
Question and Answer Period: Concurrent Session II — Specialty Crops

Elizabeth Davison: Do you need to control the greenhouse environment to grow the carnivorous plants?

Jim Booman: I use a fog system to increase the relative humidity and help reduce the temperature.

Dick Criley: What kinds of problems are you experiencing with tissue cultured plants?

Jim Rietkerk: When we experience problems of any kind with plants we purchase we simply stop doing business with whoever provided problem plants.

New Trends in Natural Ventilation

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There is no question that natural ventilation is the current "buzz word" of the day. If you had the privilege of attending this years Ohio Floral Industry trade show you would have witnessed more versions of "natural ventilation" than you may have known existed. While the issue of natural ventilation may seem new to some, it has, in fact, been a standard within our industry almost from the beginning.

In order to gain a proper perspective as to where the trends are going it is sometimes helpful to see where we've been. For the purposes of this discussion, we should start at the beginning of our industry. Please remember that the first greenhouse businesses were inherently smaller "Mom and Pop" operations. Smaller operations were the norm of the day primarily due to the more regionally based sales area and the demand for plant products. These greenhouses typically were much smaller in size than what we see today and, therefore, much easier to manage. These early structures typically incorporated small ridge vents as the primary means of ventilation. The ridge vents were opened and closed with a manual chain and pulley system.

As advances in transportation expanded the grower's sales area and the general public took more of an interest in plant products, the standard grocers found themselves requiring ever-increasing space in order to keep up with the demand for plant material. Unfortunately, the standard style of ventilation was not able to maintain the same environmental control due not only to the inadequate sizing of the vents, but also to ever increasing demands on the grower. Since there was no reliable thermostatically controlled motor available to open or close the vents, the grower found it almost impossible to manage the vent position as required.

It was during this period that mechanical ventilation found its way into the greenhouse industry. Compared to the alternative, mechanical ventilation was a Godsend in that it allowed the grower to introduce an adequate supply of fresh air to the plants on demand.

While the use of exhaust fans represented the best form of ventilation available at the time, it came with its own set of drawbacks. Some of these included:

- The full volume of fresh air was generally introduced through one vent at the opposite wall to the fans. The plant medium closest to this inlet vent almost always got a shock from a blast of either cold damp or hot dry air.
- Growers became locked into using houses that were limited in length due to the fact that air traveling through the house picked up heat creating temperature differentials from one end of the house to the other.
- Growers who grew hanging baskets experienced warmer temperatures in the upper sections of their greenhouses (where they really needed cooler temperatures) due to the natural effects of warm air rising.
- There was a cost involved in operating exhaust fans (both the day in and day out consumption of electricity as well as ongoing maintenance required to keep these fans in good operating order).

Our desire to implement passive ventilation makes sense for many reasons including:

- The air outside is free.
- Plants, by their very nature, grow best in an outside environment.
- Natural ventilation travels vertically with the normal flow of air movement.

The problem always comes down to the fact that naturally ventilated greenhouses can not always be counted on to maintain the desired environmental conditions. I got my start in this industry working with high-pressure fog cooling systems where adequate ventilation wasn't an option, but rather a necessity for the successful cooling of the environment. In those days I can remember individuals asking my advice as to how large they should build their vent so as to create the most efficient natural ventilated design. To illustrate how naive our thinking was then, and how far we've come in just the past few years, the norm called for 10% of the total square footage of greenhouse to be vented. Based on these recommendations, a 30 ft × 96 ft long greenhouse would only require a 3 ft-wide ridge vent.

To my own defense, I can honestly say that the advice I tried to give growers was that one could not, short of removing the roof off the greenhouse, have enough vent opening to facilitate adequate natural ventilation. Of course, at the time we did not possess the proper tools or experience to remove the roof from a structure though we saw the need.

In just the past few years, while our industry has wrestled with the most efficient means of implementing natural ventilation, the methods most commonly employed to ventilate included:

- Rack and pinon ridge vents
- Rack and pinion gutter vents
- Rack and pinion side or end wall vents

With such limited vent sizes and placement, the performances achieved in naturally ventilated houses was dependent on many external factors including:

- Outside temperature
- Outside relative humidity

- Light intensity
- Wind direction
- Wind speed

In most cases, we find growers incorporating natural ventilation, orientating their roofvents in such a way as to allow the air to pass over the vent as opposed to blowing directly into the vent opening. This theory has, in my opinion, proven correct, as the air passing over the top of the vent tends to create a venturi siphoning effect assisting to draw air out of the structure. However, if the environment outside were still, the rate of ventilation would typically suffer. These problems were more prevalent in more humid environments such as the Southeast regions of the U.S.

Some of the newest trends we are seeing emerge in naturally ventilated greenhouse operations include:

1) Creating higher under gutter heights within the structure.

- Even 10 years ago we can say that standard under gutter heights rarely exceeded 8 to 10 ft.
- Today 10 ft is about as low an under gutter height we see with 12 and 14 ft fast becoming the norm.
- The advantage to creating more height in your greenhouse environment has to do with putting more distance (volume of air) between the plant and the top of the roof.

2) The introduction of faster and more reliable environmental control packages (computers).

- Manufacturers are designing their controls specifically for naturally ventilated houses.
- Controls are now available which will open a vent in multiple stages.
- Controls are available to operate roof vents under a separate zone of control from sidewall vents.
- Controls are now available with light and humidity sensors which give the grower more flexibility in what perimeters they use to control their environment.
- Controls are easier to understand and operate.

3) The introduction of larger roll-up style roof vents both in the roof and roll-up vents on side walls and end walls

- Rack and pinion roof vents are expensive and, in some instances, not able to open very wide.
- Roll-up vents typically create larger openings than their rack and pinion counterparts.
- Roll-up roof vents typically reduce the amount of “dead air space” created in the uppermost part of a greenhouse.
- Roll-up side wall curtains are available in much taller designs and are effectively utilized even for colder localities.

4) The implementation of stress-reducing environmental controls systems. Internal retractable shade systems: shading vs. heat retention

- External retractable shade systems
- High-efficiency fog systems
- Hot water heating and infrared heating systems

5) The introduction of open-roof greenhouses.

- Several styles available

- Flat profile accordion-type retractable systems
- Gable profile accordion-type retractable systems
- Sawtooth profile accordion-type retractable systems
- Arched-roof roll-up style systems
- Rack and pinion style systems

- Open-roof greenhouses are not for everyone

- Consider fuel costs
- Consider regional snow loads
- Consider available ventilation in all styles of weather
- Consider direct sunlight
- Consider insect screening
- Consider ventilation requirements

Given the tools available to us today, I believe we will see more and more growers implement natural ventilation into their operation. The type of crops grown dictates the degree and style of natural ventilation which should be incorporated. In most cases, bedding plant growers should probably be considering fully open roof greenhouses while tropical plant growers may not require this degree of ventilation.

Regardless of the style of ventilation which best suits your needs, natural ventilation offers a viable means of obtaining your goal.