

Proper use of fans in greenhouses

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The last two articles in this series were about uneven temperature pattern or 'temperature gradients' in greenhouses. This can cause diseases, waste of energy and loss of production. It costs much more money than most growers realise. Last month's article described how to identify the cold and hot spots, and suggestions were given on how to restore the situation. One option, although not always the best, is using fans. This article is about how to use the fans in the best possible way.

Resolving temperature unevenness

Temperature unevenness can best be overcome by restoring the cause of the trouble: flaws in the heating or venting system. The solution can be a modification; for instance insulating a transport pipe, putting plastic against a cold wall, painting the heating pipes to reduce or increase the radiation from the pipes, adjusting the computer settings.

Horizontal air flow fans (HAF)

If temperature gradients cannot be resolved by adjusting heating or venting systems, the grower can consider the use of fans, often called 'horizontal air flow fans' or HAFs. So fans are a sort of last resort. The benefits are:

- improving the evenness of air temperature, humidity and CO₂ concentration
- moving air along the leaves, which dries the leaves, and so reduces diseases
- avoiding a dull climate e.g. when the vents are closed
- avoiding a dull climate when a thermal screen is closed e.g. early in the morning

The disadvantages are that the use of fans cost money. First there is the investments, secondly the electricity costs, thirdly maintenance and in addition some energy may be wasted. This is because hot air is blown along and against the roof, where it loses heat.

Small solutions

It is not always necessary to hang fans throughout the whole greenhouse. In some cases it can be sufficient to install one or a few fans on trouble spots. It is possible to install one fan on a support that can turn, so that the fan can blow in several directions. This is a good way to find out what works best. If you do want to install a whole series of fans throughout the greenhouse, there are several ways of doing so. Only two ways will be discussed here: the serial and the parallel system.

Serial system or S-shape

In this system, the fans are placed in a series, behind one another, as a train above the plants, from wall to wall. The next train goes in opposite direction, like an S-shape (see Figure). The air blown out by the first fan is sucked up by the second one and blown forward to the third one, etc. This creates a constant mild air flow over and between the plants. Plants can be susceptible for strong air movement, and are better off with low speed fans, and hence the serial fan lay-out.

Serial circulation is done with variable speed fans. Some growers let the fans first run on full speed for a little while, to get the air flow going. After a short while the fans slow down to lower speed and maintain a nice continuous flow. The slow speed uses less electricity and is better for the plants.

Nowadays the fan speed can be controlled by the computer. Measurements are done on various places in the greenhouse. A setting in the computer tells how big the variation in temperature is allowed to be. If a larger temperature difference is detected, the fans are set to turn faster. Fans are not useful when the vents are open, so should be switched off then.

Parallel fans

The alternative to serial lay-out is parallel lay-out. Here the fans are positioned beside each other, along the main path. Parallel fans are activated now and then, but when activated they blow a large volume of air towards the wall. Not all plant types can cope with such strong air movement.

Parallel fans are preferred by growers who use LVM for pest and disease control. In this method, pesticide is blown out above the main path, while the parallel fans along the main path blow the pesticide mist into the crop.

Positioning

The best place for a HAF is above the crop, blowing in the direction of the bay, with nothing in the way of the fan's pathway. The fans are suspended from the truss, more or less in the middle of the truss. The positioning is different for 'serial' and 'parallel' systems as described above. A special case is when the greenhouse is in a slope, as the installer will be able to tell.

The distance between fans and the way they are arranged depends on the type of fan, e.g. its strength, how far it throws, and how wide it spreads the air. It also depends on the greenhouse, whether it is a Venlo-type or wide-span, low or high, etc. As an example we give information for the 'Ecofan' from Priva, for use in a Venlo-type greenhouse. The recommendation is about 16 per ha, depending on the dimensions of the greenhouse. The distances should be 45 m and 16 m, which means 45 m between two fans in one line, and 16 m between two lines of fans.

Technical developments

Fans have been developed over the years. As an example we look at the Priva Ecofans. They are compact and white (to limit the light loss) and with improved energy efficiency. Serial fans are 157 Watt, and parallel fans are 225 Watt. The number of rotations is reduced to make them less noisy. It has variable speed control, instead of on/off control only. The rotation speed can be controlled by the computer on the basis of temperature measurements on various places in the greenhouse. Apparently, the cost of the new fans is lower than of the old version. These fans, as well as some other brands are made of synthetics (plastic) rather than metal, putting an end to corrosion problems.

'Hygrofan' and other fans

The Ecofan can be equipped with a vaporizer that sprays water into the air flow. It is then called 'Hygrofan'. The water spray can be used to increase the air humidity in hot dry periods. The water droplets are very small and evaporate before they can land on the plants. So this does not make the plants wet, but increases the air humidity when that is desired.

