

Portable pens for pastured poultry: designs that beat heat, wind, and rain

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Summary: proper pen design makes the difference between pastured poultry failure and success.

One of today's **most profitable small-farm enterprises is pastured poultry**. Clean conditions and a more natural diet produce extra-tasty birds and eggs that can be sold direct to consumers for a premium price. Inspired by Andy Lee's book *Chicken Tractor* and Joel Salatin's *Pastured Poultry Profits*, producers across the country are raising broilers in portable open-bottomed pens that get **moved to fresh pasture daily**.

Proper **pen design** is vital to success. The main factors:

- **Easy to move.** Salatin estimates that at least 75% of the people who try and abandon pastured poultry build pens that are too hard to move. Solutions include lightweight construction (but not too light, or the pen blows away), plus dollies, wheels, skids, or PVC pipe bottom rails. (Unlike wood, PVC slides and jumps over grass clumps.) Hanging waterers and feeders save time because you don't have to take them out before moving the pen.
- **The right size.** The smaller the pen, the easier it is to move but the more work per bird. Salatin's 10 x 12 x 2' (3000 x 3700 x 600 mm) pen stocked with 75-100 broilers seems to be a good compromise. Large pens moved by tractors run over too many birds.
- **Prevents heat deaths.** The combination of high temperature, high humidity, and still air can kill birds, especially broilers near slaughtering age. Solutions include shade (one grower throws bed sheets bought at a thrift store over his cage roofs), good ventilation, and reflecting the heat before it gets into the pen. In drier areas, a soaker hose across the roof can provide evaporative cooling.

Wilma Keppel



Chicken tractor built by students at Shasta College in Red Bluff, California. Too small for a commercial broiler pen, this design would work fine in a garden.

Designs that work well in milder climates can fail in the extreme weather of the Midwestern U.S. One Wisconsin grower lost over half her birds in Salatin-style pens during a 110° F. (43° C) heat wave. Others have lost batches to **drowning and chilling** when downpours left rain standing on the ground or running across the pen bottom. I spoke to growers across the Midwest to find out what works there.

Salatin pen

The vast majority of growers use some variation of **Salatin's pen**. This 10 x 12 x 2' (3000 x 3600 x 600 mm), U.S. \$200 cage is moved by slipping a dolly under the back, then pulling a handle on the front. While it can withstand sustained 100 m.p.h. (160 km/hr) winds, many women find this 200-pound (90 kg) design too heavy to move. In windy areas, hinge or bungee the set-in-place sheet metal door to keep it from blowing into the next county with every storm.

Build the **frame** from **lightweight lumber** -- either cheap pressure-treated softwood one-by-sixes (not deck wood), or cedar. Cedar is lighter than pine, rot-resistant, and nontoxic ("pressure-treated" lumber contains poisonous arsenic and copper compounds). It may also cost less than pine. Sort through the sticks to find good ones, rip them into one-by-threes, and then assemble with plenty of drywall screws. Give cedar a liberal coating of construction adhesive on all joints, as it holds nails less securely than fir or pine.

Salatin recommends covering pens with **corrugated aluminum roofing**, which is lighter than steel but at twice the price can double the cost of a pen. Aluminum must be special-ordered in some areas. **Lightweight corrugated steel** is a good substitute, but standard corrugated is much too heavy. A few growers build with used aluminum printer's sheets or aluminum scrap from house trailer manufacture.

On a still 90° F. (32° C) day, bare aluminum or galvanized steel can reach 170° F. (77° C) in full sun. Drop the temperature to 110° F. (43° C) by using sheet metal with a baked-on white finish (the most durable), or by coating it with reflective white roof paint or even house paint. One grower throws white bed sheets over his pen, while another in a hot part of Mexico adds a cloth roof with airspace to shade the metal tops of his pens.

Instead of sheet metal, you can cover roof and sides of your pen with **tarps, canvas, or lumber wrap**. These don't reflect as much heat as metal, and on a flat roof will sag and collect water which invariably ends up dripping on the chicks below. Solve both problems by **peaking the roof** (one foot/300 mm is plenty) and covering the triangles under the roof with wire for extra ventilation.

