FARMER FOCUSED *Technology*

SHOWCASING AWARDEES OF
THE SMALL FARM INNOVATION CHALLENGE

Brought to you by
THE SMALL FARM TECH HUB AT
COMMUNITY ALLIANCE WITH FAMILY FARMERS

THE SMALL FARM INNOVATION CHALLENGE

All the following innovations were submitted by farmers for CAFF's Small Farm Innovation Challenge in the category of "Do It Yourself" or DIY. These innovations exemplify how simple DIY innovations can lead to significant improvements in the farm and offer blueprints that can be adapted, improved upon, and implemented by other farmers.

As applicants of the Innovation Challenge, their contribution to agricultural technology showcases the power of practical, scalable solutions in transforming the small farm landscape. The Innovation Challenge invites farmers, entrepreneurs, students, hackers and any ingenious, farm-loving thinkers to propose tech-based innovations that will help small scale agriculture compete, survive and thrive. All ideas, big or small, in any phase of development, will be accepted for the Innovation Challenge. Learn more by visiting www.caff.org/innovation.

HIGHLIGHTED INNOVATIONS

2023-24 INNOVATION CHALLENGE WINNER

ONION DRYING RACK

Rachel Greathouse
Farm Owner,
Greathouse Garden
Hillsboro, Missouri
Paul Krautmann
(co-designer)
Stephen Greathouse
(builder)

Rachel designed and built a large-scale vertical drying rack with built-in shelving, perfect for harvesting and curing onions, garlic, and more. Her design enhances the efficiency of crop drying processes.

Problem solved: crops are harvested directly onto the drying rack, saving space and time

Skills/tools needed: pallets, plywood and various sizes of lumber (2"x2"x8'; 2"x6"x8'), screws, wire mesh.

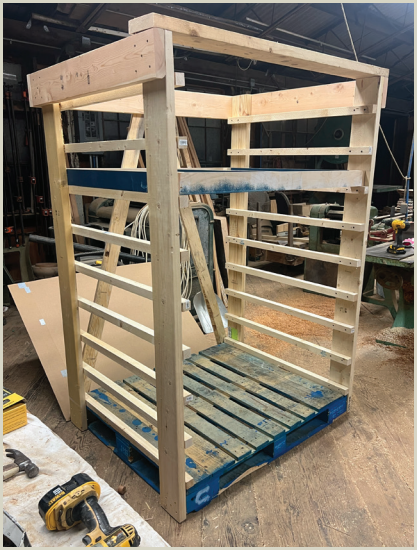
Cost: $100 - $150 per tower

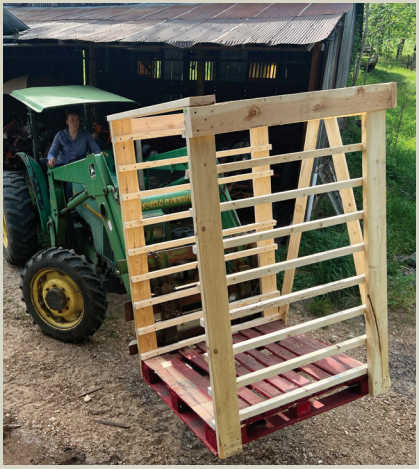
Best suited for: Small to mid size farms that grow crops that require curing, like onion and garlic

INNOVATOR PROFILE

Rachel Greathouse is owner of Greathouse Garden, a small three acre farm that specializes in storage and winter crops including squash, garlic and onions. Rachel started her farm in 2022 with three acres of leased land and was able to purchase farmland in 2025.

INNOVATION





Rachel's invention is a large-scale drying rack with removable shelves designed specifically for harvesting and drying crops like onions and garlic. The rack features wire mesh bottoms for optimal airflow and vertical drying capabilities, which not only saves space but also reduces the handling of the crops.

Key Features:

- High Capacity: Each mobile rack (or tower) holds up to 1,000 lbs of onions.
- Tractor-Ready: Built for easy transport, harvest and dry in one unit.
- Cut down from a 2-touch to a 1-touch process

PROBLEM SOLVED

Large farms have other means of curing onions, but there was a gap for the small farm on how to harvest and dry onions with fewer steps while using minimal storage space.

Traditionally, harvesting onions in small farms involves collecting them in bins and then transferring them to a drying location (typically laid out in a greenhouse with shade cloth and a single layer)—a process that requires handling the produce multiple times.

Rachel's drying rack reduces this to a single step: crops are harvested directly onto the shelves of the rack, where they remain for the next two to four weeks to dry.

This innovation significantly cuts down on labor, time and risk of mishandling crops, making the post-harvest process more efficient, especially for a low value crop. Additionally, the drying rack saves space by stacking the produce rather than spreading out in a single layer.

HOW TO BUILD IT & WHAT ARE THE COSTS?

