Greenhouses

Transcript – Cooling

Hello and welcome to Honor's Lab, Greenhouse Construction. This is module six. So, in this module, we're going to learn about the different systems that you can use to cool your greenhouses. Even in the middle of winter, your greenhouses may need to let out some excess heat and humidity. So, plants, they can get stressed at temperatures over 90 degrees Fahrenheit and the ability to vent year-round is really important. So, the thermal heat storage can help to absorb some of the heat, but greenhouses can heat up faster than the thermal mass can absorb it. The first question we need to ask ourselves is what are our cooling needs? If you live in a warm climate, cooling is going to be very, very important and for those of us in a temperate climate, we need most of our venting in the summer months.

The main ways that people cool their greenhouses are passive ventilation, active ventilation, shade cloth, and swamp coolers. I find that even my buildings with the passive thermal mass do get hot in the middle of the day and do need some venting in the summertime. So passive ventilation is a system where the air moves naturally, comes in the intake vents, and goes out the exhaust vents by natural convection. So, when designing your passive ventilation system, you want to have the intake air on your windward side and the exhaust vent on the opposite side. It's really hard to vent a greenhouse when the wind is blowing against the vent cover and it's held shut and it won't let the air through. To take advantage of the natural convection of warm air rising, place the intake vents low and the exhaust vents high in the building. Be sure to think about snow depth. If the snow covers your vents that you need to open in the winter, you may not be very happy outside shoveling the snow away from your vents. You'll want your passive ventilation system to be about 10 to 20 percent of your total square footage of your greenhouse. So, if you live in a very sunny place, then go with the larger figure of 20 percent and if you live in a cooler, cloudier place, then go with the smaller number. Half of that will be the intake vents and half of that will be the exhaust vents. The vents can be opened manually, or you can add a solar vent opener, or you can add a thermostatic control vent opener.

Okay, so I want to show you my two buildings that have a passive ventilation system. Okay, we're here in between my two passive ventilation system buildings. The wind comes this direction at us, so on this building, this solar house; this is my leeward side and we just have these vents that open at the bottom. They open on this side and on the windward side. These are manual. They just hit on a little rebar post here. There's a hole in the vent cover and these just open and shut when -- well, we open and shut them when we want them. Not a big problem because we work here. There's somebody here seven days a week. A little bit of an issue in the spring when it's hot, cold, hot, cold, but in the summer they're open pretty much all summer and in the winter, they're actually shut all winter for this building. We do have a door on either end and we open the doors if we want any ventilation in the wintertime. In the winter, our ventilation is just the doors and, in the summertime, it's this whole thing. When the snow comes, it slides off the building and we'll have snow depth sometimes up here about five feet and these vents are completely sealed, but I actually like that in our climate because I don't get air leakage through the vents. The snow just kind of seals us up.

Okay, this building over here, this is the Odyssey. This is my windward side; the wind comes through here. It has the roll-up sides which is really, really like; open all summer pretty much and then spring and fall we're open, shut, open shut during the day. In the winter, this one closes completely, and there again, we have snow up to here. This entire little valley here is just full of snow and that seals me down at the bottom and then I have to tape this shut. I'm gonna roll this down so you can see the action of how it works and then the part that I have to put a little tape on. The nice thing about this building is I can shut the entire side at once and it's really quick and really easy and this just rolls down. See, it hasn't been unrolled in a long time. A little water. Really super slick system; love this one. I think this one better than the individual flaps that we have to keep opening and shutting. The only probably with this one is the end down here and

what happens on my windward side is this puffs open and the wind goes directly in there. So, what I do is I take this, and I tape this shut against the building. You can see the tape from previous years and then that stops that wind from coming in and going through the building. This one also has a door on either end, and we can vent in the wintertime with the doors, and then the vents are completely shut with the snow load. It's a super neat system. I really like this system really well.

All right, so those are my two buildings that have the passive ventilation system. The solar house used to have a vent at the very, very top so the air would come in and go up and out the top and it got to where it would malfunction and it was like 13 feet in the air. We couldn't repair it, fix it; it was really a pain in the butt. So, we actually took that off, put a solid roof plastic all the way over, and now it just vents side to side. So, it comes in the windward side, out the leeward side. Also, the Odyssey does the exact same thing. In our climate, we're not needing a vent at the top, but if you're in a super-hot place, you might want to consider air coming in rising and going out of the top.

The next kind is an active ventilation system that has fans, vents, and usually a thermostat to control the system. So, we have three buildings with active ventilation systems and the best way is to place the fans high to exhaust the warmer air out of the building first. The thermostat should be at plant level. To figure out what size of fan that you want for your greenhouse, you'll want one that can exchange all the air in the greenhouse in two minutes. So, for example, if you have a 2,000 cubic foot greenhouse space, then you'll want to buy a fan that can move 1,000 cubic feet of air per minute. So, for the vents, you place them on opposite side of the fans. We'd like our vents on the windward side and the fans on the leeward side of the building if possible. One more thing about the vents. You can get different types of vent screens to keep out the bugs. We don't need them for our buildings except for our chickens. We actually have chicken wire on the buildings, but if you live in a really buggy place, you can add vent screens to prevent bug infestations from coming in the buildings. So, let's go take a look at a few of our active ventilation systems.

This is our tomato house and it only requires one fan to do all the ventilation for us and this is our leeward side. We're just blowing the air out of the building. It comes in on the windward side. We'll go take a look at the vents. Okay, this is one of our vents on the tomato house. We actually have two. This is a motorized vent system that's run off a thermostat, so when we hit 85 degrees in here, the thermostat opens the vent and it also turns the fan on. And then when it drops below, probably about 80 degrees, the system shuts down. I can set that thermostat to whatever temperature I want, but right now I'm growing tomatoes in here and I want it hot, so this is a really good system. I really like it. It doesn't require very much maintenance and I can be gone, and it opens and shuts all on its own. In the wintertime, this system is active. It will come on maybe once a month in the coldest part of the winter and then on the shoulder seasons, maybe once a day. It’s a really nice way to have the ventilation working without us having to be actively here.

