bolts (4) and lock washers (4)

(To determine length of bolts, stack the fan on top of the alternator with both shafts in line, fan pulley on alternator pulley. Measure the length along the two shafts from back of alternator fan to back fan clutch hub. Use this length for the bolts.)

Once you have all the generator components fastened together, mount it on your pole or tower. Insert the pipe on the generator inside the larger pole pipe (or the top of your tower). Use two steel washers together to create a bearing between the generator and tower for a smooth surface for the generator to pivot 360 degrees. Attach the positive and negative wires to the alternator and secure with zip ties, baling wire and/or duct tape on the bracket and along the tower. It isn't really homemade unless it has a little baling wire and duct tape on it somewhere, now is it?!

You'll need assistance standing the tower and generator upright as it will be pretty heavy. Ropes and a come-along will help if you're going up fairly high. If it's always windy in your location, you only need to be high enough off the ground to keep the moving parts safely overhead. Securely fasten your tower in place. The wind can be deceptively strong so do not cut corners on this final assembly stage.

Now that you've erected the wind generator, connect the wires to your battery(ies) with a charge controller in between to prevent over-under charging. Now you're ready to hit the lights, crank up the jams and bust out those old disco moves I know you've been saving up for an electric slide on the beach with your family and friends.

Build and use at your own risk. You are responsible for your work. Good luck and power up!

RD Copeland (7)

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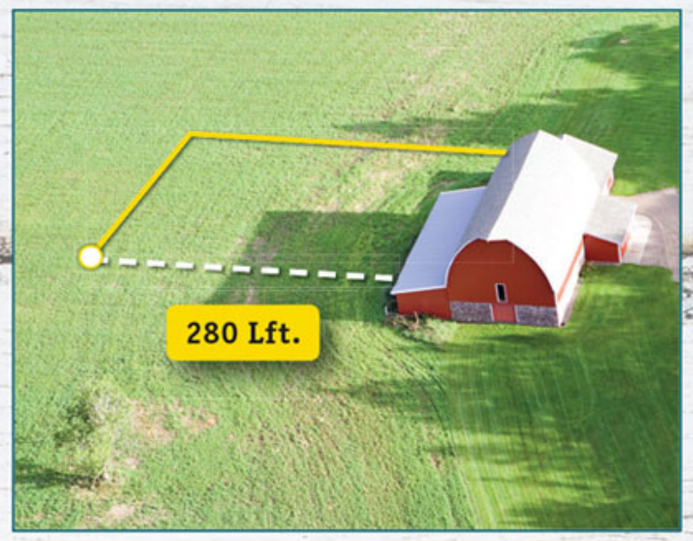


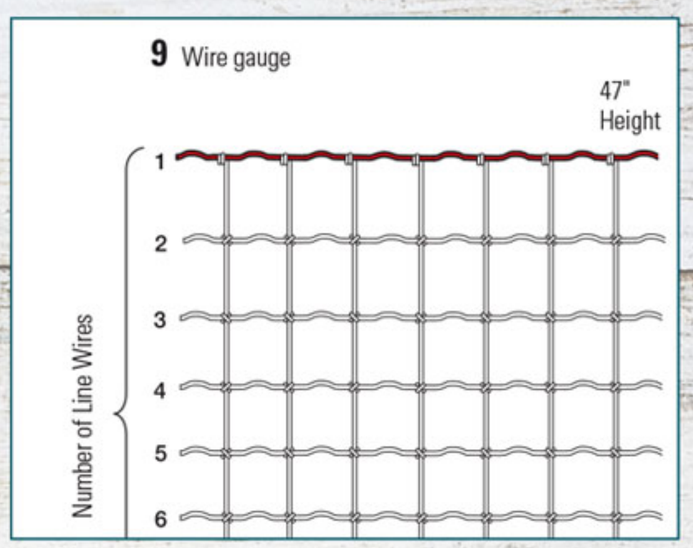


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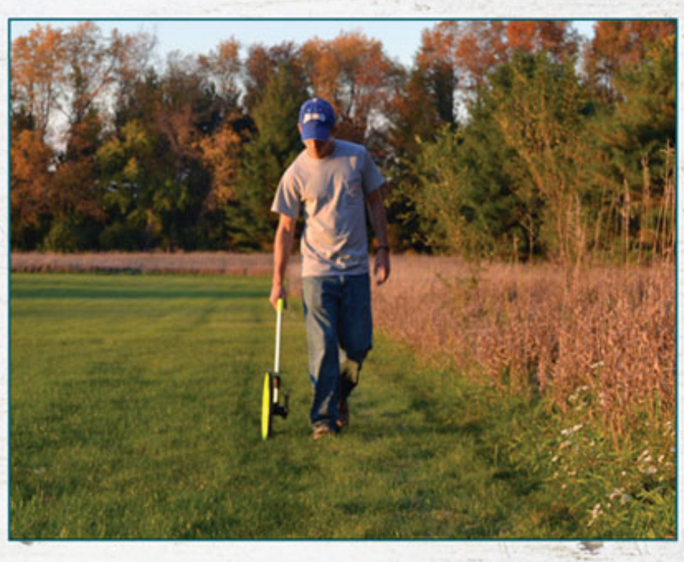

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