Ventilation has been a problem for many Midwestern growers. Salatin jacks the back of his pens a few inches off the ground in hot weather, but that's **inadequate for Midwestern heat waves**. Various growers have **modified their pens** by removing the metal sides, fastening the metal back panel only at the top and propping the bottom open when temperatures rise, or leaving it off entirely. Tarp sides can be rolled up in hot weather.

U.S. lumber sizes

U.S. construction panels (plywood, etc.) usually measure 4 x 8' (1220 x 2440 mm).

Construction lumber is measured by actual length in feet, plus approximate dimension in inches: two-by-four, two-by-two, etc.

"Two-by-four lumber" has shrunk from 2 x 4 inches (51 x 102 mm) in 1900 to a nominal 1-1/2 x 3-1/2" (38 x 89 mm). Low-quality lumber shrinks as small as 1-3/8 x 3-1/4" (35 x 83 mm).

Several growers reported **problems with poultry mesh**. Predators can pull it off, big dogs charge right through it, and it rusts out in a few years. **One-inch (25 mm) welded wire** yields a much stronger pen. Fasten with electrician's staples or heavy netting staples, not a hand stapler.

Salatin's pens require a dolly to move. His dolly has 8" (200 mm) wheels that slip inside the pen. During the instant the pen is raised, small chicks can pop out or run under the side of the pen and get smashed. This led several growers to modify their dollies to **keep the wheels outside**. One substituted a portable axle that fits into brackets on the back of each pen. Others slip wheels onto bolts run through the pen frame. If predators start reaching under the walls, take the wheels off at night.

One grower cut **PVC pipe** in half and wrapped it around the bottom boards of his pen sides to make smooth **runners**. This allows his pens to be dragged without a dolly, but does leave a 1" (25mm) gap under the ends. Broom bristles mounted on the back of these pens make a sound that herds the birds forward as the pen is moved.

Salatin pen variations

Growers across the country are adapting Salatin's pen to their conditions. Brad Jepson uses **peaked roofs** to keep heavy Nebraska rains from dumping water in his pens. To bend the metal panels over the roof peak, he simply cuts the ribs, folds the panel, then caulks the holes.

Other changes aim at **increased durability**. In Iowa, David Ossman uses a two-by-four across the bottom front of the pen where the handle attaches, and a second for the top header running down the center of the cage. This adds strength under his water buckets, keeps the roof flat so it doesn't dump water in the pen, and gets rid of the brace wire across the middle of the pen that was tripping his chickens. Other **durability tricks: Store wooden pens on bricks** during the off season to keep soil contact from rotting the bottom rails. And **don't run cattle** with any type of pens -- they'll **rub on and destroy** them. One grower's calves learned to knock the lids off, then jumped inside for fresher grass.

In central Iowa, Connie Tjemeland's 8 x 10 x 2' (2400 x 3000 x 600 mm) pens are built mostly from one-by-fours, with a few two-by-fours where needed. A tarp covers the roof and 3 x 8' (900 x 2400 mm) access door. Three bowed pieces of wood beneath the tarp keeps rain from pooling. **Roll-up tarp sides** have a board across the bottom to stabilize them, and get bungeed up or down depending on weather. Axles at one end of the pen take slip-on go-cart wheels; only one set is needed for many pens.

Keith O'Neal raises 1,000 broilers a year in western Kansas, where **heat and wind** are big problems. Three solid sides and 1" (25 mm) welded wire on the fourth make Keith's cedar-framed pens very rigid. (In 1998 a dust devil blew several pens 25 feet [8 meters] without damage.) The birds are fed through a 2 x 10' (600 x 3000 mm) door that doubles as a **wind**

scoop. Closed at night for predator control, it is covered in white fiberglass to let more light into the back of the pen. The wire-covered front third of the roof lifts off for access to waterers.

Strong prairie winds are no threat to Dennis Demmel's pens. Built for his 17-year-old son Paul, each is **welded together** from four 9'-6" x 34" (8800 x 860 mm) **gates** left over when they got out of the hog business. The back panel can be propped open at the bottom to provide extra ventilation. It and the roof are flattened steel bin panels attached with self-tapping screws. The rest of the pen is covered in 1" (25 mm) chicken wire.