All right here we are in the little greenhouse. This system is a little different from all our others. All our systems are a little different and this is our pit greenhouse with the 16-inch thick rammed earth wall which is our mass heat storage and the way this one works in the door that comes into this building is our vent on that end and then on this end, we have two fans and they're both a set on a thermostat and they're both set at different temperatures. I can -- one will kick in and then if it gets a little too hot, the second one kicks in. This one's got our plastic to the south, so we get a little bit hot in the afternoons and sometimes I'll hear both fans running, but it comes on and off by itself. This building uses a lot less electricity than the other buildings. The fans do not run near as much as the buildings that are on ground level and the buildings that don't have any mass in them. So, I really like this system. It works very, very well. It's nice to have the two fans on separate thermostats so that I can either pull in a little bit of air or I can move a lot of air just depending on how intense the sunlight is that day.

The next part of cooling your building is shade cloth and it's a great way to reduce the amount of solar gain in a greenhouse. So shade cloth can be put over the entire greenhouse on the outside to cut the light and heat coming in. You want to look for a 30 to 50 percent shade cloth to keep your building cooler and it'll come in green or black or white. It comes in woven, it comes in knit; many, many kinds and there's many places online to order shade cloth and it's best if you get a custom piece for your greenhouse that has the sides sewn and grommets installed. This way you can just

throw it over your building and tie it down and then it's easy to take off for the wintertime. So northern growers and people in cool, cloudy climates will not need the shade cloth. The vents will do enough to cool the greenhouses. We don't need to use shade cloth here. In the south and the very tropical areas, shade cloth will be your very best friend. So, plan on putting shade cloth over your greenhouse for the hot summer months.

Another thing that we've done is we've sprayed our greenhouse with a diluted interior white latex paint to cut the light, but what we found out was the paint did not wear off the roof for many, many years and is not a good plan if you want to get solar gain the winter, so I don't recommend the spray-on shade for your greenhouses because it doesn't always come off. Okay and then the last way to get your greenhouse cool is to install a swamp cooler system. Most commercial greenhouses will have one and ours works by dripping water through the swamp pad in front of the intake vents. When the fans turn on, the vents open and the water circulating pump turns on and sends water through the swamp pads. We turn off our pump every day about 4 p.m. and let the pads dry down overnight to keep them from smelling like dead fish. Now I know, you can use chemicals to do that, but we prefer to not use any chemicals in our buildings. We only have one swamp pad in our longest greenhouse of 100 feet. The others don't need this much cooling. We only use the swamp pad from May to September, so let's go ahead and take a look at our swamp pad and I'll show you how it works.

All right here we are in the big house. This is our biggest greenhouse. It's about 30x100, so we're almost 3,000 square feet in here and this one has two great big vent fans. They have the louvers on them which can shut when the fans are not running. These are on a thermostat that runs the swamp pad, the vents, and the fans all the at the same time. So, everything comes on at once and turns off at once. We'll go to the other end of the building and take a look at the swamp pad and the vent system at the other end. Okay, here we are at the other end of the big greenhouse. This is where the vents are; the vents are behind the pad, so when the thermostat kicks on, the vents open. They're motorized, so the motor pushes them open and then the fans that were at the far end, that we saw, they draw the air through the vents, through the pads and you can see the water starting to drip down through the pad. I just turned it on here.

So, this is our sump tank and we have a pump in here, just a submersible pump that comes up to the hose. It comes up through a filter in here to keep the junk out of the pads. Goes up here and then gets distributed along that top metal bar up there and it drips down through -- this is our collection gutter. The water gets collected here and then it comes back in this tube and comes back to the tank so it can circulate again. And then this is freshwater coming in. It's on a float valve just like one you would have in your toilet and when the water fills up then this shuts off and that way the system doesn't run out of water. We don't have to check it all the time. Really, really good system. It was designed and came with this building. We bought this building as a kit and it's been working really well for almost 30 years. So fabulous way to cool a building especially one of this size. This is the one that's 100 feet long and it really needs the extra cooling to keep the plants from getting too hot.

Swamp coolers work best in the places with low humidity, but they can still help out in places of high humidity. The amount of pad area needed is calculated but multiplying the floor area by eight and dividing by 250 for a four-inch pad or 400 by a six-inch pad. For example, our building is 30x100 foot greenhouse with a four-inch pad, this would require 96 square feet of pads. You take your 30x100 times eight, divide that by 250 equals 96 square feet. The overhead water supply pipe should distribute the water so that the pad gets evenly wet. The minimum water flow rate is a half a gallon per square feet for a four-inch pad and .8 gallons per minute per square feet on the six-inch pad. The extra water's collected below the pad in a gutter and piped to a sump tank. The tank capacity needs to be .8 gallons per square feet of pad for four-inch pads and 1 gallon per square feet for six-inch pads.

All right, before you start your construction on your buildings, sit down and assess your cooling needs and design your cooling system. If you're buying a kit, the dealer can help you design a cooling system just right for your area. Okay, for your homework research cooling system on the internet and go visit a few local greenhouses and ask them what they like and don't like about their cooling systems. Their insight and knowledge will be super valuable to you because they are local and they have the same cooling needs that you will have. This is the end of module six and in module seven we're going to learn about how to orient the building so that you have the best success. Okay, we'll see you in module seven.