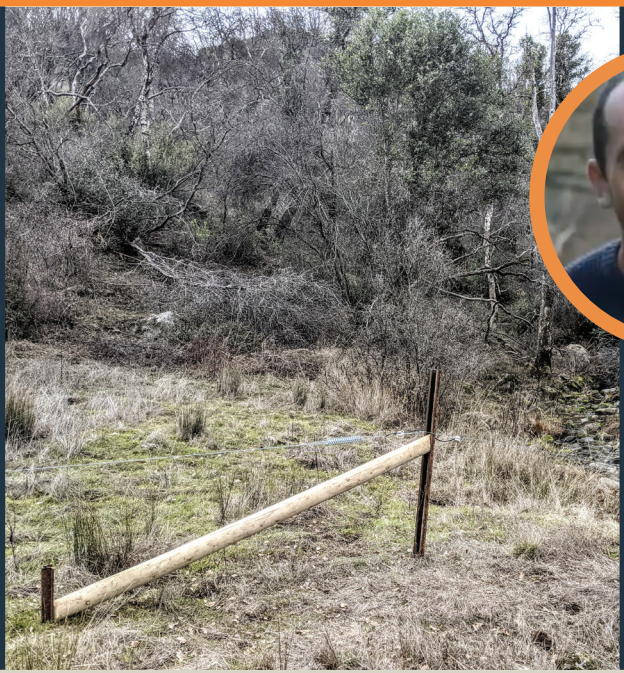
The drying rack can be easily replicable by other farmers. All the materials needed are readily available at general hardware stores; pallets, plywood, lumber (2"x2"x 8', 2"x6"x8'), screws, wire mesh/hardware cloth. Each rack can be constructed for approximately $100-150, making this a cost-effective solution for many small-scale farmers.

Rachel breaks down her innovation build, supplies and process during the Innovation Challenge Awards Ceremony.

Scan this QR to watch the build video:
https://www.instagram.com/p/CvNgO2UgYJr/

2022 INNOVATION CHALLENGE WINNER

NO-DIG REMOVABLE ENDPOST



Kyle Farmer
Cattle rancher,
Magruder Ranch LLC
Potter Valley, CA

Bryce Krizan
Co-innovator/
ranch hand

McGruder Ranch's "No-dig Removable End Post", a simple end-post created with locally available U-channels (or highway posts) and installed with a handheld mechanical post-driver making the always arduous task of fence-building easier.

Problem solved: a simplified and effective way to build fencing without digging post holes
Skills/tools needed: petro-assisted post pounder with modified attachment, U-channel, 4" post, two good nails, chop and reciprocal saw, height to install post (tall person, ladder, stand on side-by-side)
Cost: $40 for fence supplies, post pounder is $1,000 or borrow/share, saw for cross piece ("45")
Best suited for: operations where a lot of post holes get dug; ranches, garden fencing and trellising vegetables

INNOVATOR PROFILE

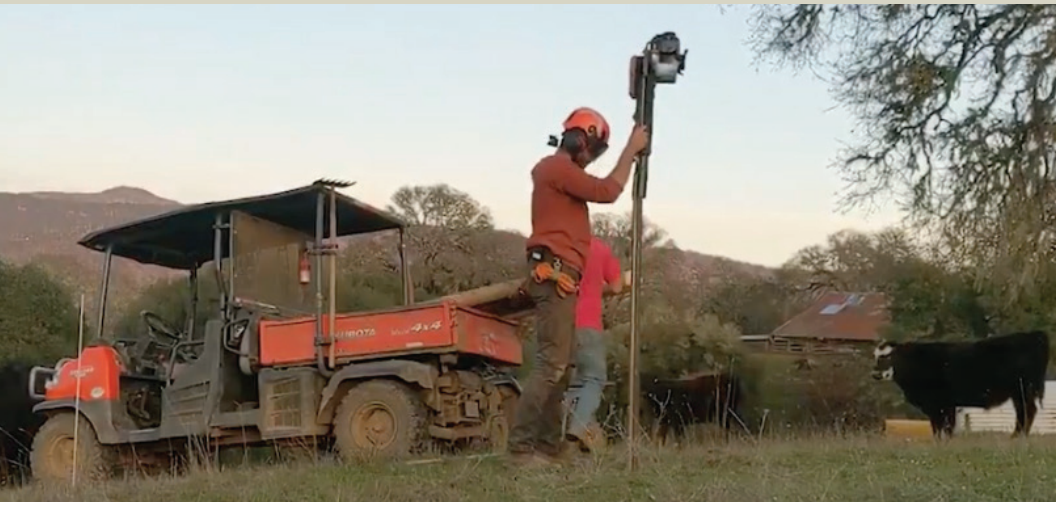
Kyle Farmer, "soil tender" at Magruder Ranch in Potter Valley, California. The six generation family ranch focuses on adaptive grazing and wildlife stewardship and provides beef, lamb, and pigs to the Mendocino, Sonoma and Bay Area communities.

INNOVATION

The No-dig Removable Endpost works great for farms with limited access to their own lumber, inaccessible areas with varying topography and soil types, and for the purposes of rotational grazing where a fence may need to be moved in the future or taken out after a burn.

