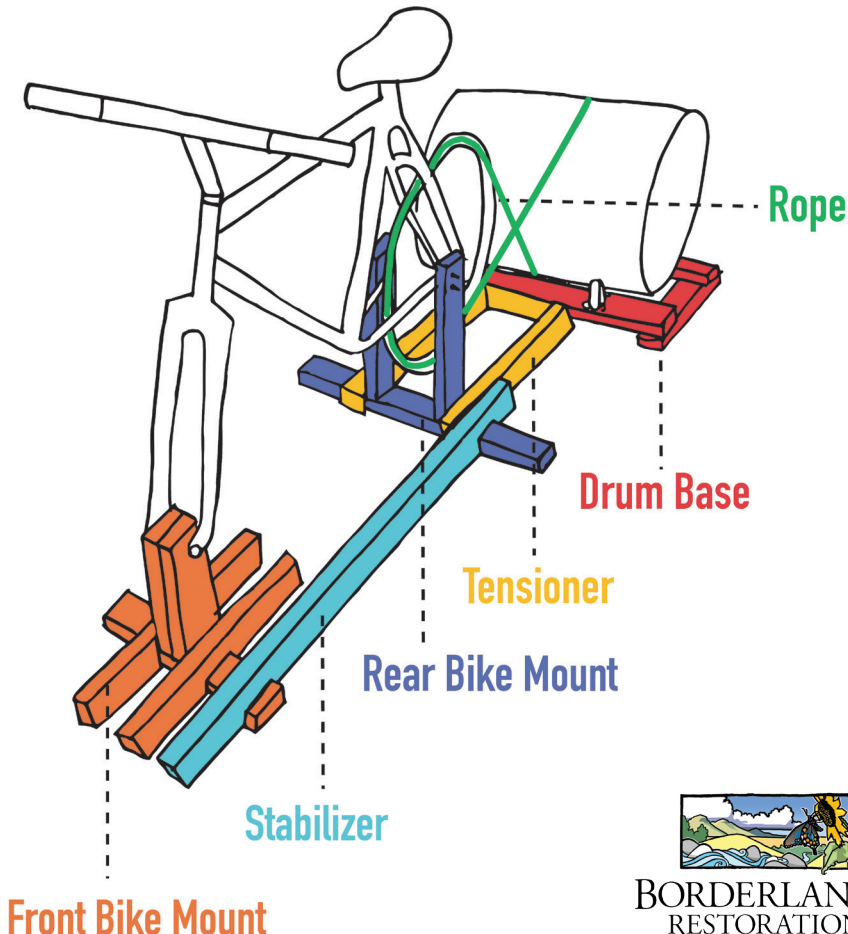




HOW TO CONSTRUCT

A Bicycle-Powered Seed Pelletizer for Use in Gardening and Restoration

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Ashlee Simpson
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Constructing a Bicycle-Powered Seed Pelletizer

Seed pellets encapsulate seeds in a mixture (often clay, and nutrient-rich organic matter such as compost, humus, or charcoal) that will potentially reduce predation by insects and rodents while allowing for increased water retention and seed-soil contact.

Seed pellets are an ancient method of sowing seed, and are especially useful in areas with compacted or dry soils. Seed pellets are strewn in the desired location (no need for soil preparation) and remain inactive until heavy rains arrive, washing away the clay and allowing seeds to germinate.

Making seed pellets by hand is extremely time consuming and labor intensive. To make large numbers of seed pellets in a reasonable amount of time, we constructed a bicycle-powered seed pelletizing machine that effectively coats seed in clay and compost materials. It is designed to be easily taken apart for storage or transport, so each component fits against the others without being screwed together. The bicycle spins a barrel containing the seeds and coating materials while the operators periodically mist the contents with water. The result is coated seed balls that can be used for restoration or home gardening. Here, we explain how to construct the seed pelletizing machine.

