Utah Greenhouse Heats, Cools Itself

55-degree pitch restricts enough sunlight in the summer to help hold down temperatures.

Nate Christensen has a passion for growing the food his family eats. He and his wife grow fruits and vegetables all year long in his off-grid 17 by 103-ft. greenhouse he calls a "walipini hybrid."

"We finished the greenhouse in July 2022, and despite one of our hardest winters, we grew bananas, avocados, and mangoes in the snow, as well as tomatoes, cucumbers, squash, carrots, peas and more," says Christensen. "This summer, it has handled the high heat just as well, never getting over 100 degrees inside."

Also known as a pit greenhouse, the basic style was used in Victorian-era Britain and pre-revolution Russia. With its in-ground design, it offers year-round production in a wide variety of climates. In recent years, it's regained its earlier popularity. Christensen gathered ideas from multiple sources to design his hybrid.

"The biggest challenge was having the confidence to build one that was unique," he says. "I knew I wanted it as off-grid as possible. I based the roof angle with its 55-degree pitch on what others had done in this area. It restricts enough sunlight in the summer to help hold down temperatures."

Rather than use a kit, Christensen designed trusses and had them fabricated. Like other walipinis, he set the lower 4 ft. below ground level to take advantage of geothermal warming in the winter and cooling in the summer.

Credit for the winter warmth and summer cooling is shared by the insulated in-ground and above-ground walls, the heat bank of 68 blue water barrels running the length of the back side of the structure, the angle of the roof line, the 24-in. insulated blanket above the front 18-in. stem wall, and the cold air drops. Foam sprayed on the end walls, rear wall, and roof helps to seal out cold air. Screened windows and doors at each end facilitate air movement in the summer.

The 4-ft. grow wall at the front of the greenhouse has a double layer of insulation. The 8-ft. rear wall has a double layer of 2-in. insulation sheets in between 2 by 4 framing with the second layer perpendicular to the first to prevent gaps.

In the summer, raising the blanket at the front provides massive air input, which vents through the roof vents, doors, and windows.

"There's a ton of airflow in the summer, and the plants love it," says Christensen. "What really helps is the mass of plants and the water in the soil. It acts like a giant swamp cooler."

In the winter, the heat reservoir of blue barrels gets an active assist from convection created by the cold air drops.

The drops are two high, 55-gal. barrels buried 6 ft. in the ground beneath the center walkway. Grills over them allow cold air in the winter to pass down and through a network of 8-in. single-wall corrugated poly pipe that connects them. As the air is warmed by the ground, it rises through pipes buried at a gentle incline to the rear of the greenhouse in front of the barrels.

The 30-in. high raised planting beds are 3 ft. wide at the front of the greenhouse and 5 ft. wide at the rear. However, the 2 ft. next to the rear wall is taken up by the line of water barrels.

Combined with outside gardens for corn, tomatoes, potatoes, extra onions and carrots, the greenhouse is helping to meet a key goal for Christensen. He and his wife plan to grow as much food for themselves and their eight children as possible.

Heat reservoir of 55 gal. barrels gets an active assist from convection created by cold air drops.

"We noted recently that we don't buy produce at the store at all anymore," says Christensen. "The kids go in for a handful of blackberries or strawberries or to get stuff to make salsa. It's available, and we know where it came from, fresh and right in our backyard."

Christensen posted several videos on the greenhouse building process on his Manti Homestead YouTube channel. He did so in the hopes that others would take the plunge. If not to build their own greenhouse, then simply to grow at least some of their own food.

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Rope connected from front of coop to fence frame keeps fence from collapsing.

Chicken Tractor Fitted With Sliding Fence

With 2,800 laying hens on pasture, Michael Gutschenritter had better things to do with his time than moving electric fence. His HenPen sliding fence saves time and energy. Best of all, it leaves more time to spend with his growing family and for other work on the family's Three Brothers Farm. In addition to selling eggs direct to consumers and through a network of local stores, he and his wife market lamb and wool produced on their 100-acre farm.

"I built the first one when our first daughter was born 4 years ago," says Gutschenritter. "It worked so well that I added three more."

Cost savings were immediately apparent. Gutschenritter realized he needed only a third as much electric netting. Time savings were apparent as well. He can move the entire 3,000-sq. ft. unit in less than 5 mins. Just hook on a tractor and go versus spending about 75 mins. per day moving fences by hand. Installing a guy wire at corners with each move is the only manual labor needed.

Gutschenritter uses the 20 by 40-ft. Prairie Schooner from Featherman Equipment (Vol. 42, No. 4) for a mobile coop. Hens have an additional 2,200 sq. ft. within the enclosed sliding yard, with fences extending 10 ft. to either side of the coop.

"The design would work equally well with any large, skid-style coop, such as the Mobile Range Coop or a do-it-yourself coop," says Gutschenritter. "We use it with laying hens, but it has been used with all types of poultry, including broilers and turkeys."

Gutschenritter received funding to refine and evaluate his original concept from the Northcentral Region of Sustainable Agriculture Research and Education (SARE), a USDA program. He shared details of how he built his prototype HenPen unit in a SARE project overview (FNC21-1275).

He began by reinforcing the coop and building a framework that extended to either side, as well as front and back. The frame included 8-ft. landscape timbers mounted perpendicular to the coop. He attached 4-in. HDPE pipe to the ends of the timbers to create sides for the frame. Chain link fence top rails were used as braces from the coop to the pipes to help maintain the shape of the frame when the coop moved.

Gutschenritter removed the posts from the netting to be used and trimmed the spikes to 3 1/2 in. He laid the electric netting (without posts) along each side of the frame. He drilled holes for posts in the frame at pipe connectors and at corners for corner posts. He inserted the posts and wove them back into the netting.

The final step was to connect a rope from the front corners of the coop to the front corners of the fence frame. As the HenPen is pulled forward, the rope prevents the frame from collapsing.

Gutschenritter notes that the addition of the fence frame to the coop increased the horsepower needed to move the coop. Where he had been using a 30-hp. tractor, he upgraded to 75 hp. "I was ripping up the pasture with the lightweight tractor trying to move the coops," he says.

In the 4 years since he designed his first HenPen, he made several changes to the design. They include improving the corners and using higher-quality materials for the frame.

"The changes allow the entire fence to swerve as needed while being dragged," says Gutschenritter. "The new corners and higher quality materials have allowed me to reduce the amount of bracing and wood mounts. This led to easier construction and slightly lower costs, as well as a higher value system."

Gutschenritter has hosted tours of his system, as well as shared the project at several farmer meetings. He also developed a 29-page construction manual with extensive pictures and step-by-step instructions. It's priced at $300 and includes regular email updates on use and design.

Some of the changes made over time include replacing the rope brace with a 14-ft. pipe running from the front of the pen to the coop. "It provides more rigidity and makes it easier to move the pen through tall grass and over woodier stems like burdock without kinking," says Gutschenritter. "I also designed a water system to work with the HenPen, all accessible from outside. Changes like these will continue to be made and shared with the folks who buy the manual."

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Gas station-style pumps can handle between 500 and 40,000 gals. per fill.

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