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Reduce storm damage to your greenhouses



By John W. Bartok Jr.

Nature seems to be getting more violent in recent years with frequent earthquakes, increased numbers of hurricanes and record breaking snowstorms. Insurance damage claims have increased considerably. The International Building Code has revised upward its wind and snow loading requirements for some areas of the United States. Selecting greenhouses that meet the International Building Code and good construction techniques are important considerations when building new greenhouses.

Each year there are reports of greenhouses that have been damaged by severe weather and natural events. Greenhouse design is different than conventional farm buildings in that the structural profile has to be small to allow maximum light to reach the plants. Most farm buildings are over designed to handle severe weather conditions.

Damage to greenhouses can include racking of the frame, bending of the support hoops, broken glass or torn plastic and uplifted foundation posts. Preparation ahead of time can minimize the damage.

Wind loading

Wind forces that act on a greenhouse are influenced by numerous factors including wind speed, building orientation, exposure, height and shape of doors or vents that may be open. The wind passing over a greenhouse creates a positive pressure on the windward side and a negative pressure on the leeward side. These can combine to create a force that can collapse or overturn the building. An 80 mph wind can produce a pressure of 16 pounds per square foot (psf). For example, the 10- by 100-foot sidewall of a gutter-connected greenhouse would have to resist a 16,000 pound force.

Wind can also create a force similar to an aircraft wing that wants to lift a greenhouse off the ground. An 80 mph wind blowing perpendicular to the side of a 28- x 100-foot hoop house can create a lifting force of 220 pounds per foot of length or 22,000 pounds of uplift

on the whole structure. Considering the total weight of materials and equipment in the greenhouse is about 6,000 pounds, the foundation posts must have a withdrawal resistance of about 300 pounds each. This is why building inspectors frequently require that greenhouse posts be surrounded by concrete.

Minimize wind damage

Although you have no control over the force or direction of severe winds, here are a few tips to help minimize storm damage:

- Check the area for loose objects. Anything that can be picked up and hurled through the glazing should be secured or moved indoors. Metal chimney (stove pipe) sections should be secured with sheet metal screws.
- Inspect for dry or weak tree limbs that could fall on the greenhouse.
- Close all openings including vents, louvers and doors. The effective force of the wind is doubled when it is allowed inside a building. The wind on the outside puts a pressure or lifting force on the structure. The wind inside the structure tries to force the walls and roof off.
- For air-inflated greenhouses, increase the inflation pressure slightly by opening the blower's intake valve. This reduces the rippling effect. Check to see that the plastic film is attached securely and that any holes are taped.
- On all motorized air intake shutters, disconnect the connecting link that holds the fins open and tape the shutters closed. Then turn on enough exhaust fans to create a vacuum in the greenhouse. This will pull the plastic film taut against the greenhouse frame and keep it from rippling or billowing, reducing stress.
- Windbreaks can reduce the wind speed and deflect it over the greenhouse. Conifer trees (hemlock, spruce, pine, etc.) in a double row located at least 50 feet upwind from the greenhouse can reduce the

damaging effects of the wind. Wood or plastic storm fencing can be used as a temporary measure.

Snow loading

Snow that accumulates on a greenhouse can put significant weight on the structural members. Snow loads vary consider-

ably from zero along the southern coastline to more than 100 pounds per square foot in northern Maine. Local building codes specify the design snow load.

Snow can be light and fluffy with a water equivalent of 12 inches of snow equal to 1 inch of rain. It can also be wet and heavy with 3 inches of snow equal to

1 inch of rain. Snow having a 1 inch rain water equivalent will load a greenhouse with 5.2 pounds per square foot. This amounts to 6.5 tons on a 25- x 96-foot greenhouse.

Minimize snow damage

The following are a few pointers to consider before the next snow season:

- The foundation piers or posts should be large enough to support the weight of the building including crop and equipment loads.
- All greenhouses should have diagonal bracing to keep them from racking from the weight of the snow or force of the wind.
- Collar ties and post connections should have adequate bolts or screws. This is a weak point in some greenhouse designs.
- Allow 10-12 feet between individual greenhouses for snow accumulation and to prevent sidewalls from being crushed in.
- When building new hoop houses, consider using a gothic design that sheds snow easier. In hoop-shaped houses, install 2- by 4-inch posts under the ridge every 10 feet when heavy snow is predicted.
- The heating system should be large enough to maintain 60°F to melt snow and ice. It takes 250 Btu per hour per square foot of glazing to melt a wet snow falling at a rate of 1 inch per hour. The heat should be turned on in a greenhouse or under the gutter several hours before a storm begins.
- The plastic film should be tight and inflated to at least 0.25 inch water pressure. This can be checked with a monometer. Any cracked or broken glass should be replaced.
- Energy screens should be retracted to allow heat to rise toward the glazing.
- A standby generator should be available with adequate fuel for the duration of the storm to power heaters, fans and blowers.

John Bartok Jr. is faculty emeritus, University of Connecticut, Department of Natural Resources Management and Engineering, jbartok@rcn.com.

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SPECIAL INSERT NGMA SPOTLIGHT

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ON THE COVER

Maumee Valley Growers board of directors: (l-r) Theresa Hoen, Wade Smith, Bill Dearing, Jeff Creque, Walter Krueger, Dick Bostdorff and Diane Hill.
Photo by Daniel Miller

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COVER STORY

8 Collaborative effort



Maumee Valley Growers work together to address industry-wide challenges. More than 60 greenhouse owners in a six-county region belong to the group.

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