The key to getting a pen this heavy to work is to make it easy to move. Demmel welded frames for two dolly wheels with 10" (250 mm) pneumatic tires. These clip into the original gate mounts. A shop dolly with a swing-up brace post holds the back of the pen up while the wheels are added. The same dolly is then used to pull the other end of the pen. Mounting the wheels takes very little time, and the pen can be moved fairly easily by one person. The wheels attach to any corner so pens can be moved in any direction without turning them. Empty pens can be pulled at 20 m.p.h. (30 km per hour) using the 3-point hitch on the tractor.

A common variation on Salatin's pen is to **weld the frame from thin-wall tubing**. Panels can be attached with self-tapping metal screws or pop rivets. Weld 1" (25 mm) wire mesh directly to the frame, or attach poultry mesh with wire or nylon ties.

Nebraskan Tom Larson builds an **ultralight \$70 pen that can be put together in a day**. One finger will pick up an end. Larson's pens are 10 x 10 x 2' (3000 x 3000 x 600 mm), with a welded frame of 1/2" (13 mm) electrical conduit (outside diameter is about 3/4" [19 mm]). A handle at each end is made from a 5' (1500 mm) piece of conduit bent into a U shape measuring 1 x 3 x 1' (300 x 900 x 300 mm). Larson butt-welds 18" (450 mm) skids to the bottom corners of each end, extending the side rails. Lifting one handle 6" (150 mm) shifts weight to the skids and raises the opposite edge of the pen an inch or two (25-50 mm) so it clears the grass. This is still low enough to crowd the chickens along.

The roof of Larson's first pen was half chicken wire, but the birds stayed in the shade. Now he makes the roof and two sides of the pen from thin galvanized roofing, pop-riveted to the frame. Four of the five roof sections are pop-riveted to conduit crossbars placed where the panels overlap. To make the door, he welds 3/4" (19 mm) inside diameter washers to the last roof brace so that they stand vertically. After threading a 10' (3000 mm) piece of conduit through the washers so it hangs out a little on each side, he rivets the last sheet of roofing to it. This door must be weighted so the wind won't pop it open. The rest of the pen is covered with chicken wire.

PVC pens

Another lightweight frame alternative is PVC pipe. As mentioned earlier, **PVC will slide and bounce over grass clumps** that stop wood, so **no dolly is needed**. The **flexible frame** hugs the ground, **minimizing gaps**. Material costs are comparable to wood. Coverings are

fastened on with drywall screws, nylon ties, or wire. Designs range from straightforward Salatin imitations in sizes up to 10 x 15' (3000 x 4500 mm), to domes, hoop houses, and A-frames.

One potential problem with PVC is brittleness. Minnesotan Charis Stenberg had a pen shatter in the middle of its second summer after a big storm puddled water on the roof. Although it looked fine, the plastic had gotten brittle when winter temperatures dipped (hers routinely hit -35° F. [-37° C]). According to ATTTRA, this is mainly a problem with PVC that is not UV-stabilized.

In spring 1999, **commercial PVC pens from two U.S. vendors** went on the market. Nature's Family Farm field-tested their 10 x 10' (3000 x 3000 mm) design for four years in Wisconsin. This pen features vinyl panels and a clip-on cable handle that allows the pen to be dragged in any direction. All four roof sections are hinged in a way that lets you leave them cracked open for better ventilation in hot weather. Although light, this pen withstands strong winds as long as it is properly oriented.

In Iowa, Hawkeye Steel's Brower Poultry Equipment division has turned its hog expertise to portable pen design. The Brower pen measures 10 x 12 x 2' (3000 x 3600 x 600 mm), with a 3' (900 mm) tall model for turkeys. The pen's bowed roof is covered with hoop house fabric and features closable end vents for extra ventilation on the hottest days. The frame is high-impact UV-protected PVC. **Pen weight is adjusted by filling the frame with water** until you reach the right combination of portability and wind resistance. This pen is sold as a kit you assemble yourself. Top-quality materials boost the price to around \$350 (in 1999).

