e-GRO Alert

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Greenhouse Snow Load and Removal

Since the beginning of the New Year, gray skies, strong winds, and cold, snowy days have been among most of the United States. Over the past two weeks, we have experience extreme cold temperatures, low light levels, and inches upon inches of snow. As a greenhouse operator, are you prepared to remove heavy, wet snow that accumulates in greenhouse gutter-connects or blankets poly-covered greenhouses? If you do not have a plan, you may find yourself in a crisis to save your vulnerable greenhouse from collapsing.

Snowfall

The moisture content of snow can vary dramatically. Dry snow typically occurs over interior sections of the state or at very low temperatures. Snows are "wet" after they pick up moisture from large bodies of water or when the temperatures hover around 32 °F. Wet snows can weigh four times as much as dry snows, causing a considerable amount of weight baring down upon every square foot of greenhouse roof surface. For instance, 3 to 4-inches of heavy, wet snow is similar to 1-inch of rainfall and is equivalent to 5.2 pounds of snow per square foot. If one does the math, a 30' wide x 96' long double poly-covered greenhouse may be supporting about 7.5 tons of snow!

Snow Load

Snow load of a greenhouse is based on expected ground accumulation, greenhouse roof slope, whether the structure is a gutter-connect or free-standing greenhouse, and whether if the greenhouse is heated or unheated during the time of snowfall. For more information regarding snow load of your greenhouse structure, refer to the National Greenhouse Manufacturing Association. In general, an uneven snow load

that blankets the greenhouse is more likely to collapse the structure because the pressure of the snow is not evenly distributed among the bows (Fig. 1). This often occurs when wind-blown snow settles on the greenhouse roof and the greenhouse peak provides shelter from the wind.

Snow can also collapse the side of a greenhouse frame and sometimes, endwalls. In some instance, when greenhouses are constructed too close together, snow that slides off the roof and accumulates between two structures presses upon the frame (Fig. 2), thus causing it to bend. If space is limited and you cannot plow or use a bucket loader to remove the snow, then one must cut the greenhouse plastic. Cutting the plastic will relieve the pressure from the structure by letting the accumulating snow fall into the greenhouse, thereby sacrificing greenhouse plastic and not a greenhouse structure. To best prevent this challenge, one must consider site planning and layout prior to construction and future expansions. In general, providing a minimum of 6 to 8 feet between greenhouse structures is recommended.

Inspecting the Greenhouse Frame

Prior to a snow event and during routine maintenance of the greenhouse structure, one should check bolts, screws and clamps on the frame for tightness. Screws and holes where screws once were in the tubing create weakness, especially at the bottom of frame this is where greenhouses likely buckle and bend when a heavy snow load falls upon the greenhouse roof. Installing diagonal braces from the peak to the baseboard at the endwall, on all four corners provides stability and keeps the frames vertical. Most free-standing greenhouse are equipped with diagonal braces and if not, consider an installation

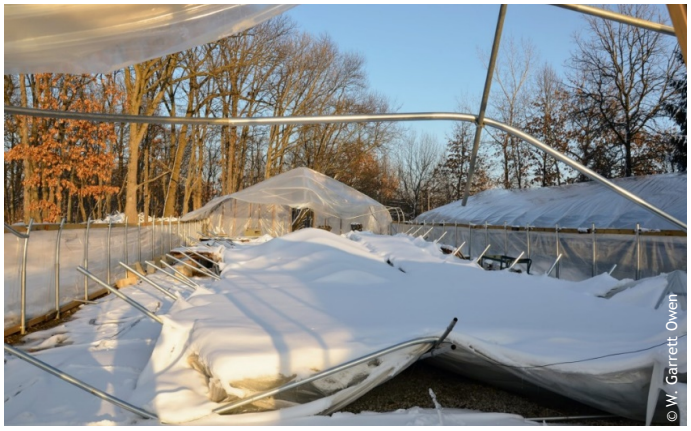

Figure 1. Heavy, wet snow accumulation on the double-poly greenhouse resulted in collapse of the greenhouse structure. Photo by W. Garrett Owen.