Key Features:

- End posts are installed in under three minutes with two people
- Eliminates digging and packing holes, and having to pour cement
- With proper U-channel gauge, it can be used in any soil including rock hard shale subsoil.
- The cross piece ("45") can be sawn in the barn lot, instead of custom cut in the field

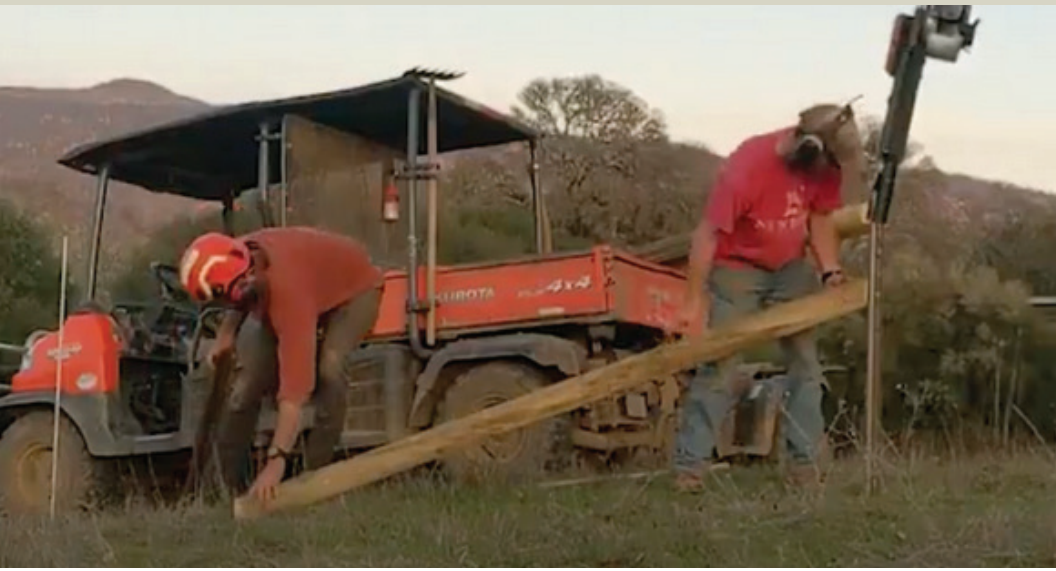


PROBLEM SOLVED

This innovation cuts down on the time and cost spent by ranchers on fencing and digging post holes, not particularly joyful memories for most. Without a tractor auger, an H-brace end post can take a well conditioned team 45 minutes and $80 to install. Packing holes and pouring cement is laborious and the resulting post is very difficult to remove and relocate. The No-Dig Endpost is installed in under three minutes, at half the supply costs, and can be removed with a tractor or high lift jack. This post system can also outperform a 8" post H-brace under load and has withstood five fully tensioned wires regularly being hit by 600 lb elk night crossings.

One of the most convenient parts of the design is that the cross piece ("45") can be sawn in the barn lot, instead of custom cut in the field. The U-channel selected gauge works with rock hard shale subsoil. The design also helps save workers wrists and bodies from not having to drive posts.

A skid steer auger still holds its place for easy to access ground and swinging gates, but the No-Dig Removable Endpost allows for more hillside cross fencing to improve grazing outcomes.



HOW TO BUILD IT & WHAT ARE THE COSTS?

This ranch has good access to U-Channel because of neighboring vineyards. Total material costs are $40 with $30 for the U-Channel (two pieces), $10 for the 4" post, and two good nails. This is half the price of total material costs compared to a standard end post.

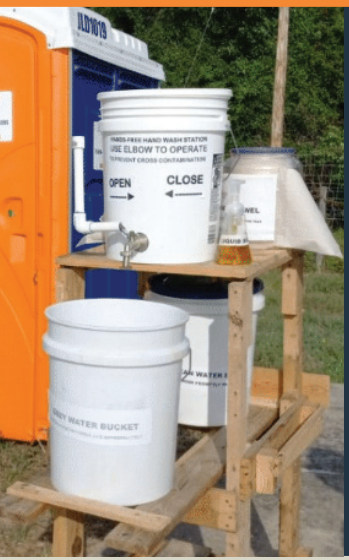
This design requires a gas powered post pounder with an attachment for U-channel. This can be store bought or modified by cutting grooves into a 2.5" pounder attachment (the 2.5 attachment for pipe applications is not ruined). A petro-assisted post pounder runs around $1,000 but the modified attachment can also work for T-posts so pounding labor can be saved there as well. They loan out their post pounder to other ranchers so look into local borrowing options.

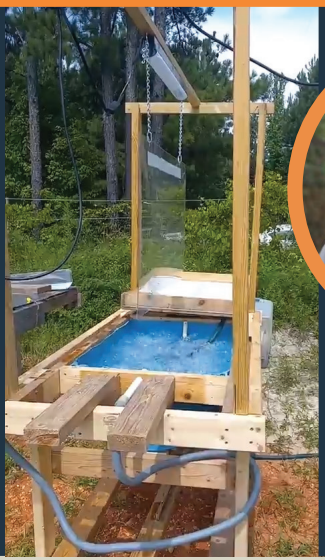
They cut and build the cross pieces before heading out to the fields using a chop and reciprocal saw. The notch can work on any topography and the wood post determines the distance to the second U-Channel "deadman" so it always fits.