Tools

- Drill and bits:
 - $\frac{3}{8}$ " bit
 - $\frac{3}{32}$ " bit
- Jigsaw with wood blade
- Lighter
- Measuring tape
- Scissors/knife
- Pencil
- Eye protection
- Clamps to hold planks while drilling (optional)

Materials

- Bicycle with front wheel and back tire removed
- Box of 3" wood screws (50+ screws)
- Sixteen 1" woodscrews
- Hex wood screw with nuts to fit bicycle dropouts (we used $\frac{1}{2}$ " x 6")
- Washers (sixteen $\frac{1}{4}$ " and one $\frac{3}{8}$ " x 16")
- Two U-bolts ($\frac{5}{16}$ " x 1.38" x 3.88")
- 30-gallon poly drum with 6-8" hole cut in the center of the lid
- 3" x 4" rigid casters (wheels with housing)
- Nylon rope - at least 18' (climbing rope works well)
- 2" x 4"s of the following lengths:

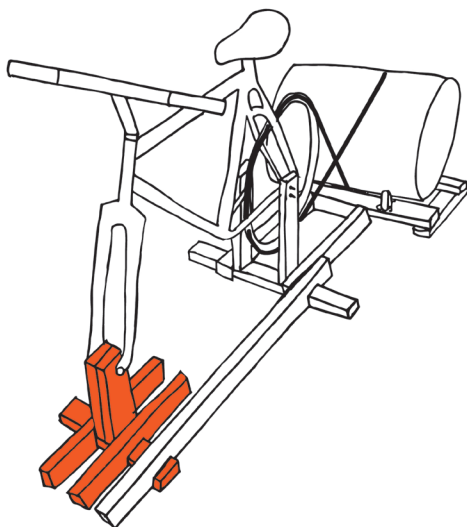
A - two pieces 12"	F - two pieces 20"
B - one piece 17"	G - two pieces 28"
C - two pieces 20"	H - two pieces 31"
D - two pieces 17"	I - one piece 9"
E - one piece 28"	J - one piece 52"

COMPONENT 1**Front Bike Mount**

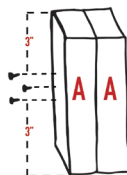
This component is where the front of the bike is mounted by attaching the front of the bike on the hex screw with fasteners tightened on the outside of the bike frame to stabilize.

Tools & Materials

- Drill
- $\frac{3}{8}$ " bit
- Jigsaw
- $\frac{1}{2}$ " x 6" hex wood screw
- One washer ($\frac{3}{8}$ " x 16")
- Eleven 3" screws
- 2" x 4"s cut to length:
 - A – two pieces 12"
 - B – one piece 17"
 - C – two pieces 20"

**Front Bike Mount Assembly**

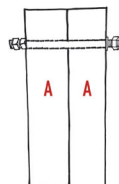
- 1** Screw the **A** planks together using three 3" screws starting at least 3" from the top and 3" from the bottom of the planks. *Insert screws in a triangle arrangement.*



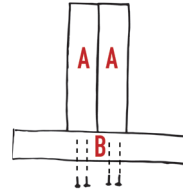
- 2** 2" from the top of the **A** planks, drill a centered hole through both planks using a $\frac{3}{8}$ " bit.



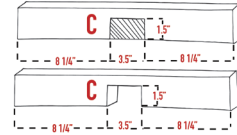
- 3** Thread the hex wood screw through the hole and thread nut on open end (sold with the screw).



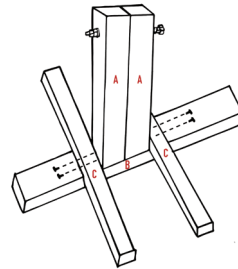
- 4** Screw the **A** planks to the center of **B** (on the long side) from the bottom using two 3" screws for each.
Drilling pilot holes first in B can be helpful.



- 5** Make a 3.5" x 1.5" notch in each **C** plank to fit over **B**. Trace the end of a 2" x 4" to mark the 3.5" x 1.5" notch and use the jigsaw to saw out the notch.



- 6** Place the **C** planks over **B**, notch-side down and snugly fit against the **A** planks. Screw the **C** planks into the **A** uprights using two 3" screws for each plank.



