Climate Battery (Geothermal) Greenhouse

Threefold Farm

The climate battery greenhouse allows for further season extension or year-round growing with very low energy costs. Through use of off-the-shelf tubing materials and simple fans, the earth below the greenhouse functions as a thermal battery, allowing the grower to capture and re-use excess heat generated by the structure.

Left: Installation of climate battery tubing
Right: Greenhouse going up over climate battery installation
Above: Installation of second climate battery greenhouse tubing

Benefits:

- Low operating cost season extension
- Further extension of growing season by approximately 2-3 months over a high tunnel structure alone
- Faster warming of soil in the spring and better retention of fall heat
- Few moving parts (Tubing should far outlast greenhouse structure.)

Drawbacks:

- Up-front labor and install cost (excavation plus parts)
- Not as predictable as fossil fuel heaters

Years in Service: 1

Parts List:

- Corrugated, perforated drain tile (4")
- Tubing for manifolds and risers
- Fans to push air through tubing
- Thermostat and wiring to operate fans

Estimated Cost:
Dependent on install

Submitted by:
Tim Clymer, tim@threefoldfarm.org
Mechanicsburg, Cumberland County, PA

PASA Sustainable Agriculture

Contour Pig Plowing

Blackberry Meadows Farm

What's behind your barn? On our farm it's mud. Eighteen inches or more that persists, even when the cows are out to pasture. We solved the sprawl (and nutrient loss) by putting our temporary electric hog fence slightly off contour (key-line). When we turned the pigs loose, they plowed up 6 ditches that direct barn overflow across the entire hillside.

Left: Hamloaf poses on the fruits of her labor. She helped make 6 parallel key-line swales.

Our meat pigs are forced south by the downhill/key-line fence. Notice the wettest muck seeping into the top few swales.

A bird's eye view of the swales in the hog's walking path.

Benefits:

- Prevents pollution
- Keeps water and nutrients at the hilltop
- Provides groundwork for Alley planting
- Saves farmer from digging ditches

Drawbacks:

- Need electricity, temporary fencing, and pigs
- Semi-permanent
- Planning is critical (e.g. Plotting accurate fence line)

Years in Service: 2

Parts List:

- Fence charger
- 3/8" polyrope
- Kencove livestock netting
- Pigs

Estimated Cost:

No additional cost for the pastured hog farmer

Submitted by:
Greg Boulos, www.blackberrymeadows.com
Natrona Heights, Allegheny County, PA

PASA Sustainable Agriculture

Farm Cart

Green Heron Tools

Design of this innovative and versatile cart is part of a USDA Small Business Innovation Research grant-funded project to reduce musculoskeletal disorders (MSDs) from lifting and hauling heavy objects & materials, particularly among women livestock farmers. MSDs such as low-back pain are near-epidemic in farming and especially prevalent among women. The cart has been designed to transport a wide variety of loads over varied terrains and to minimize lifting. Green Heron Tools is owned by two women who are former market growers (now avid gardeners); our Design Team also includes two women livestock farmers; a female agricultural engineer who is also a farmer; another agricultural engineer who is a specialist in ag safety; an ergonomist; and a representative of our manufacturer.

Jan pushing cart

Lyn pushing cart

Benefits:

- Transporting heavy, awkward items; bagged materials; liquids etc.
- Can be operated by hand or towed by lawn tractor
- Adjustable handle; ability to roll or nudge objects onto cart to avoid lifting; balance; innovative design to allow cart platform to remain flat during loading
- Maneuverability, including in small spaces, muddy fields etc.
- Durable, quality construction (made in PA)

Drawbacks:

- Could be challenging to push on very rough terrain
- Note: Cart is still in prototype form but has been extensively tested; generally, drawbacks have been addressed via design modifications

Years in Service:

On sale in 2019

Parts List:

- Not available

Estimated Cost: $375-$400

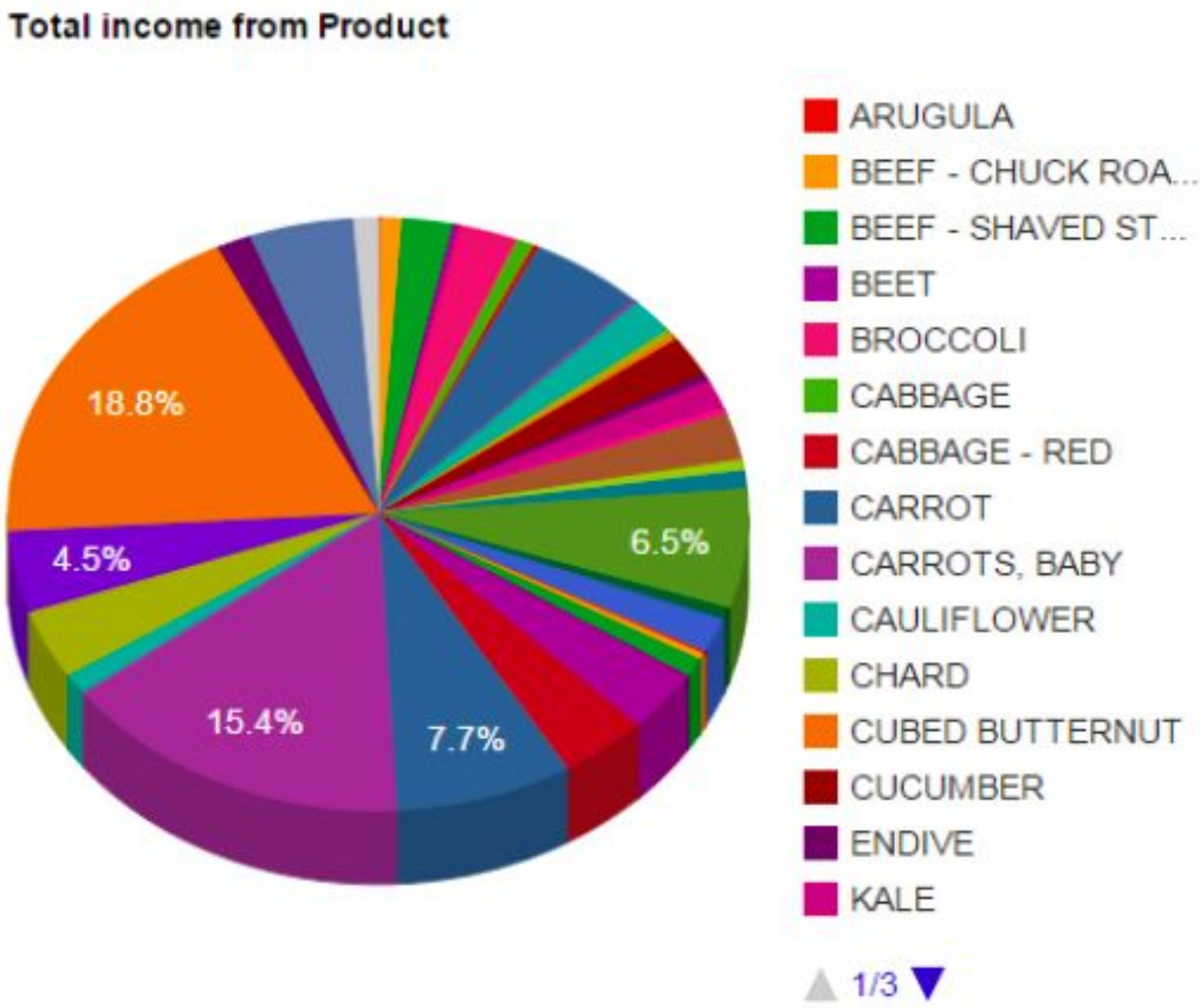
Submitted by:
Liz Brensinger & Ann Adams, greenherontools@gmail.com
New Tripoli, Lehigh County, PA

PASA Sustainable Agriculture

FARMDATA & AnimalData

Dickinson College Farm

FARMDATA and AnimalData are digital clipboards for small farm record-keeping. These online databases were designed and built by farmers and computer scientists to be fast and easy to use from a smartphone or any computer. FARMDATA records plantings, harvests, sprays, fertility, scouting, electronic invoicing, inventory and more. AnimalData includes livestock roster, birth, parentage, sale, slaughter, vet care, feed purchase, egg log and more.



Above: Farmdata home page
Below: Invoice graph

Smartphone view

Benefits:

- Free open source software
- Fast and efficient record keeping from the field or office
- Easily searchable, downloadable data, with graphing
- Great records for organic or welfare inspections
- Better records = more efficient farming

Drawbacks:

- Requires an internet connection or data plan
- Requires data entry - records are only as good as the information you enter.
- Software developer passed away in 2017

Years in Service: 4

Parts List:

- Most effective if someone on the farm has a smartphone and an internet connected computer.

Estimated Cost:

Currently free

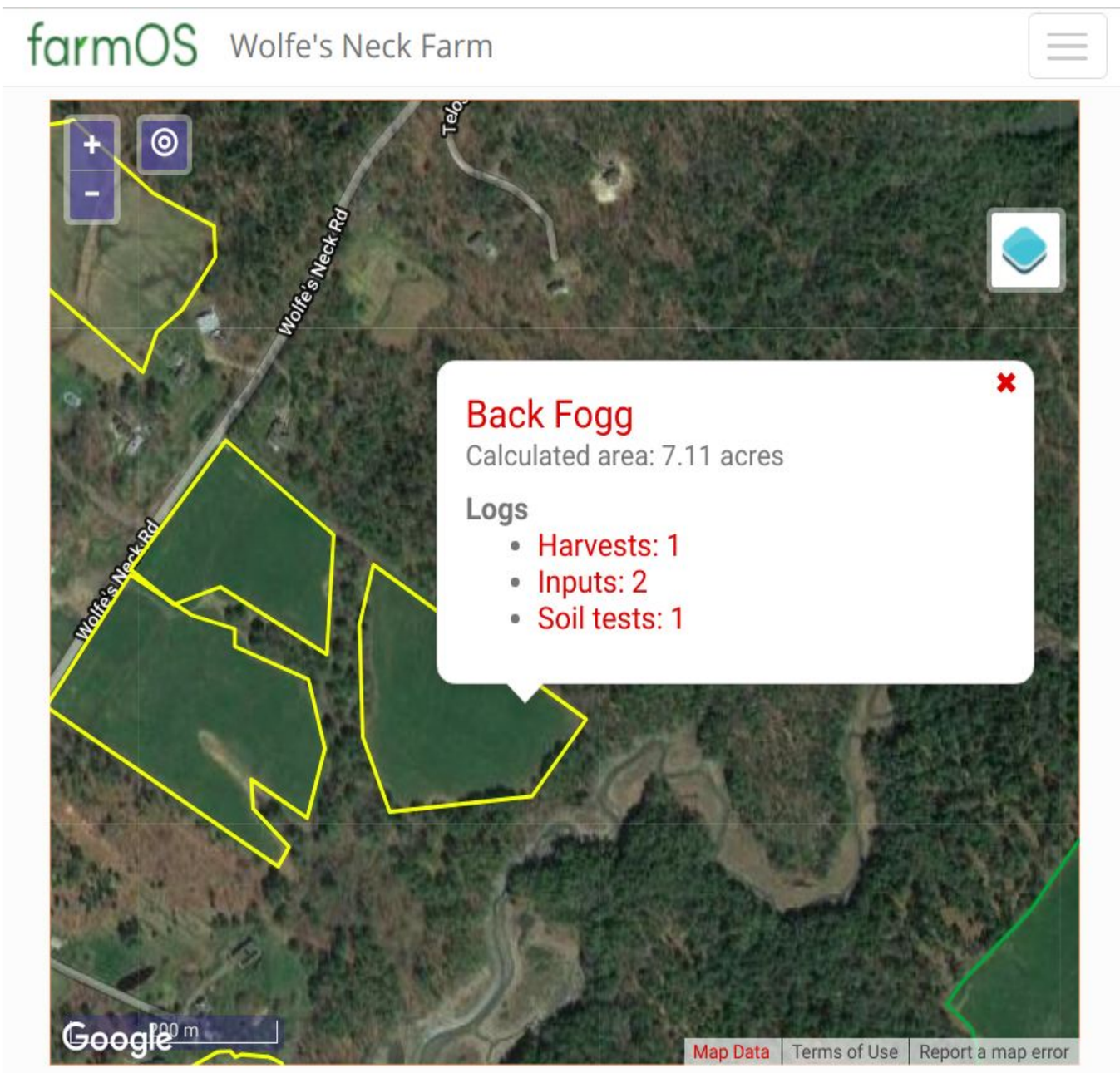
Submitted by:
Matt Steiman, www.dickinson.edu/farm
Boiling Springs, Cumberland County, PA