"This is the best kind of post I've ever built."
- Kyle Farmer

Watch Kyle and Bryce build their No-dig Removeable Fence Post:
https://www.youtube.com/watch?v=m_ZYDlcslqY

TWO TIME WINNER
ELBOW OPERATED HAND WASH STATION & MULTI-PURPOSE FARM USE STATION





Daniel Sena Ahiabor
Sustainable Food Systems Resource Specialist
Tuskegee University, Alabama

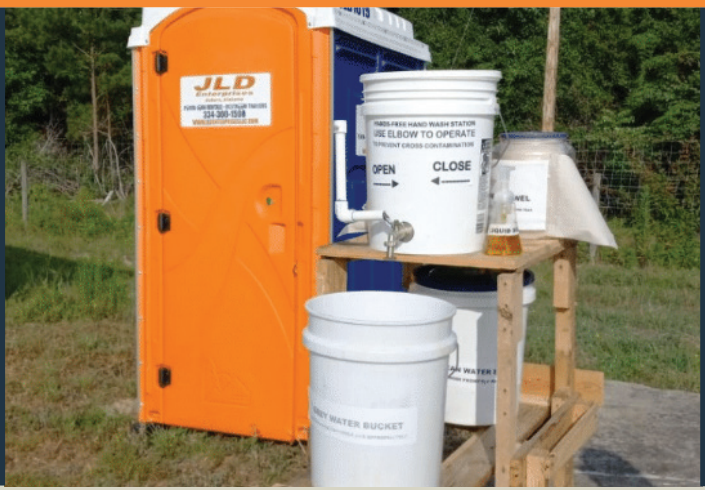
INNOVATOR PROFILE

Sena's enthusiasm for innovation and creative solutions has led him to become a two time winner of the Do It Yourself category of the Challenge. Sena grew up in a farming family in Ghana and graduated from Tuskegee University, Alabama with an M.Sc of Plant and Soil Science. He now works as an agronomist and a Post-Harvest Specialist working for Tuskegee University Cooperative Extension Program. Sena has won the Trellis Grant twice from the Horticulture Innovation Lab at the University of California at Davis. He is a constant innovator and fixer; from repairing the local solar dryer to helping build zero energy cooling chambers for farmers in Ghana. His continued commitment to small farmers highlights the importance of accessible, practical solutions that improve working conditions and food safety.

Both of his innovations are listed on the following pages.

2022-23 INNOVATION CHALLENGE WINNER

ELBOW OPERATED HAND WASH STATION



*Daniel Smith, Co-developer of the Hand Wash Station**

The Elbow Operated Hand Wash Station offers an affordable in-field solution with a fresh twist to the design, especially for lower-resource farmers. Using only a few materials easily found at a hardware store, this innovation makes it easier to meet the requirements of Good Agricultural Practices (GAP) and improve on-farm sanitation for workers.

Innovation: Elbow operated hand wash station
Problem solved: Hand washing station useful for field settings where mobility, water conservation, and hygiene are priorities.
Skills/tools needed: Basic carpentry and plumbing skills are enough to c omplete the build. 5-gallon lidded water bucket, PVC pipe and fittings (1⁄2 inch, L-shaped, elbow-operated), wood for the frame and shelves, a liquid soap dispenser, hand sanitizer, a paper towel container, and extra buckets for greywater and backup supplies.
Cost: $150-$200
Best suited for: field settings where mobility, water conservation, and hygiene are priorities.

INNOVATION

The Mobile Hands-Free Hand Wash Station works great for hygienic hand washing by using a creative pipe placement for elbow operation. It is a simple structure that anyone can build with access to a hardware store or by using reclaimed materials. A long-handled L-shaped 1⁄2" PVC pipe which is elbow-operated allows the user to wash their hands without touching anything, preventing cross contamination. Beneath sits an empty bucket to collect the grey water. Provisions are made with buckets on the other two shelves for extra water and extra paper towel, soap and hand sanitizer. Its screws dismantlable so that it can be packed down and relocated.

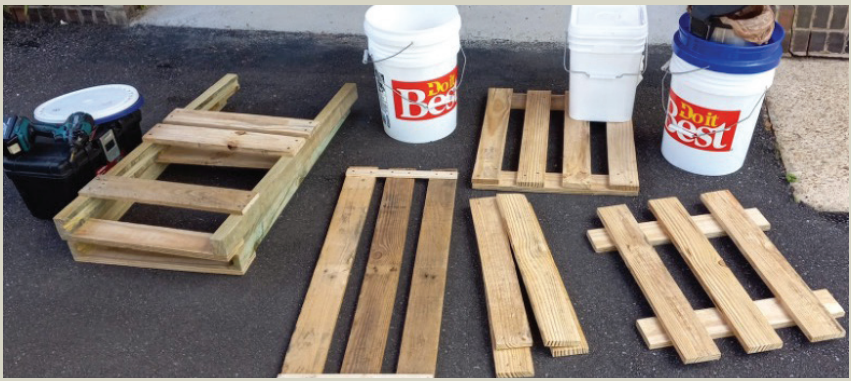
PROBLEM SOLVED

For the Mobile Hands-Free Hand Wash Station, its mobility, cheapness to construct, water saving and grey water capture, makes this a more accessible option compared to the conventional hand washing stations. The station can also be moved to different parts of the farm during harvest for easier access.

HOW TO BUILD IT & WHAT ARE THE COSTS?