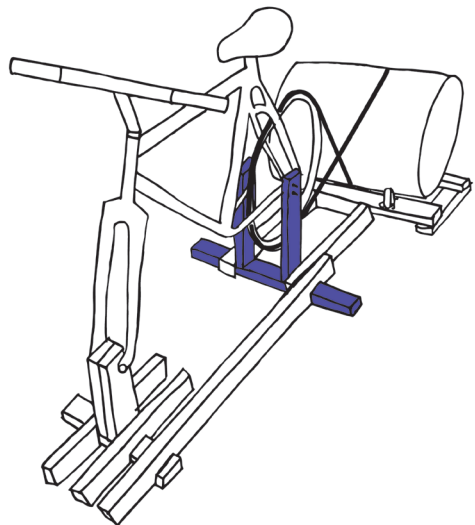
- 7** Set this aside as the front bike fork will be attached with the hex screw through the connected **A** planks.

COMPONENT 2 Rear Bike Mount

This component is where the back of the bike is mounted to allow the back wheel to spin freely. Specific dimensions are not provided for each piece because placement of the pieces can vary based on the size of the bicycle.

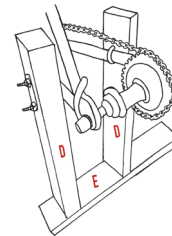
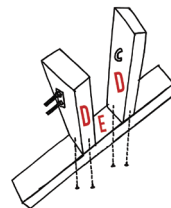
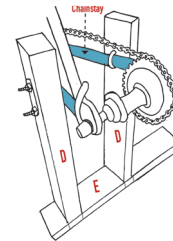
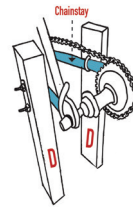
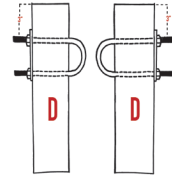
Tools & Materials

- Drill
- $\frac{3}{8}$ " bit
- Two U-bolts ($\frac{5}{16}$ " x 1.38" x 3.88")
- Four 3" screws
- 2" x 4"s cut to length:
 - D - two pieces 17"
 - E - one piece 28"



Rear Bike Mount Assembly

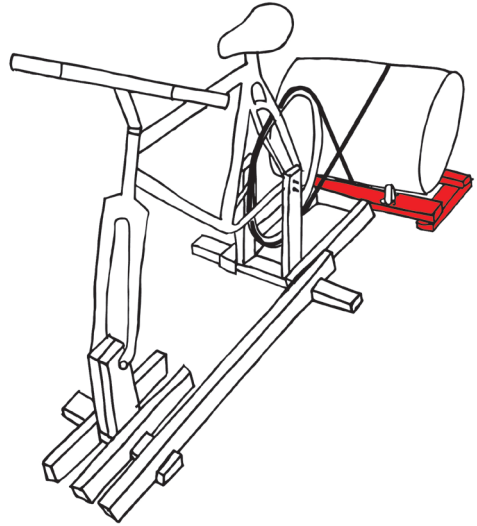
- 1** On each **D** plank, drill holes for U-bolt 3" from the top using a $\frac{3}{8}$ " bit, however, do not install U-bolts at this time. Make sure U-bolts easily slide through **D** planks.
- 2** Attach the U-bolts on the **D** planks to the chainstay of the bike on either side. *Attach D planks to gearshift side first.*
- 3** Center the **E** plank beneath the **D** planks and trace where the **D** planks line up on the **E** plank. *Make sure the bike can pedal smoothly when the D planks are attached, adjust gears or position of mount as necessary.*
- 4** Detach the bike from the **D** planks. Drill from the bottom of the **E** plank to attach the **D** planks in the place where you marked using 2 screws for each.
- 5** Attach bike to mount using U-bolts. *It is recommend to drill guide holes before placing screws.*



COMPONENT 3

Drum Base

This component is where the drum sits on wheels and spins in order to mix the seed and coating products. The dimensions provided are based on a 30-gallon plastic drum with grooves that line up with the wheels. If your drum is a different size, adjust accordingly.