PASA Sustainable Agriculture

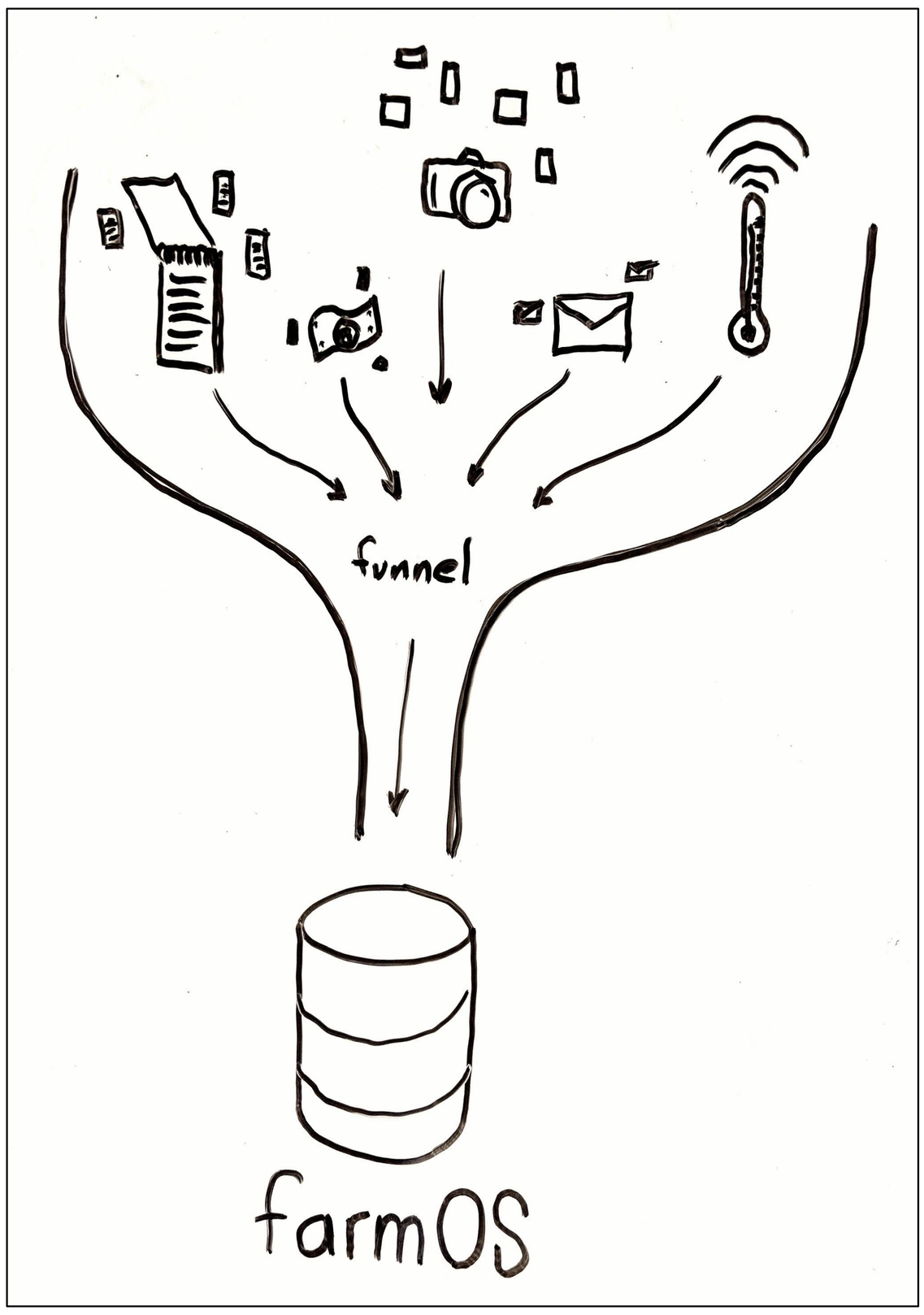
farmOS

farmOS is a free and open-source software platform for agricultural planning and record keeping. It is designed, built, and maintained by a community of developers, farmers, and researchers with the aim of creating a common platform for farm data management. The goal is to give farmers control over their data, as well as options for sharing it when/where/with whom they choose. It is accessible from any device with an internet connection and a web browser (phone, laptop, tablet, etc). https://farmOS.org

farmOS



Screenshot of a farmOS map



Graphic showing the flow of data from different sources into farmOS

Benefits:

- Manage maps, crops, livestock, equipment, and all activity records in one place.
- Quick forms for recording activities quickly in the field.
- Connect to sensors for monitoring environmental conditions.
- Additional modules can be built to provide specific features.
- Free and open source software. Farmers own their data.

Drawbacks:

- Requires an internet connection. (Offline mobile app is being developed.)

Years in Service: 5

Parts List:

- N/A

Estimated Cost:

Free software, $50/year hosting

Submitted by:
Michael Stenta, mike@farmier.com

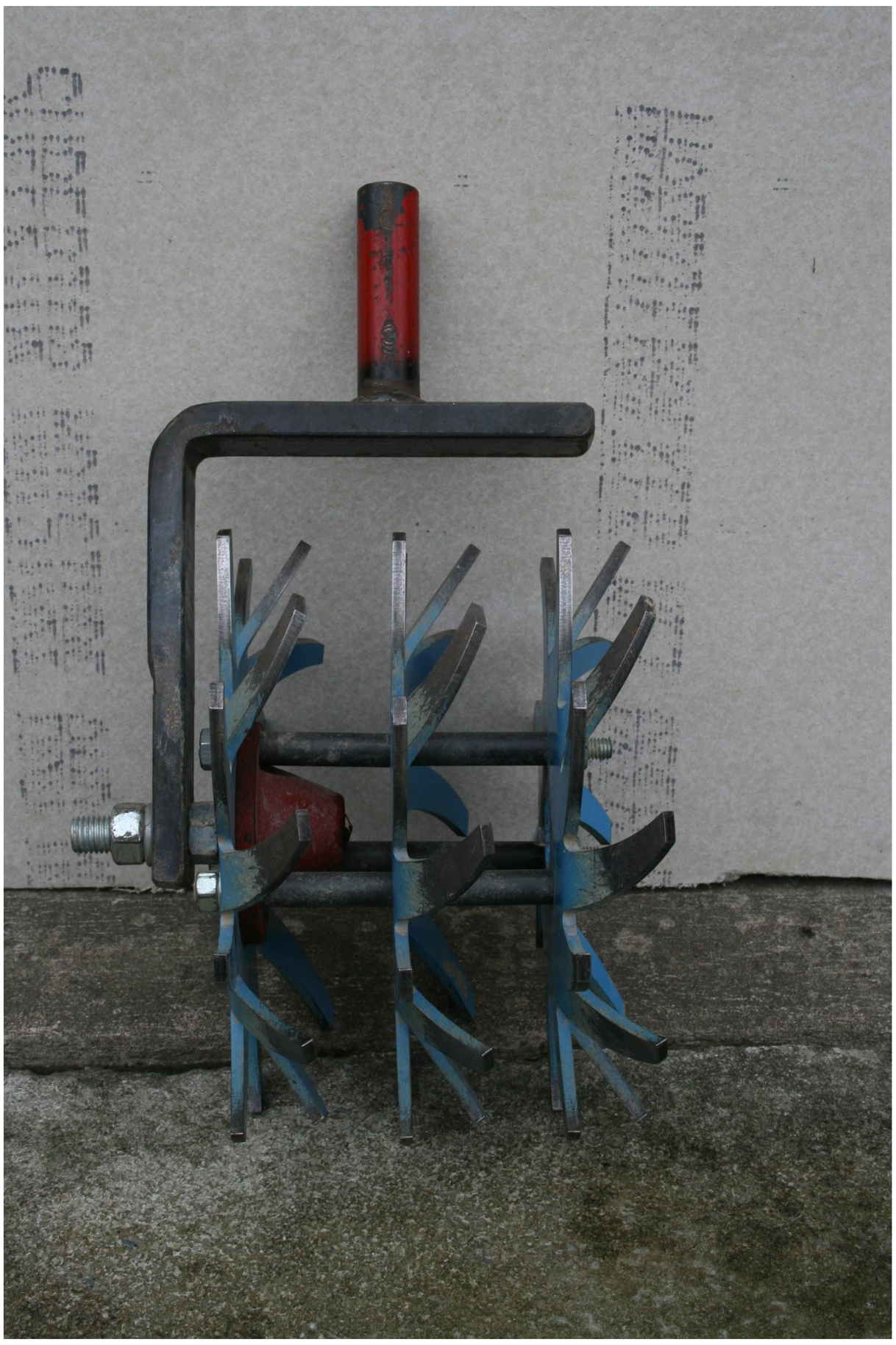
PASA Sustainable Agriculture

The Good Dohnervator

The Good Farm

Rolling basket cultivators created by John Good and Andy Dohner. We use these cults to replace basket weeders on the belly of our Kubota L245. They are easier to take on and off and are much more effective at breaking through a soil crust after heavy rain.

Cultivator, side view



Cultivator, front view

Benefits:

- Using these on the belly and a tine weeder on the back of the tractor, we are able to get most of our greens to harvest without hand weeding.
- They are aggressive at breaking through the soil crust, but don't throw any soil onto baby crops.
- These can be used at high ground speeds on very tiny crops.

Drawbacks:

- Mud will clog up between the spyders if it is too wet.
- They are heavy, (hard to put on, but effective and strong.)
- Sometimes they catch rocks.

Years in Service: 5

Parts List:

- Bezzerides Spyders are used for the baskets.
- Everything else is readily available hardware.

Estimated Cost: $500

Submitted by:
John Good, farmers@goodfarmcsa.com
Germansville, Lehigh County, PA

PASA Sustainable Agriculture

Hanging High Tunnel “Pick and Pack” Rack System

River View Organics

A barn door track is mounted to the top-center of a Haygrove-type high tunnel. Custom fabricated aluminum packing racks hang into the walkways between staked tomatoes. The high tunnel is situated on a moderate slope, which allows for an easy downhill harvest. A footbrake is located on the center rack. Once racks are filled with packed and graded tomatoes, the whole system is rolled about 12 feet beyond the end of the tunnel to be offloaded immediately into a wagon.

Left: Rack system in-season

Below, left: Rail hanging assembly

Below, right: Rails extending out of the tunnel for offloading

Benefits:

- Simultaneous harvesting, grading, and packing of multiple rows
- Easy unloading off rack system
- Reduced time walking
- Reduced lifting and carrying of boxes
- Easier to move racks and boxes of produce through tunnel with gravity

Drawbacks:

- Heavy. Need adequate purlins to avoid over-stressing the high tunnel.
- Round (not square) barn door track tubing and hardware is needed for a sloped system. Otherwise, the racks move quickly, and a hazard is created.
- Difficult to find the parts above. The company has gone out of production.