Hog panels and more

Wire panels make inexpensive pens that are quick to build and easy to move. A common design uses 4 x 16' (1200 x 4800 mm) **hog panels** bent in the middle to make 8' (2400 mm) walls. Wire two panels together, bungee a tarp across the top and sides, and you have an instant pen. Roll up the side tarps in hot weather.

John deSaavedra uses 6 x 10' (1800 x 3000 mm) pens to raise broilers, banties, and Rhode Island Reds in Ohio. Made from two 34" x 16' (860 x 4800 mm) hog panels, five 1/2" (13 mm) **metal conduit roof bows**, and a conduit ridgepole, each is fastened together with 14-gauge electric fence wire. Everything but the roof gets covered with 1" (25 mm) poultry mesh. A 10 x 14' (3000 x 4300 mm) poly tarp over the top is fastened with cage rings on one side and tarp straps on the other. The tarp gets flipped back for access to the feed and water. A door 6" wide by 12" tall (150 x 300 mm) lets all but the largest chickens on pasture if desired. Four cinder blocks clipped to the corners serve as anchors. To move his pen, John unhooks the anchor blocks, then scoots the ends alternately. For longer moves he recruits a helper or stands inside with the pen on his shoulders.

A **similar design** developed in Vermont uses as **wooden lower frame** and 3/4" (19mm) **conduit bows**. This 8 x 12' (2400 x 3600 mm) design stands about 5' (1500 mm) high, with an access door at one end. Pulled by a rope, it rides on 16' (4900 mm) wooden skids, and does not require a dolly. In 1997 David Wallace used this pen to grow 28 turkeys in central Kansas. He mounted 8" (200 mm) wheels on the back end of each skid, switching ends when he reached the edge of the field. He found that in spite of its height, this U.S. \$100 pen is very resistant to wind because the weight is all close to the ground.

No one I spoke to liked the wood-framed pen design in the first edition of Andy Lee's *Chicken Tractor*. Designed to sit atop a garden bed, it's too heavy and, at 4 x 8 x 4' (1200 x 2400 x 1200mm) high, too small for efficient use in a commercial broiler operation. Lee has since experimented with a number of much larger pen designs.

The most unusual design I've seen comes from Chad Anderson, a high-school student living in northern Alberta, Canada. Anderson's 5 x 16' (1500 x 4900 mm) **A-frame** chicken tractors are strong, wind-resistant, and so easy to build that he puts them together without a measuring tape. Each rides on two skids made from two-by-fours (he tried four-by-fours, but they were much too heavy). A small triangle of plywood fills the end under the roof, which is two 4 x 8' (1200 x 2400 mm) sheets of oriented strand board (OSB). The roof angle is wider than 90° to increase the width of the pen. Anderson says the roofed section could be shorter; he just didn't feel like cutting the panels. An OSB shelf at the open end supports 5-gallon (22 liter) feed and water tubs. This will be replaced by a welded wire mesh shelf the birds can graze through. Covering is stucco wire with 2" (50 mm) squares, held on one side by hooks, and elsewhere by fencing staples. A good pull releases it for pen access. He has raised up to 35 broilers per pen.



Keeping predators out

Filling **gaps beneath pen edges** with scraps of wood can be time-consuming on bumpy pasture. Even if the chicks can't get out, predators may reach under the walls and snag them. One solution is to leave some **extra poultry mesh at the bottom of the pen** -- even one to two inches seems to help a lot. Pens a friend and I built had 12" (300 mm) of extra wire folded out at the bottom. When weighted with a brick, this filled even large gaps. We credit the wire apron for no predator digging problems. A dog leash clip held the wire on the front of the pen out of the way while we were moving it.

To stop predators from **digging**, Charis Stenberg used antenna standoffs to hold **electrified polywire around the bottom** of each pen 6" (150 mm) above ground and 4" (100 mm) away

from the sides. The wire was high enough not to touch her boot tops, though she did occasionally have to clip tall grass underneath. Power came from a feeder clipped to the nearest paddock wire.