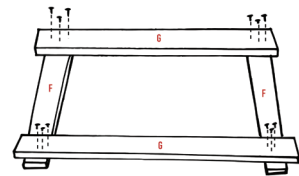


Tools & Materials

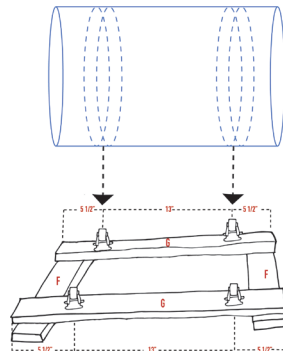
- Drill
- Sixteen 1" screws
- Twelve 3" screws
- Sixteen ¼" washers
- Four casters (wheels with housing)
- 2" x 4"s cut to length:
 - F - Two pieces 20"
 - G - Two pieces 28"

Drum Base Assembly

1 Drill the **G** planks into the **F** planks using three 3" screws for each corner.

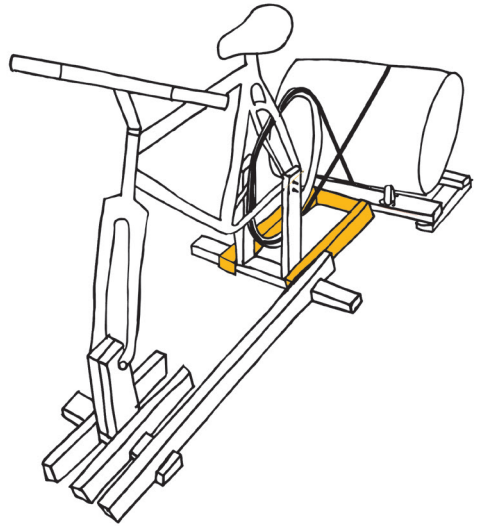


2 Mount 4 casters on the **G** planks: Drill the casters in place (dimensions shown in diagram) using 1" screws at each corner with a ¼" washer for each screw. Double check this placement lines up with your drum before mounting the casters.



COMPONENT 4 Tensioner

This piece provides tension between the Rear Mount and Drum Base to help the drum spin smoothly. The notched end of the H planks rests against the Rear Mount and the flat end of the I plank rests against the Drum Base.

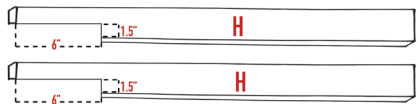


Tools & Materials

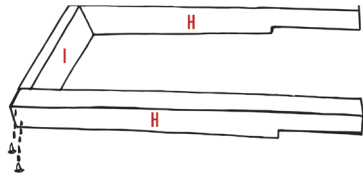
- Drill
- Jigsaw
- Four 3" nails
- 2" x 4"s cut to length:
 - H – Two pieces 31"
 - I – One piece 9"

Tensioner Assembly

- 1** Cut out a 6" x 1.5" section from the bottom corner of each long H plank using a jigsaw.



- 2** Screw the uncut side of the H planks into the I plank using two 3" screws on each side of I plank.

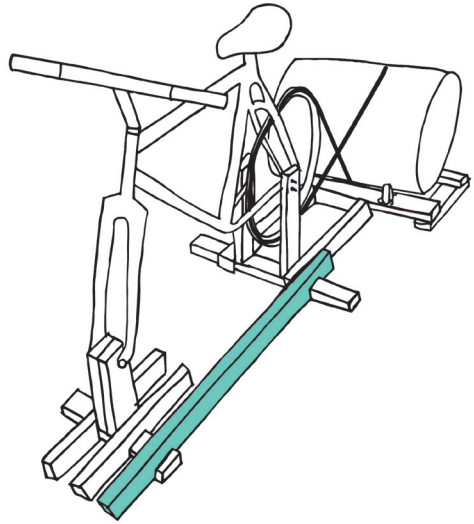


COMPONENT 5 Stabilizer

This component is one plank with two notches that connects the front and rear bike mounts to stabilize the pelletizer during use. Placement of the notches will vary depending on the size of the bike so specific dimensions are not provided.

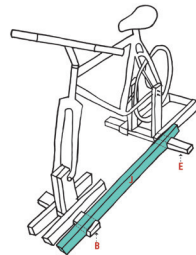
Tools & Materials

- Jigsaw
- 2" x 4" cut to length:
J – one piece 52"



Stabilizer Assembly

- 1 Connect bike to mounts. Place the **J** plank as shown in the diagram. Measure and mark where the **J** plank intersects the **B** and **E** plank. This is where you will make two 3.5" x 1.5" notches to connect the front and rear bike mounts.
- 2 Use the jigsaw to cut out the two notches to fit over the front and rear mounts.