Approximate material cost is $155 when items are purchased in bulk or shared across multiple builds. The cost is around $200 if everything is bought individually at retail. This includes a 5-gallon lidded water bucket, PVC pipe and fittings (1⁄2 inch, L-shaped, elbow-operated), wood for the frame and shelves, a liquid soap dispenser, hand sanitizer, a paper towel container, and extra buckets for greywater and backup supplies. Basic carpentry and plumbing skills are enough to complete the build. A power drill, saw, and simple hand tools are sufficient. Fixtures like PVC fittings and buckets can be reused or shared between builds to keep costs down.

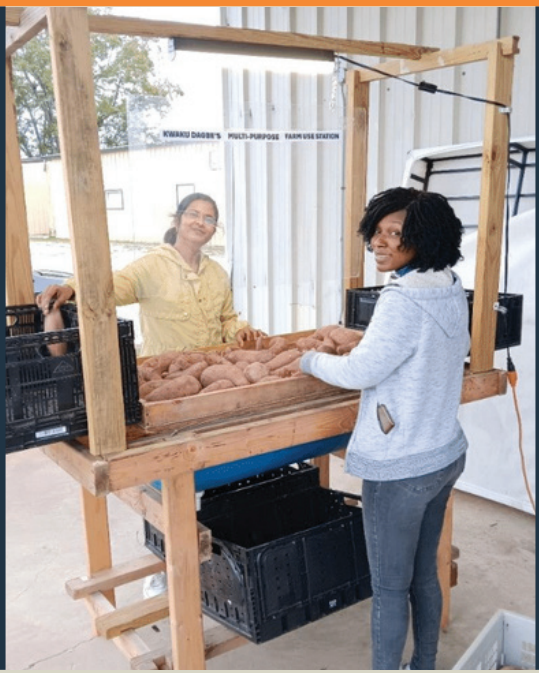
The station is simple, quick to replicate, and easy to train others on. A step-by-step manual can be developed to support wider adoption. This design is especially useful for field settings where mobility, water conservation, and hygiene are priorities.



Watch Sena Daniel Ahiabor operate his Elbow Operated Hand Wash Station: https://www.youtube.com/watch?v=V7tAwX34J7M

2024-25 INNOVATION CHALLENGE WINNER

MULTI-PURPOSE FARM USE STATION



The Mobile Multi-Purpose Farm Use Station is an all-in-one workstation designed to assist small-scale farmers with post-harvest handling, packaging, and repairs.

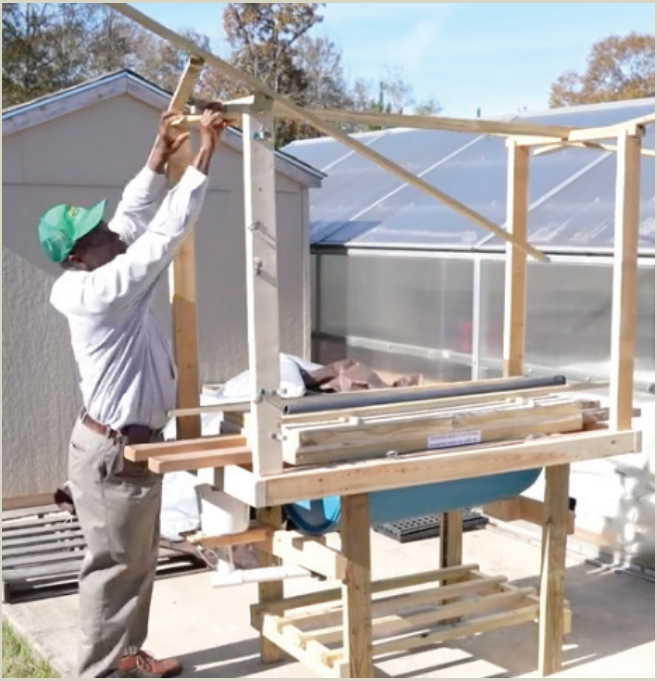
Problem solved: an affordable option for increasing post-harvest efficiency
Skills/tools needed: 55-gallon food-grade plastic drum, water-resistant plywood, basic lumber, crate stands, a removable and adjustable plexiglass shield, umbrella, and hardware for assembly. Basic construction skills, saw, drill.
Cost: $350-$920
Best suited for: small farms just getting started in post-harvest activities and looking to refine their system

INNOVATION

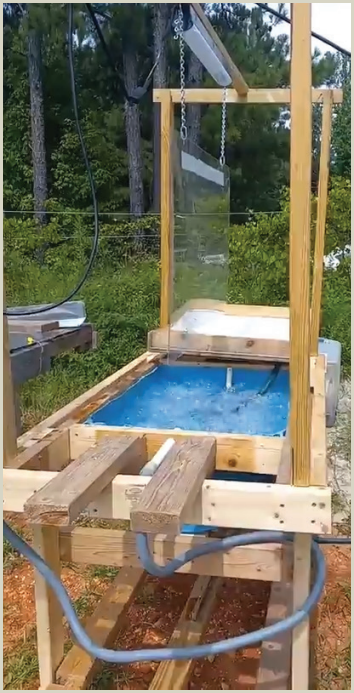
Constructed with affordable, locally available materials, the station improves efficiency in produce sorting, bubble washing, and storage while incorporating features for integrated pest management and COVID-19 safety. The station can be easily assembled and disassembled making it mobile for the farm.