Years in Service: 2012-2013

Parts List:

- Barn door track and hardware
- Custom-fabricated aluminum racks
- Hanging chains and hooks

Estimated Cost:

Unknown

Submitted by:
Aaron Zook
Lancaster County, PA

PASA
Sustainable Agriculture

Market Pallet

New Morning Farm

This is an angle iron and plywood shelving attached to a sturdy pallet. We are able to pack all our market supplies (scales, calculators, signs, baskets, bag stands, table clothes, jams and jellies, etc) onto this pallet a day or two ahead. Then we roll the whole pallet onto the truck first thing the morning of market. No need to work down a long checklist at 3:00AM!

Two market pallets ready to go

Market pallet in the truck

Benefits:
- Easy handling
- Protects valuable scales and market equipment
- Saves space in the market truck
- Saves time loading and unloading the truck
- Keeps supplies organized

Drawbacks:
- Need to have truck and dock
- Need a pallet jack for this system
- Will need additional pallets for multiple markets on the same day
- Construction is based on set dimensions of the pallet

Years in Service: 14

Parts List:
- Angle iron
- Flat iron
- 3/8 plywood
- Sturdy wooden pallet
- Big wood screws

Estimated Cost:

Cost of materials plus 8 hours labor - welding and final assembly

Submitted by:
Jennifer Glenister, https://www.newmorningfarm.net/
Hustontown, Huntingdon County, PA

PASA Sustainable Agriculture

Mobile Hoop Houses

North Mountain Pastures

Large, steel hoop houses are built to move around the pasture. These shelters house mainly poultry (chickens, ducks and turkeys), but are useful for pigs, sheep and cattle as well. The walls are strong enough to mount half-ton grain bins. They are moved with a solar-powered winch.

Above: Inside of a hoop house with chickens
Below: The same hoop house kit with pigs inside

Above: Hoop house with solar winch for moving

Benefits:

- Mobile
- Strong
- Long Lasting
- Multi-use

Drawbacks:

- Harder to move than small shelters
- Become large kites if not held down

Years in Service: 7

Parts List:

- Hoop house kit
- Hog panels
- Frame built from Schedule 40 steel pipe

Estimated Cost: $1200

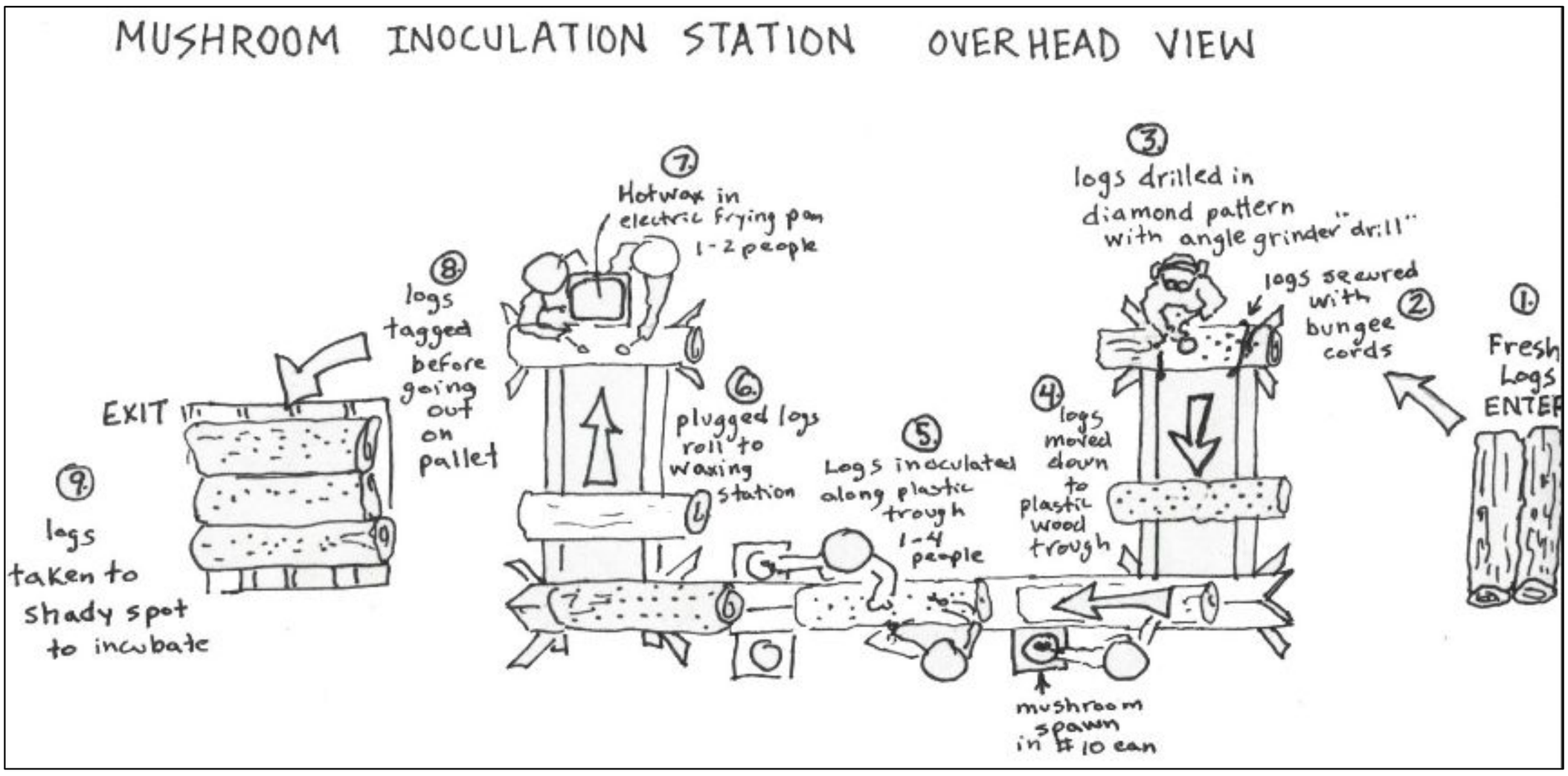
Submitted by:
Brooks Miller, brooks@northmountainpastures.com
Newport, Perry County, PA