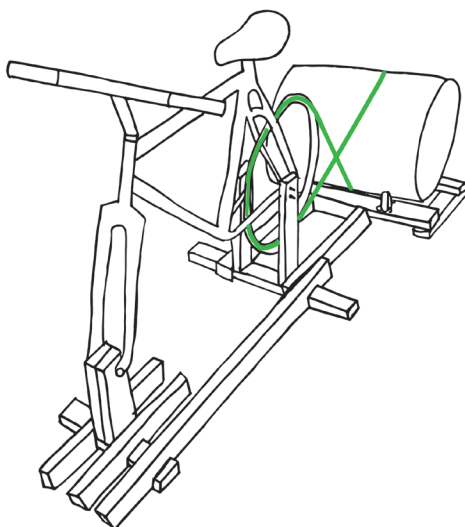
COMPONENT 6

Rope

A closed loop that wraps around the back bike wheel and the drum.

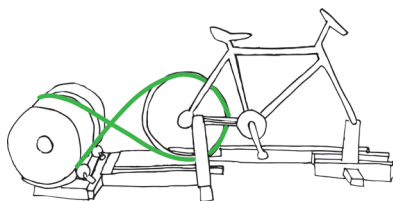
Tools & Materials

- Approximately 14' 3" of rope
- Lighter
- Scissors/knife



Rope Assembly

- 1 Set up all the components you have assembled up to this point.
- 2 Wrap the rope around the rear wheel (after removing tire) and bring it around the drum making a figure-8 loop in the center. Cut the rope at the point where it will form a closed, tight loop.
- 3 Fuse together each loose end of the rope using a lighter.



Making Seed Pellets with the Bicycle-Powered Machine

This requires at least two people, one to pedal and one to mist and scrape the drum contents.

Materials

- Hose with misting attachment
- Scraper: Tool for scraping the sides of the barrel (we used a plastic pipe with an angled edge)
- Containers to catch material
- Sieves with $\frac{1}{2}$ " - $\frac{1}{4}$ " screens
- Trays for drying pellets

Pellet components

- Seed
- Dry powdered clay
- Other potential ingredients used as an adhesive: peat moss and finely sieved compost

Process

- 1 Combine ingredients in drum, only filling the drum about $\frac{1}{4}$ to $\frac{1}{3}$ full, place on drum base and attach the rope. We tend to create mixtures consisting of approximately: 2:1:3 - seed:tackifier:clay. Pedal to mix the dry ingredients thoroughly.
- 2 Continue pedaling and start misting the contents in 5-second intervals with water, scraping the sides of the drum periodically as it spins to loosen material. Use water sparingly to avoid oversaturating the mix. If the mix gets too wet, large soggy clumps will form.
- 3 Once pellets have started to form, stop pedaling and scoop material onto a sieve to separate loose seed from formed pellets (we used a $\frac{1}{4}$ " sieve for a native grass seed mix). If some pellets are large (>3 cm), break them apart with hands to form into smaller pellets.
- 4 Place loose seed back in drum and add more clay and other material if needed. Repeat misting, scraping, and sieving process until all of your seeds are pelletized.
- 5 Dry pellets for several days to a week.



Seed pellets made with *Oenothera elata* seeds

Troubleshooting

- Large clumps: the cause is likely too much water. Break apart clumps with hands and add more clay.
- Pellets not forming: if seed remains mostly loose and un-clumped, try adding more clay/compost mixture followed by more misting.
- Barrel not spinning easily: it is possible to overload the barrel, especially after adding water. Remove material and process in smaller batches.

Resources

- Madsen et al. (2016) Emerging seed enhancement technologies for overcoming barriers to restoration. *Restoration Ecology* 24: S77-S84
- Fukuoka M (1978) *The one-straw revolution*. New York Review of Books, New York. 184 pp
- www.tandyhills.org/story-seed-balls-jim-bones

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