PROBLEM SOLVED

Small farms are able to get more post-harvest activities done with less time without having to invest in an array of expensive equipment. This station serves as a beginner equipment module before moving forward with purchasing advanced equipment. The station is economical and handles with ease, giving a small, beginning farmer time to identify their actual needs without breaking the bank.



HOW TO BUILD IT & WHAT ARE THE COSTS?



Estimated cost is $350 when certain items are purchased as a group and shared across multiple builds. If everything is purchased individually at retail, the cost can go up to $920, especially when buying fixtures that are sold as whole units but only partially used in the build. Materials include a new 55-gallon food-grade plastic drum cut into two standing halves, water-resistant plywood, basic lumber, crate stands, a removable and adjustable plexiglass shield, and hardware for assembly.

Construction requires basic carpentry skills and access to common tools like a saw, drill, and measuring tape. The structure is designed to be assembled and taken down quickly, making it portable and practical for small-scale operations. The sorter platform flips into a working bench, and the added protection with plexiglass makes it safer for workers during face-to-face tasks.

The design is simple enough to be replicated and adapted in different settings. It can be built and taught through hands-on training, and a construction manual can be created if needed to support broader adoption.

The Multi-Purpose Use station was named after his dad Mr. Kwaku Dagbe Ahiabor who was his mentor.

Watch Sena operate his Multi-Purpose Farm Use Station:
https://youtu.be/db4a3HoxGq8?si=5OzvrYlmLzQNaZc5

2024-25 INNOVATION CHALLENGE WINNER

A REALLY COOL MULCH BLOWER

Jennifer Bantle,
Avocado and citrus Farmer

Retrofitting a commercial leaf vacuum, a plastic hose and a duct reducer, Jennifer created a "really cool mulch blower". This innovation can apply a thin or thick layer of mulch on hard-to-reach places in the farm like steep hillsides, without breaking the bank.

Problem solved: Spread mulch evenly on steep hillsides using less time and money
Skills/tools needed: basic mechanical skills, hand tools, access to supplies
Cost: ~ $3,600
Best suited for: small farms with steep slopes or difficult-to-access areas

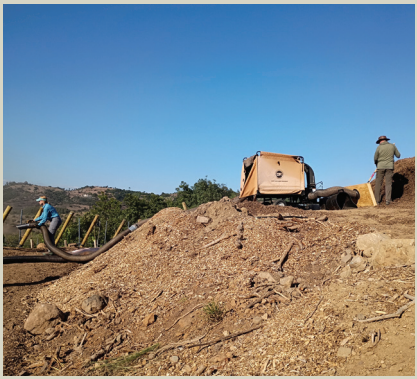
Key Features:

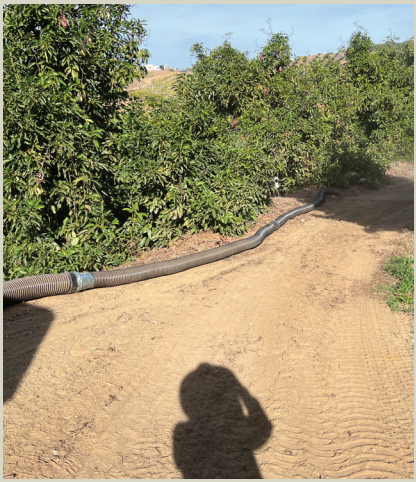
- Compact, maneuverable machine that retrofits a leaf vacuum with a 40' hose
- Macerates mulch before blowing, creating a fine, even layer
- Saves water by improving soil moisture retention, helping trees withstand heat waves
- Offers a low-cost alternative to $100k commercial mulch blowers

INNOVATOR PROFILE

Jennifer Bantle is a 13-year avocado and citrus farmer in San Diego County. Each year she applies mulch to conserve water, protect her orchard, and maintain healthy soils. Her ingenuity proves that necessity is the mother of invention, and her solution is already making farm life easier for small-scale producers.

INNOVATION





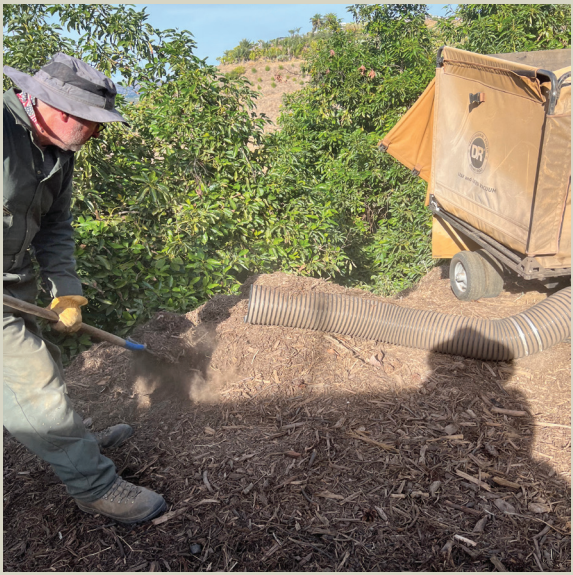
Jennifer's "Really Cool Mulch Blower" retrofits a standard leaf vacuum with an extended hose and reducer, transforming it into a mulch blower. The machine vacuums in mulch, macerates it, and redistributes it in an even layer across steep terrain, reducing back-breaking bucket work and conserving soil moisture. Instead of hauling buckets of mulch up and down hillsides, Jennifer's blower lets farmers pile mulch with a tractor and then redistribute it efficiently across the orchard. The result: reduced labor, erosion control, and improved soil moisture retention that helps trees survive California's hot, dry summers.