There are many other brands of fans available. To name just a few: Vortex of Redpath and Multifan of Vosterman. They all have their own characteristics and advantages.

Summary

Fans of HAFs (horizontal air flow fans) can be used to overcome uneven greenhouse climate, which cannot be resolved by adjustments of the heating or venting system. Fans can be installed in a serial lay-out (S-shape) or parallel lay-out. Fans in a serial system go continuously at low speed (based on using variable speed fans). Fans in a parallel system go full-speed, but only for limited periods, controlled on/off. Parallel fans can be used for spreading agrichemicals with LVM. It is important that the fans are positioned properly. This depends on type of fans and type of greenhouses. New developments include higher efficiency, less noise, long throw and wide width of air flow, plastic instead of metal housing, and optionally computer controlled fan speed. Some fans can be equipped with a vaporizer, which can increase the air humidity in hot dry periods.

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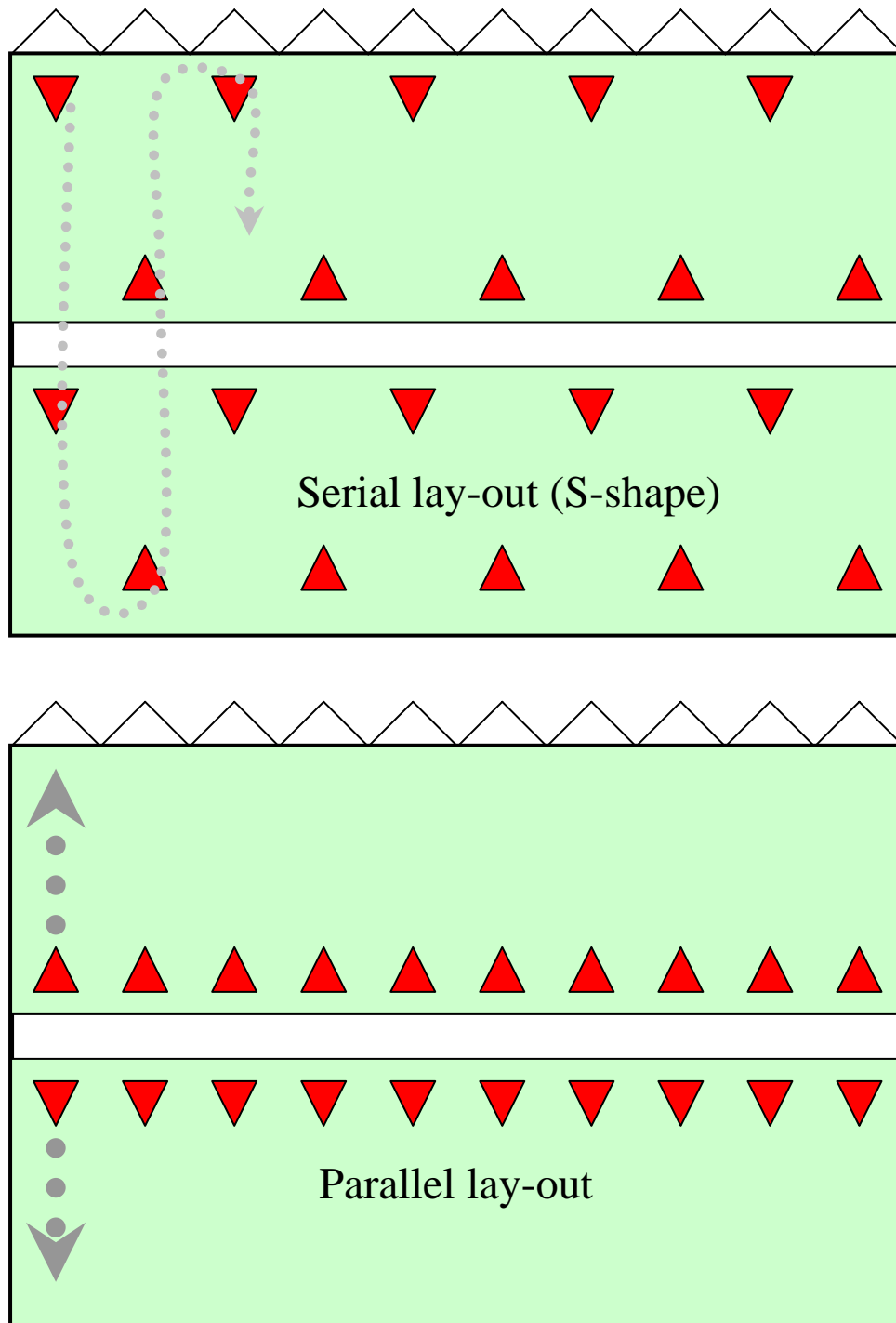


Figure. Serial and parallel lay-out of fans, and the air flow that they create. Thinner arrow means smaller air flow.