Predators like to **snag chicks that sleep against the wire**. Several growers go around at dusk the first few days chicks are on pasture and throw those near the wire to the back of the pen. After a few nights they get the idea. I accomplished the same thing by running a **sprinkler** for the first two or three evenings.

Dogs accompanying you at chore time spread their scent, which discourages wild predators. Tying a dog near but out of reach of the pens can give even better protection. Unfortunately dogs themselves are often the worst predators, digging into pens or breaking through poultry mesh.

Feed and water

Most growers I spoke to are using some kind of **trough feeder**. Materials range from custom-bent sheet metal to rain gutter to PVC pipe to PVC feeders with a lip sold by Brower. A rotating top bar keeps birds from roosting on the feeder and serves as a handle. One type is a rod with a length of PVC pipe around it. Feeders should hold 35-50 pounds (16-23 kg) of feed and provide enough access that bully birds can't hog the feed. This generally means two 5' (1500 mm) long feeders per pen. Common sheet metal feeder dimensions are 8-10" (200-250 mm) wide and 4-5" (100-130 mm) deep. Some producers hang feeders so they don't have to take them out to move the pens.

Broilers will take as much as **30 percent of their ration from pasture** if the grass is right under their feet -- but **only if they know grass is food**. Start chicks in the brooder on fresh green clippings or blocks of turf in the first few days to get them used to the idea.

Salatin's hanging **Plasson waterers** are popular among growers, though several mentioned that a pen height of 26" (660 mm) would give better clearance. Hang the waterer on a chain so you can adjust the height as the chicks grow. Waterers should be far enough from the pen walls and other obstacles that birds can stand all around them.

Five-gallon (22 liter) buckets atop the pen supply the water. Use **white buckets**, which **stay cooler** and attract fewer hose-clogging insects than colored buckets, and tie a plastic mesh screen across the top if necessary to keep out bugs and leaves. Fasten buckets to the pen to keep them from blowing off as they empty.

A pen of 7- or 8-week-old broilers can **drink 10 gallons (44 liters) or more between morning and evening chores**. Although some growers add water at midday in hot weather, Minnesotan Todd Lein thinks the extra disturbance can contribute to heat deaths. "They're like Pavlov's dogs -- when they see you, they think it's time to get up and eat and drink." He

recommends leaving them extra water (two or three 5-gallon/22 liter buckets tied together with hoses) and doing chores early in the morning and just after sunset.

Day ranging

An alternative to bottomless pens is ranging birds from a **portable shelter surrounded by a temporary fence**, usually electric poultry netting. Both shelter and fence are moved every few days. Many producers use this low-work system for laying hens, who forage far from the shelter for up to 70 percent of their feed.

Now Andy Lee has **combined fenced pasture with bottomless pens** to create a new system he calls "day ranging." In one version, the shelter measures 8 x 16 x 4" high (2400 x 4900 x 1200 mm) with 2 x 2" (40 x 40 mm) roosts spaced 12" (300 mm) apart. It is moved daily within a 1600 square foot (150 square meter) temporary paddock made with a 150 foot (45 meter) roll of electric poultry netting. The paddock is shifted weekly.

Lee shuts the broilers in the shelter with clip-on wire mesh sides for their first three days on pasture to bond them to it. After that the shelters are left open. The birds start foraging at first light. The fence keeps out four-legged predators, and hawk and owl losses have been minimal.

"This shelter is a breeze to move because it is so light and the birds aren't captive in it and don't get crushed," says Lee. **Roosts keep the birds off cold or wet ground, and provide extra ventilation on hot days.** At night the weight of the roosting birds helps the pen resist storm winds.

To train his chicks to use the roosts, Lee places broom handles directly on the floor of his brooder house. "Within a few days, most start sleeping on the perches."

"Because the birds are able to come and go from the shelter we can stock these pens at two or even three times the rate of pasture pens," Lee continues, "yet the birds stay pure white. **The whole system costs about half what pasture pens system costs, and uses about one third the labor.**" It works well for chicks, layers, and turkey poults.

Lee has also developed a **hoop-house version** that is easier on the operator, but tougher on the pasture beneath the house. See [ATTRA's poultry production page](#) for details. Or read Lee's 2002 book [*Day Range Poultry*](#).