PROBLEM SOLVED

California farms generate plenty of compost and mulch, but distributing it efficiently on steep terrain is a major barrier. Farmers often rely on manual work, an exhausting and time-consuming process. Delivery and labor costs for mulch application were exceeding the cost of the mulch itself, and commercial spreaders priced around $100,000 were out of reach and not designed for small or mid-sized orchards on dirt roads or hillsides. To solve this, Jennifer designed a do-it-yourself mulch blower that is compact, affordable, and highly effective on steep hillsides.

Jennifer's blower addresses this gap. By retrofitting a leaf vacuum, she created a portable, low-cost alternative that enables two people to spread mulch evenly throughout an orchard in a short amount of time.

The innovation reduces manual labor, prevents hillside erosion, conserves water, and supports healthier trees.



HOW TO BUILD IT & WHAT ARE THE COSTS?

All components are off-the-shelf. Supplies are available from DRPower.com, Amazon, or general hardware stores.

- DR Pro Max 450 Leaf Vacuum – $3,249
- 40′ flexible plastic hose – $259
- 8″ duct reducer – $20
- Flex-tube swivel connector - $120
- Respirator with face mask - $30

Assembly involves attaching the extended hose and reducer to the leaf vacuum, which allows the machine to draw in mulch, macerate it, and blow it out the opposite end.

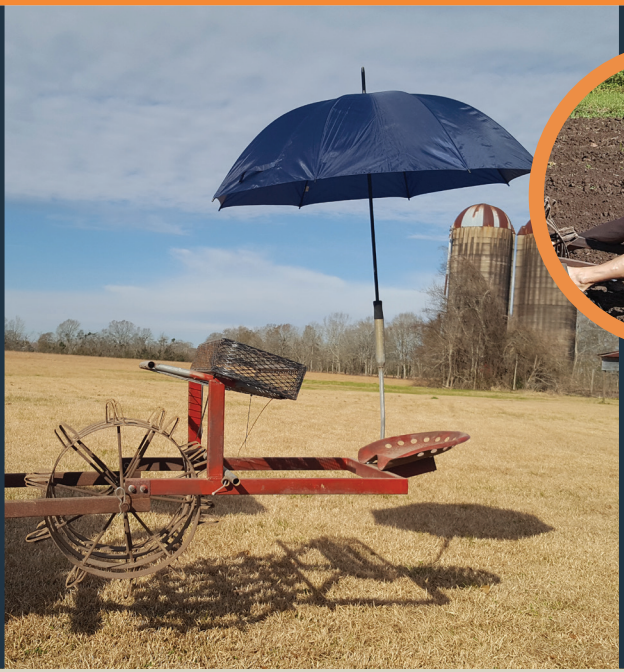
The mulch blower is easy to operate: you just need gasoline, two people and face masks with good respirators and a face shield.

As of September 2025, California does not allow the Leaf Vacuum to be shipped to state residents due to engine emission laws. Neighboring states still allows it.

Watch Jennifer share more tips & demonstrate her Really Cool Mulch Blower during the virtual awards ceremony:
https://youtu.be/HaNcdLuEo_I?si=S_edwLk-XSJXox7I

HIGHLIGHTED APPLICANTS FROM THE 2022 CHALLENGE

GARLIC PLANTER



Paul Marks
Aviation Safety Inspector
& Hobby Farmer
Opelousas, Louisiana

A small scale three point hitch ride-on style pull behind garlic planter.

Problem solved: saves time and the lower back

Skills/tools needed: Basic welding and fabrication skills. Iron, steel tubing, bars, pipe.

Cost: $100

Best suited for: garlic rows

INNOVATOR PROFILE

As a hobby farmer, Paul can now plant 2000 garlic in well tilled soil in under 50 minutes.

INNOVATION

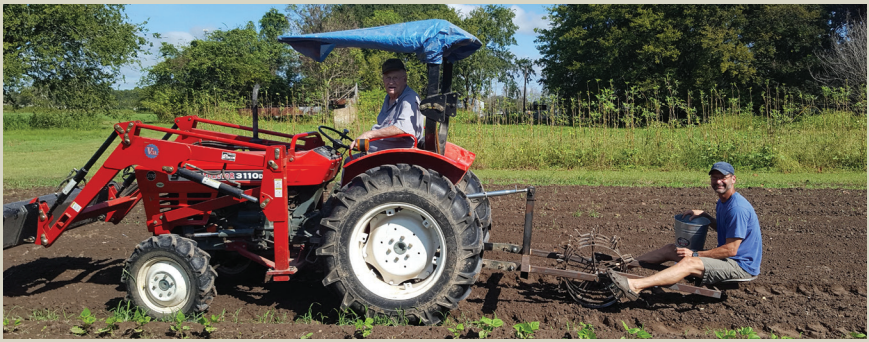
This garlic planter plants on a 24 inch row. The unit has 4 removable spiked planting wheels that punch holes in tilled ground for planting garlic or any bulbous seed. With the 4 spiked wheels installed, plant spacing is 6 inches in width by 6 inches in length.

