Passive Solar Greenhouse
AAIG Grant Recipient 2010
Final Report 2012
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I have pictured a passive solar greenhouse on my small farm operation for many years. After hours upon hours of research into such structures it became apparent that little information exists on a successful structure of this sort for Alaskan temperatures. I took it upon myself to design a greenhouse using the following information sources:

- The internet (though little information is attainable via the internet on this topic, I was able to incorporate what I did find into the design plan)
- Networking with other Alaskan growers
- Consultations with friends and family who are professional builders and engineers

The goal is for the greenhouse to provide a space large enough to start seeds for the acre outdoor plot I currently use for commercial growing, enable an early start for cold-hardy crops and create an environment conducive to warm loving plant production during the summer months.

The actual construction of this structure has taken much longer than originally planned. Being a commercial farmer with a never-ending list of "to-dos", it has been difficult to find the time for building. This project has required an immense amount of patience and persistence.

The initial plan was to begin construction in the spring and have a completed greenhouse by the fall of 2010. Due to a few unforeseeable hiccups, I was unable to start construction until fall 2010. That is when I was able to begin forming up the foundation. The foundation consists of an eight-foot North wall and four foot East, West and South walls, all poured concrete 6"- 8" thick. These walls sit on 12" deep footers, two feet wide for the East, West and South and three feet wide for the North. The walls are supported by a significant web of rebar to prevent movement from the pressure of the surrounding earth. The foundation is set into a hillside, completely insulated, and backfilled to the top to maximize the earths insulating quality. The idea is the concrete will act as the heat sink for the solar gain. After the foundation pour I put the project to bed for the winter and drafted a plan to continue construction in the spring/summer of 2011.

I was able to install the support posts, ridge beam and rafters in the summer of 2011. All of the lumber for this framing was milled by our local sawyer with exception of the 4"x12"x12' beams used for the ridge. The polycarbonate panels, purchased with grant funds, were delivered that summer and installed in the fall.

The panels are set at a 60-degree angle that is geared to optimize solar gain in the shoulder months. The plywood and the metal for the North roof were also installed that fall.

End walls were constructed during the winter of 2011/2012. All of the plywood and 2x4's for the end walls, in addition to the plywood used on the North roof, is re-used lumber from the concrete forms. With construction almost complete I was able to install the ventilation system (also purchased with AAIG funds) and began building raised beds in the spring of 2012.

Three test beds were built. Two with the originally planned under bed air pipes embedded in gravel, and one with the air pipe as well as pex tubing for hot water transmission (pictures attached). The water pipe was an afterthought in case the passive solar system does not provide enough heat during the early spring months and the late fall. In this event, a wood stove can be installed with a wrap of copper piping that forces hot water under the growing beds to promote strong root growth and warm soil temperatures.

The test beds were planted in June 2012 with tomatoes and hot peppers to test the summer growing possibilities. Despite the lack of insulation in the end walls of the structure, the peppers and tomatoes displayed the ability to thrive in this growing environment. I have no doubt that once the structure is completely insulated and the ventilation system is hooked up, we will be able to offer peppers, tomatoes, melons and other such warmer-loving crops in our weekly CSA boxes.

As a result of the delayed completion, we have been unable to test the greenhouse to the full potential. 2013 will be the first full year of production in the completed greenhouse. It is expected that our current growing season of mid May to October will be expanded to March – November. Spinach will be planted in the test beds this month to experiment with the late fall growing possibilities.

We predict this new system should provide an increase in crop productivity and longevity in the following ways:

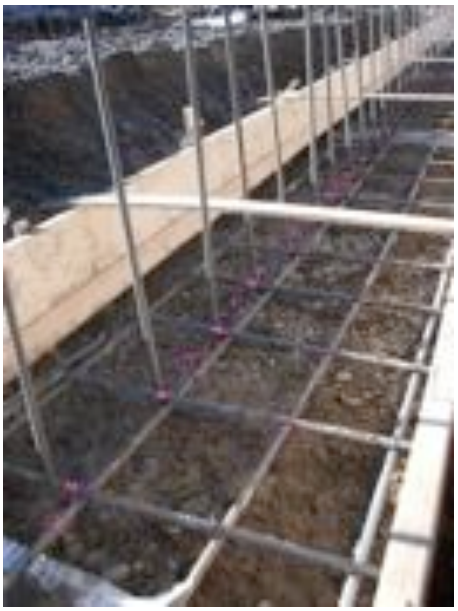
- Significant space increase for seed starting, allowing greater yields from outdoor crops
- March starts of cold hardy crops including, but not limited to, spinach, kale, tatsoi, senponsai, and pac choi. This will allow the potential for an early presence of food at spring farmers market as well as an earlier start to CSA weekly share distribution
- Greater variety of crops for market as well as CSA (ex: tomatoes, melons, hot peppers, cucumbers)
- Increase and extension of productivity in the fall months (ex: spinach, kale, tatsoi, etc.)

Details of our findings thus far will be outlined in the presentation I have planned for the 2013 SARE conference. After our first full year of growing in the

new structure I hope to share the productivity information to Homer area growers via a presentation to the Homer Soil and Water Conservation District (HSWCD). Please consider this an open invitation to Division of Agriculture employees to tour the greenhouse. You will also be notified when the presentation is planned for the HSWCD.

Many farm visitors have already viewed this structure over the course of its construction. In addition to the several visits by Homer area garden enthusiasts, we have hosted field trips from a local high school. This project has already offered a conversation piece about the possibilities of extended season production and helped display the overall enthusiasm for the local food movement in our state. I am very grateful for this opportunity to create this test project and hope through farm visit invitations and networking it will inspire other growers to implement similar systems. Thank you for this incredible opportunity.

greenhouse footers fall 2010



rebar detail N footer fall 2010

rebar grid, N wall fall 2010

concrete forms fall 2010

framing spring 2011

Interior construction spring 2012

air pipes embedded in gravel below growing beds spring 2012

pex tubing for water transmission spring 2012

raised beds built and being filled with top soil and compost spring 2012

test beds being planted with pepper and tomato plants spring 2012

outside of greenhouse with recycled metal end wall siding fall 2012