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Controlled air movement comes a step closer

Using dry air above screen to remove moisture seems effective

A new type of fan can mix dry and cold air from above a closed screen with greenhouse air. It enables dehumidification and heat removal.

Good air movement in the greenhouse is increasingly important. The principles of Next Generation Growing are closed screens, limited use of the minimum pipe and good air circulation. But how do you prevent a cold dump, a draft, a relative humidity that is too high and temperature differences? Fans that bring air from above a fully closed screen into the greenhouse appear to be the most effective. Dutch growers, Wageningen University & Research and suppliers are working closely on the 'Monitoring' project to optimise their utilisation.

Of all the aspects associated with climate, air movement is possibly the least visible and most intangible. Natural forces are incredible strong, ten to one hundred times larger than fans. Even with a small gap or if a window is closed a draft can easily occur, especially in a large greenhouse. If a strong wind blows against the greenhouse and the outside temperature is under 15°C, then sometimes uncontrollable air currents are created. It is impossible to compensate these by using fans. That is why artificial means only produce a noticeable effect if the screen is fully closed and the greenhouse is insulated.

Controlled air movement

One of the most important concepts of Next Generation Growing (NGG) is air movement, followed by screens that save energy and prevent light emission. While growers used to use the minimum pipe to maintain an active climate, controlled air movement is a more energy-saving and smarter alternative. One condition is that the temperature remains as constant as possible and humid air is removed.

Over the last few years suppliers have introduced different systems for air exchange: Vertical and horizontal fans; hoses under or above the crop; and air conditioning units. How efficient are they now?

Dry air from above the screen

Since 2013, as part of the project 'Monitoring', which is financed by the Dutch Kas als Energiebron (Greenhouse as Energy Source) program, researchers have been measuring the

Continued on page 8 >

Continued > from page 7

Peter van Weel: "It is ideal to be able to work in a triangle that that includes researchers, growers and suppliers."

effects of different energy innovations within nurseries. By using sensors they carefully measure the temperature and moisture level in the greenhouse. Smoke tests are regularly carried out to visualise the air movement. They are working very closely with growers and suppliers.

"It is ideal to work within this triangle. We can immediately look for solutions to any problems we come across in practise," says researcher Peter van Weel, of Wageningen University & Research. We already see big opportunities for relatively simple techniques such as the horizontal fan Airmix and the vertical fan VentilationJet. Both fans can draw dry and cool air from above a closed screen into the greenhouse as well as simply circulate greenhouse air. In the meantime Kas als Energiebron has gathered together a group of eight nurseries who exchange information.

Temperature differences

Firstly the experiences with the horizontal fan: In 2015 Van den Berg Roses of Delfgauw, the Netherlands, tested this product made by Van der Ende Groep on 4,000 m². It was a success and resulted in the rose nursery extending the trial at the end of 2015 to 2.5 ha. Previously, in 2013 and 2014, the fully lit nursery had tested the Verti-Fan made by the same supplier but that didn't produce the desired result.

Sander van Winden, responsible for the rose producer's crop and climate control: "The temperature differences in the greenhouse ran up to 5°C. Because it was necessary to keep gaps in the screen when using the Verti-Fan the cold dump was too large." Van Weel adds: "Gaps appear to be a poor mechanism. This was not the right option. The screen needs to be completely closed."

Controlled removal

Based on these experiences the supplier developed the Airmix, a fan and circulation system with one fan that also works when the screen is fully closed. Commercial technical advisor Ton van der Kooij: "It sucks dry and cold air from above the screen. A hole is made in the screen through which the fan sucks the air. In the unit itself is a valve that via a control in the computer can supply air from above the screen, from out of the greenhouse or a mixture of both. The air from above the screen quickly reaches the greenhouse temperature at the top of the greenhouse and doesn't touch the tops of the plants."

Although the air is blown out horizontally, vertical air movement still takes place and the temperature distribution in the greenhouse is more uniform. Via a single screen the moisture and excess heat from the lamps are removed in a controlled way.

Van Winden: "Due to the good air movement the temperature differences are brought back to 2°C. This is acceptable for us. Our priority is good quality roses. The biggest advantage of the fully closed screen is that we can use lighting for 24 hours. This allows us to produce more while maintaining quality." In addition, the rose grower has achieved energy savings of 16% due to less use of the minimum pipe rail.

Sander van Winden: "Experimenting with ventilating on the wind side was a challenge."

Ventilate on the wind side

The new fan meant that Van den Berg Roses had to ventilate differently. The air above the screen must be sufficiently cold and dry in order for the fan to work properly. Van Winden: "We experimented a lot with ventilating only on the wind-side but then you have a problem during a storm. We ended up with a combination of ventilating on the sheltered and the wind side. This allows us to easily remove the excess of heat and moisture."