PASA
Sustainable Agriculture

Mushroom Inoculation Station

Quiet Creek Herb Farm & School of Country Living

This innovation helps the small farmer inoculate mushroom logs fast and efficiently.



The inoculation station set-up.

Angle grinder adapter and drill bit.

Benefits:

- Less handling of logs
- Great material flow

Years in Service: 10

Parts List:

- 20' recycled plastic wood (2' X 8")
- Assorted hardware
- 4 saw horses
- Angle grinder
- Specialized angle grinder adapter and bit (from www.fieldforest.net)

Estimated Cost: $100

Drawbacks:

- Storage when not in use
- Time for set up each year

Submitted by:
Claire and Rusty Orner, quietcreek@windstream.net
Brookville, Jefferson County, PA

PASA Sustainable Agriculture

Seedling Tray Stretchers

New Morning Farm

Metal frames function as tables for transplants. Two people can carry 10 flats of transplants. Stretchers strap into trucks for easy transport.

Above: Stretchers and frames for holding
Below: Seedlings young and old

Above: Stretchers attached to truck
Below: The transplant greenhouse mid-season

Benefits:

- 2 people can carry 10 flats
- Slides into trucks, strap across top of truck bed
- Fully supports flats no need for special tables
- Holds flats from seeding through transplant

Drawbacks:

- Need two people
- Need trays for some flats
- Stretchers have sharp corners and that can be a hazard when walking around them (i.e. while watering seedlings)

Years in Service: 20+

Parts List:

- Angle Iron

Estimated Cost:
Unknown

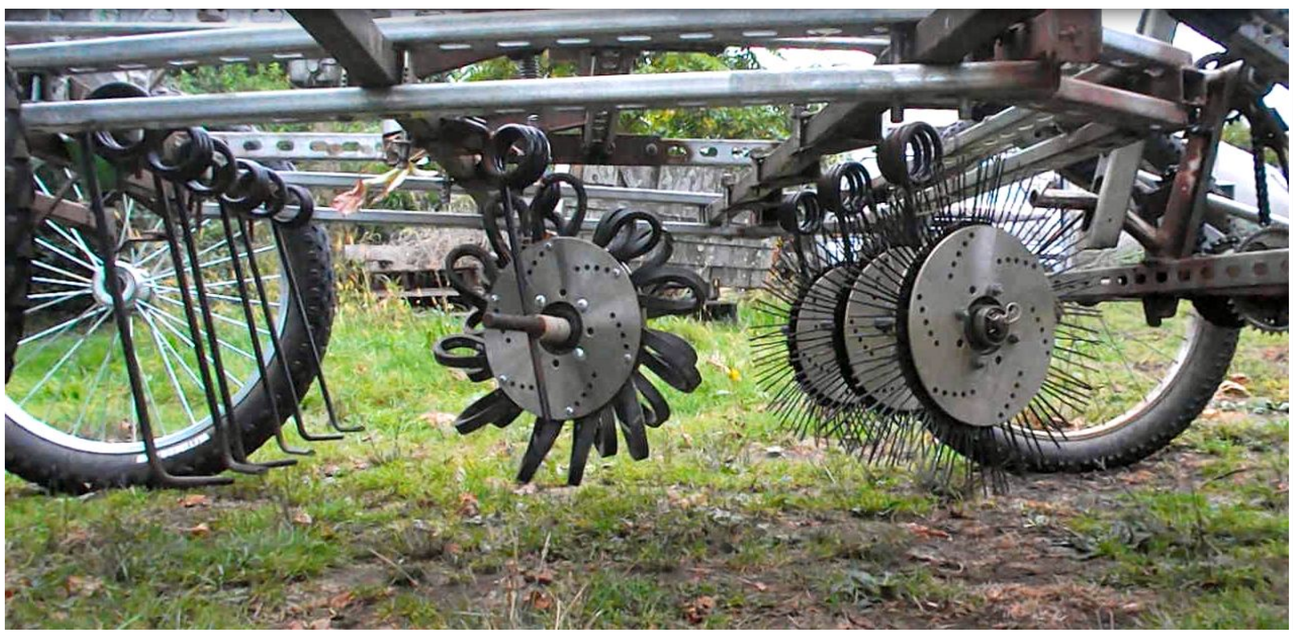
Submitted by:
Jennifer Glenister, https://www.newmorningfarm.net/
Hustontown, Huntingdon County, PA