PROBLEM SOLVED

This garlic planter allows thousands of bulbs to get in the ground without strain on the body while maximizing time efficiency.

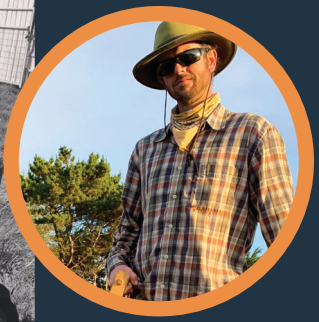
HOW TO BUILD IT & WHAT ARE THE COSTS?

The material (iron) is readily available. The main frame is made from 3" x 3"square steel tubing, 3" x 3/8" steel flat bar and 1" x 2" square steel tubing. Each wheel is hand formed from 3" x 1/8" steel flat bar with 1/4" steel rod spokes welded to 3/4" id. black pipe hub. The wheels rotate on a removable 3/4" cold rolled steel rod axle. The seat is a standard ebay stamped steel tractor seat. They use a small 30 HP tractor.



HIGHLIGHTED APPLICANTS FROM THE 2022 CHALLENGE

KEG CRIMPER



Jacob Pressey
Humboldt Regeneration Brewery & Farm
Owner/Brewmaster/ Beer-Farmer
McKinleyville CA

An 8′ wide roller-crimper made from all re-used materials.

Problem solved: low-cost method for termination of cover-crop

Skills/tools needed: Welding/metal fabrication, and adaptation/ improvising design depending on available materials.

Cost: $500 or so if the parts are sourced from a scrap yard.

Best suited for: field crops and cover-crop termination.

INNOVATOR PROFILE

Jacob transitioned their grain fiend to no-till with the help of his keg crimper made from all re-used materials. He continues to work on his innovation and has planned a compost tea sprayer with a top rack holding up to 5-13 gallon kegs. He would eventually like to up-grade to a larger electric tractor that can run the crimper front-mounted and pull their disc-seeder for a single-pass in the Spring of terminating the cover and planting barley.

INNOVATION

The roller crimper is made out of kegs and other reclaimed materials, allowing for a very effective and affordable tractor attachment to terminate cover crops.

PROBLEM SOLVED

This keg crimper is a low-tech, low-cost method for termination of cover-crop. It is scalable and adaptable to pulling power other than tractors and can be easily replicated and adapted to other farms.

HOW TO BUILD IT & WHAT ARE THE COSTS?

Jacob had an old disc and some beat up kegs, and over half of the angle-iron from bed frames that Ihe used were from free piles on the side of the road.

The roller is made from 4 beer kegs welded end to end with ports for filling with water and the crimpers are attached in the 'V' shape pattern and made from old bed frames from the scrap yard. The axils are made from an old disc, two sets with bushings and they are fed by two 5 gallon kegs that are filled with used veggie oil from a local restaurant rather than grease. It was designed to be front mounted but it could be easily built rear mounted. They use a 36 HP tractor and it would make tighter turns if it was a bit larger or if the crimper was a tow behind.

HIGHLIGHTED APPLICANTS FROM THE 2022 CHALLENGE

3 POINT COMPOST TURNER

Paul Bernier
Co-owner of
Bernier Farms
Geyserville, CA

Problem solved: an inexpensive way to process lots of compost using less space

Skills/tools needed: Cut and fit welding and engineering, scrapyard hunting skills

Cost: $2,000

Best suited for: farms that turn compost on-site with limited space or equipment

INNOVATOR PROFILE

Sonoma grape farmer Paul Bernier builds a custom compost turner using a tractor and found auto parts. His innovative compost turner is a cost-effective way of turning his grape compost or "pomace," which helps cultivate healthy wine grapes.

INNOVATION

Paul built a turner using a truck rear axle. The difference from other turners is that it only works one side of a windrow. It allows you to turn a windrow 14' wide by coming back the other side. A couple thousand yards of compost are turned per year, and the machine is long-lasting at 15+ years to date.

PROBLEM SOLVED

Turning compost with a loader takes a lot of time and requires a lot of space. This 3 point compost turner allows a farm to have more compost rows in a tighter space.

HOW TO BUILD IT & WHAT ARE THE COSTS?

Paul sourced his parts from a scrapyard. He uses his 70 HP, 2 wheel tractor and built the turner onto a 3-point hitch. He built his own agitator and blades to turn and manage the compost with some trial and error.

"I think anyone with basic shop skills and access to a junk yard can build one. Years later, I am still using the turner on manure and pomace based compost. The truck differential is the key, it is plenty strong to take the load."
- Paul

Watch Paul's 3 Point Compost Turner in action and learn about his process:
https://youtu.be/9L0oVNVgpWk