



Mobile Refrigeration Trailer for N.C. Farmers

N.C. State’s Plants for Human Health Institute (PHHI) has developed a new mobile cooling unit for farmers. The five-by-eight-foot refrigerated trailer – called the “Pack ‘N Cool” – is designed to keep fruits and vegetables at ideal temperatures during transport to and from farmers markets or as they’re harvested in farm fields.

Dr. Penelope Perkins-Veazie, professor and postharvest physiologist with PHHI, coordinated the effort to develop a mobile refrigeration unit that agricultural producers can use as a model for building their own versions. The Pack ‘N Cool unit combines the mobility of a cargo trailer with the refrigeration capabilities of a commercial cooler.

As a scientist that studies fresh produce after it’s harvested, Perkins-Veazie recommends that many fruits and vegetables be stored at 32 to 41 degrees Fahrenheit. This includes most fruits (apple, blackberry, strawberry), leafy greens (cabbage, lettuce) and immature vegetables (broccoli, cucumber, green beans), which decay in heat.

The Pack ‘N Cool utilizes CoolBot temperature technology to maximize the output of a basic window air conditioner unit. The CoolBot adapter interfaces with the AC unit, which typically bottoms out at 60 F, to generate temperatures as low as the 30s in the trailer.





Materials List

NEW

1. 18-22 sheets of 2" foam
2. 3 sheets of (3/8") plywood
3. 4 sheets of 1/4" plywood
4. 60-70 4" sheet metal screws #14
5. 3/16" x 6" drill bit
6. 1 gallon of polyurethane
7. 1 gallon of paint
8. 1 paint roller
9. 1 paint brush
10. 12 3" self-tapping screws (door)
11. 15 (5-1/16") screws (floor)
12. Brad nails for trim
13. Glue trim
14. 2 tubes of silicone (for gluing panels together)
15. 6-7 cans of spray foam
16. 1 roll of duct tape
17. 2 sticks of 1/4" round trim
18. 2 tubes of caulk
19. 1 stick of bath glass surround
20. 4' angle iron or shelf legs
21. RV Plus Box
22. Wire and spade connectors
23. Wood filler

REUSED

1. Plywood from trailer - 3 sheets (3/8") (sides)
2. Plywood from trim (1/8"), several strips (end cups)
3. Light
4. Aluminum from AC cut out (pan for bottom of AC)
5. Aluminum trim inside (corners of the trailer)

Sample Materials Budget

CATEGORY	COST
Trailer	\$1,545.86
Transporting	\$23.27
AC Unit	\$726.87
Insulation	\$727.10
Painting	\$135.36
Plywood	\$60.97
Hardware	\$194.37
Miscl.	\$57.26
TOTAL:	\$3,471.06

**This budget is a guide for planning purposes, costs vary based on brand, quantity and retailer. Customization is encouraged. Find a detailed budget at plantsforhumanhealth.ncsu.edu.*

Note: A new trailer was purchased for the Pack 'N Cool model, but a pre-owned trailer could cut costs.



Construction Instructions (1/2)