PASA
Sustainable Agriculture

The Culticycle

Green Tractor Farm

A quadricycle with a belly mounted lift which mounts cultivation and seeding tools. Sort of a pedaled version of an Allis Chalmers G. Because a lot of row-crop work requires very little horsepower, it's possible to do it with human power, which reduces fuel use and benefits the health of the farmer.



Above: Culticycle, front view
Below: Cultivator detail

Above: Culticycle, side view
Below: Cultivator detail

Benefits:

- Physical health: farm work is all weightlifting and no aerobic, and tractor work is nothing but sitting and twisting, so anything that causes farmers to move will be beneficial to joints, heart and lungs, and overall health.
- No fuel, no emissions.
- Wide open belly space which allows for 3 separate toolbars, and facilitates tool combination (for example sweeps/knives/vertical fingers/star hoes in one pass).

Drawbacks:

- Human power has a low limit: an acre takes an hour and a half, and this does not include sweeping the wheel tracks (the culticycle doesn't use a rear lift).
- Hard to use on a field that slopes up: 10 degrees is the maximum. But then it's easy coming downhill.
- It has only 1 gear, because it has a differential, and it has to be able to go forward and backward. The gearing is not ideal for everybody.

Years in Service: 12

Estimated Cost: $600 for parts, plus 1 month labor

Submitted by:
Tim Cooke, greentractorfarm@gmail.com

PASA
Sustainable Agriculture

The Pigtiller

Sunnyside Farm

Our Pigtiller is a movable pig pen, a self contained system using 4 piglets up to 200 pound pigs as a groundbreaking device to eliminate sod, roots, and till garden rows of any length. Pigs clear ground in as little as 24 hours. It eliminates use of fossil fuels, runs on waste, saves labor and time, and is fun to watch!

Above: Pigtiller being moved

Left: Tilled bed

Right: Tilled bed

Benefits:

- Low cost turf removal
- Saves your back
- No fossil fuels, reducing climate impact
- Eliminates waste products on farms
- Starts every time, little maintenance
- Sell the pork when pigs outgrow the pen

Drawbacks:

- Have to get pigs butchered at the end of the season

Years in Service: 10

Parts List:

- 2x6 frame
- Goat panels
- Watering pipe
- Hurricane clips
- Wheel jacket & Wheels
- Tarp
- Rope

Estimated Cost: $250 per pen

Submitted by:
Homer Walden & Dru Peters, https://sunnysidefarmpa.com/
Dover, York County, PA

PASA
Sustainable Agriculture

Wheel Hoe Tine Weeder

Foxtail Community Farm

This wheel hoe tine weeder is a modification of a Glaser wheel hoe purchased 10 years ago with a stirrup hoe attachment. I have extremely rocky soil here in the Catskill mountains and snapped the stirrup hoe right off within 2 hours of using it.

Six years later I purchased a Kovar tine weeder for my tractor and saw how well it did despite all the rocks, but being a blind weeder, it had inherent problems with weeding direct seeded crops. It consists of three rows of tines (I used dethatcher tines) bolted to angle iron which is bolted to the wheel hoe. The tines are offset from each other and the total width is 13".

It is relatively easy to push on friable soil without rocks. Rocky soil makes it a bit of a workout.
I run four passes per row, 1 each direction on each side, at a brisk walking rate. As with most tine weeders, weeds must be small, unseen to white thread stage, for best effectiveness.

Left: Eric de Long with wheel hoe tine weeder

Right: Tine weeder assembly detail

Benefits:

- The tines do a good job raking the ground
- Move easily around rocks and do not pick up trash
- It has worked well on peas, corn, potatoes, and most transplanted crops
- Using it at the white thread stage, weekly, I would hope for 80%-90% effectiveness

Drawbacks:

- The initial impetus for the design was to get better control of weeds in direct seeded crops like carrots and spinach. Results on these have been varied, mostly having to do with killing the crop along with the weeds.
- Overall a good start, but more tweaking needs to be done.

Years in Service: Unknown

Parts List:

- Glaser wheel hoe
- Dethatcher tines
- Angle iron

Estimated Cost: Unknown

Submitted by:
Eric de Long, foxtailcommunityfarm@gmail.com
Greenville, Greene County, NY

PASA Sustainable Agriculture