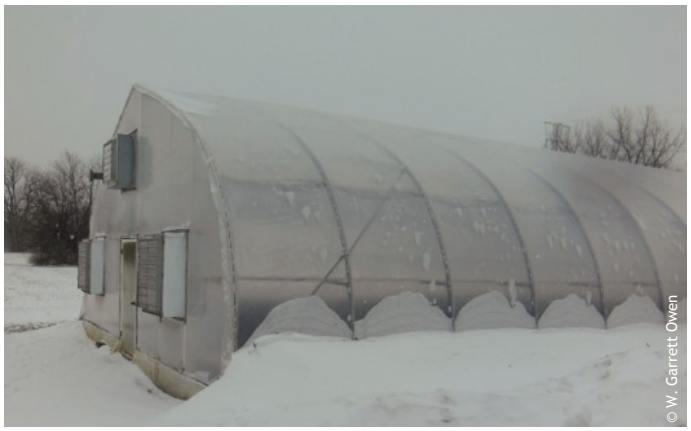

Figure 2. Avoid snow accumulation along the sidewall as it may crush it in. Photo by W. Garrett Owen.

Figure 3. To provide additional support in double poly-covered greenhouses, 2' x 4's can be placed under weight bearing bow and purlin connections, however snow removal may still be required. Photo by W. Garrett Owen.

especially if you your greenhouse operation is located in the Northern U.S. To provide additional support in double poly-covered greenhouses, 2' x 4' boards can be placed under weight-bearing bow and purlin connections (Fig. 3). Operators can also install diagonal braces attached at the peak inside the greenhouse and vertical supports (Fig. 4), thereby providing additional support to the greenhouse structure. However, this only provides additional support to the greenhouse infrastructure and snow removal may still be required.

One should also inspect welds of the greenhouse structure and be mindful of welds that are not continuous or that have burned through the metal. Additionally, one should examine welds between gutters, tubing that are welded together without an insert, and truss braces.

Greenhouse Snow Melting Methods

Double Poly-covered Greenhouses

The greatest snow removal challenge is with double poly-covered greenhouses (Fig. 5). Although an advantage of double poly is to reduce heat loss during the growing season, it delays heat transfer and the rate in which snow melts during heavy snowfall events. Greenhouse operators can reduce the air pressure between the two layers by manipulating the blower fan speed, thus allowing for the greenhouse to become deflated to a single layer. However, operators should be cautious of this method because on windy days, when the layers are deflated, rippling of the poly can place stress on the point of attachment or at the track of wiggle wire.

Other snow removal methods include snow rakes or knotted ropes. Operators that use snow rakes to pull the snow off should be

Figure 4. Installation of diagonal braces attached at the peak inside the greenhouse and at vertical supports will provide additional support to the greenhouse structure. Photo by W. Garrett Owen.

Figure 5. The greatest snow removal challenge is with double poly-covered greenhouses. Photo by W. Garrett Owen.

Figure 6. The most common method for melting snow in high-tech glass-glazed greenhouses is to open the energy curtains. Photo by W. Garrett Owen.

Figure 7. To collapse snow bridging and melt the snow, a heating source such as heating pipes or fins are installed sideways and 18" below the greenhouse gutter. Photo by W. Garrett Owen.

Figure 8. To provide additional support in glass-glazed greenhouses, 2' x 4's can be placed under and near gutter connections, however snow removal may still be required. Photo by W. Garrett Owen.

cautious to not pierce the poly or allow snow to accumulate along the sidewall. Operators who use knotted ropes can successfully remove snow from the greenhouse by pulling it across the greenhouse without damaging the single or double poly. A solid braid nylon is soft and will not damage poly, while other ropes made such as polypropylene and even nylon twist can damage poly (Barry Thoele, personal communication).

Glass-glazed Greenhouses

The most common method for melting snow in high-tech glass-glazed greenhouses is to open the energy curtains (Fig. 6), which allows the heat to rise to the peaks of the greenhouse before snowfall. By doing so, the heated air warms the greenhouse glass so that the snow melts upon contact. However, if snowfall exceeds the rate of snow melt, snow will begin to accumulate on the greenhouse, forming an insulation barrier and reducing heat loss. Although an insulation barrier is created, the snow contacting the greenhouse glass will melt and run off.

Another problem among greenhouse operators who manage gutter-connect greenhouses is bridging. Bridging occurs when snow slides towards the gutter, accumulates, and the heat transferred from the gutter melts the snow and creates a bridge between the two greenhouses. In many cases there is not adequate heat exchange to collapse, melt, and run or slide off the snow. So how do you prevent bridging? Most recommendations are to place a heating source sideways and under the gutters (Fig. 7) to cause the bridge to collapse and to melt the snow. Additional support in glass-glazed greenhouses can be provided by 2' x 4's placed under gutter connections (Fig. 8), however snow removal may still be required.

Overall, a plan should be established by greenhouse operators before winter weather arrives. It is recommended to frequently check snow accumulation on greenhouse structures and maintain proper heating or snow removal equipment.

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