Meanwhile there is demand for this fan in other crops. Van der Ende is currently engaged in further development. Ferry van der Ende, project engineer for the supplier: "We are installing such fans for a potted plant grower who has a double screen. In this case we installed nine fans for 5,200 m² and developed a connecting piece with a flexible skirt as we customise the product for specific customer needs."

In two phases

The other fan that can bring dry and cool air from above the screen into the greenhouse is the VentilationJet, by Hint Installatietechniek. This has been on the market somewhat longer. In contrast to the Airmix it has two parts: an upper fan that sucks in air and a lower fan – made by various manufacturers such as Hint, Nivola and Vostermans – that distributes the air vertically. Holes in the screen are not necessary.

Dekker Chrysanten, of Hensbroek, has been using it for 2.5 years in a trial section of 7,200 m². Erik Floris is responsible for the crop there. "Compared with the other greenhouse we see better leaf quality at the bottom of the crop, a more homogenous greenhouse

"We are developing the new fan for use in other crops," says Ton van der Kooij and Ferry van der Ende.

climate and during the summer we reach the desired temperature sooner."

Release overpressure

One month ago the chrysanthemum grower equipped another greenhouse section of 4,800 m² with a revised version. The upper fan has been placed under the boiler which is better for the air supply. Both the upper and lower fans are arranged in revs, so that they can be custom-controlled. "We choose to run the trial in this section because here we can control the under net. An extra energy screen has also been installed, which creates an insulation layer and so saves more energy. The capacity of the fans is increased so that the usual moisture removal by the pipe rails within the crop is partly replaced by extra air movement within the crop. If necessary we can make a small gap in the screen above the path to remove any overpressure."

Floris is cautious about commenting on the results of the second trial. "The climate is constant during the night but that can also be due to the double screen. We use the minimum pipe less but I can't yet say how much energy we are saving. We need to use the upper fan mostly in the evening for dehumidifying, while at night we only use the lower fan. There is still room for improvement. Also, we've noticed in smoke tests that the adjustment between the upper and lower fan is not yet ideal. We don't have any problem with condensation."

"The climate is very stable," says Erik Floris.

Condensation and drip

Condensation, drip and algal growth can be a problem for some nurseries, realised Wageningen University & Research during the monitoring. That is especially true in greenhouses that make intensive use of a double screen. Moisture has been seen dripping from the screen or greenhouse cover. "The question is, where does the moisture come from exactly? Is it from the greenhouse roof of does condensation form in the screen itself? We are researching that now and then we can work on a solution," says Van Weel.

Summary

Controlled air movement is essential for Next Generation Growing. Two types of fans can bring dry and cold air from above a closed screen into the greenhouse. This seems to result in a very stable climate. Areas of improvement are condensation and the correct adjustment of the fans.

Iran, special country of opportunities

Last September a small Dutch trade mission visited Iran. Because my company Sion has a client there and at the same time there was an exhibition I decided it would be interesting to go along. Iran is a country with 80 million inhabitants of whom 10% are exceptionally wealthy and at least 50% are of the high middle classes. These people like good quality and are prepared to spend money on it. The country consists of multiple climate zones with very large differences in dryness, temperature and humidity. Large-scale agriculture and horticulture is carried out throughout the entire country.

The exhibition and trade mission were held in Tehran. This is clearly a dry climate zone with little vegetation except for that which has been planted in the city. The first thing you notice are the modern people. The men are dressed like westerners. The older generation of women tend to wear black headscarves but not a burqa. The young generation dress western style, often appearing very hip with a headscarf covering half their head. The road services are well maintained but somewhat out of date which is why Tehran is in the world's top-5 of most polluted cities.

The payment system unfortunately is not very well organised. According to the Dutch embassy it can take a while before that is in order. Once it is regulated and the import rules are liberalised then over the coming years Iran could become an interesting export country. The good quality of the flowers and plants at the wholesale markets and the top quality flower arrangements in the shops was a very positive surprise. The nurseries we visited varied from very old (40 years) to reasonably modern with all the necessary equipment. The temperature in the greenhouses can rise to above 40°C, but due to the lower RH the pad&fan system work well and growers can lower the temperature to 25°C. They carry out sales themselves, often through their own flower shops, or products are sold through the wholesale market. The import of plant material runs via all kinds of routes, sometimes through Turkey, Dubai or even Thailand.

It feels safe to walk on the streets with very few police or military visible. The people are very hospitable. Of course there are rules and regulations that we don't know about and that makes the country very special. All in all it was a very good trip and there is certainly a good reason to go back again to become familiar with the other climate zones and horticultural regions.

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