1. Remove aluminum trim and plywood from inside of trailer, save for be reuse. Note if there are any wires that need to be disconnected.
2. Cut foam to go between trailer wall studs. Consider cutting the foam to slide into/behind studs.
 - Walls = 4" foam
 - Floor = 4" foam
 - Ceiling = 2" foam
 - Layers were laid in opposite directions (first was vertical, second was horizontal) to cover seams.
3. AC Unit
 - Remove case/box from cooling components.
 - Mount as high as possible.
 - Make a cardboard template of the AC box and mark the cut out on the trailer wall.
 - Cut hole slightly smaller than the template and trim with actual box unit.
 - i. Be sure unit is level left to right or have the unit slightly tilted towards the drain hole side of unit.
 - Cut hole in trailer just larger than AC box.
 - i. Use both tubes of glass surround to frame hole for AC. Slide box into hole. ****DO NOT SCREW IT IN AT THIS POINT.**** It will need to be adjusted once the walls are up.
 - Cut angle iron to go from center stud to the two next to it; use screws to secure it.
 - The trailer needs 110V to operate (it uses a cellphone charger).
 - To supply power to it, tap power out of the AC unit power cord. Put new female spade connectors on AC cord, with extra wires from the positive and negative wire place a female spade on these wires. The spade connector now slides on to the trailer power supply.
4. Powering the AC Unit
 - Install an RV power inlet on the outside of the trailer (Part II 200BB1VRV or equivalent).
 - Cut off the end of the AC power cord and wire accordingly to the inlet.
 - Cut a groove in the foam to run the cord to the AC unit.
 - Lay the cord in the AC box to be hooked up later.
5. Plywood
 - Cut the floor wood (3/8") first and lay it in.
 - Then install the ceiling plywood (1/4").
 - The walls can be reused from the original plywood that was removed, just cut it down to fit.
 - Cover the front of the trailer with the two plywood pieces (3/8") that were cut from around the AC unit.
 - There is a gap of about six inches from the sides to the front wood; cover this with the aluminum removed earlier.
 - Cut out the ceiling plywood to accommodate the vent. This is to allow the trailer to breath/dry after use.
 - With the wood in place, drill holes with the 3/16" x 6" drill bit into the studs, being careful not to push too hard and dent in the outside of the trailer.
 - ****Only drill the holes, do not screw the wood down at this point. Counter sink all the holes so the screws will sit flush.****

Construction Instructions (2/2)

6. Final Assembly

- Once the wood is all cut and holes drilled, remove the wood and the first layer of foam all around.
- Spray foam the cracks around the floor foam and tap the seams. Secure the floor plywood first using the 5 1/16" self-tapping screws.
- The ceiling is next. Tape the gaps and use 3" screws.
- Next are the walls. Spray only one side at a time. Put up the next layer of foam and tape the seams.
- You may have to use the 3/16" drill to help line up the holes, and then use the 4" #14 sheet metal screws to hold the plywood.
- **Only tighten the screws enough to pull wood in a little. Do not drive the screws in too hard.**
- Once the wood is screwed down, set the position of the AC unit by installing the front cover and positioning it so you can still remove the cover, but as much as possible is still hanging outside.
 - i. Note: the air conditioner needs to be tilted so water drains properly out of the unit. (See AC unit instructions.)
 - ii. The top support for the unit may need to be repositioned to give support.
- Once the AC is in the correct position, screw the unit to the angle iron brace installed earlier.
- Fill all the holes and imperfections with wood filler and then sand it all down with 80 grit.
- Paint with polyurethane to help seal out moisture.
- Trim out skylight opening (for appearance).
- Install 1/4" round molding at ceiling side joint (this helps hold up the ceiling panels and cover any gaps).
- Caulk all joints for appearance and to seal out moisture.
- Once dry, paint the inside with low-VOC paint.
- Install aluminum trim in corners using silicone and brad nails or staples.

7. Insulated Doors

- Use 2" of foam (layer of 2") then 1/4" plywood.
- Cut the foam so that the doors can close and open freely. Leave about 1/2" gap on the sides to allow for 1/8" trim piece.
- The door with locking bar needs enough room for door to open freely.
- Cut plywood the same size as the foam.
- Glue the foam to the door with silicone, then the plywood to the door.
- Use 1/4" x 3" self-tapping screws to hold to the door.
- To trim the edges, use the 1/8" plywood that was removed earlier.
- Cut strips a little wider than needed (1/16" to 1/8"), and then glue and nail to plywood.
- Once dry, sand the 1/8" plywood down flush with 1/4".
- Fill any areas and sand again.
- Paint with polyurethane and low-VOC paint.
- Reconnect any wires that may have been disconnected.

8. Install CoolBot

- Follow the instructions in the CoolBot manual.

Recommendations for the use of any construction materials are included as a convenience to the reader. The use of brand names and any mention or listing of commercial products or services in this publication does not imply endorsement by N.C. State University nor discrimination against similar products or services not mentioned. Individuals who use construction materials are responsible for ensuring that the intended use complies with current regulations and conforms to the product's intended purpose. Be sure to obtain current information about structural integrity and consult the retailer with questions about the strength of the equipment or compatible hardware.