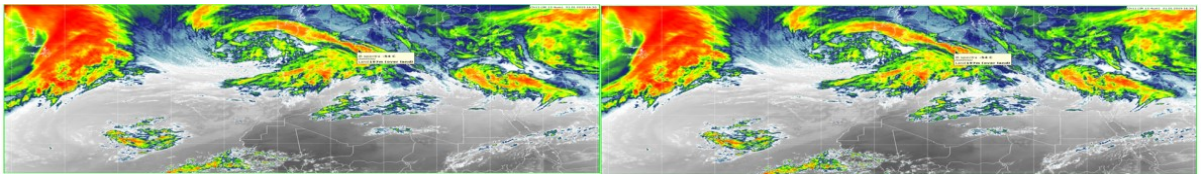

In this post, I share my experience with the semi-closed glasshouse. There is much confusion on how best to grow crops in a semi-closed glasshouse, and this series of articles tries to clear up confusion, inspire new discussion and educate.

Daytime Humidity in a Semi-Closed Glasshouse Part 2

In previous posts we learned that it is important to keep the humidity high during hot sunny weather. In addition, we saw that the temperature and humidity of the air entering the glasshouse is as important as the temperature and humidity inside the glasshouse. So, what is the best climate for a tomato plant? Well of course this depends on the age of the crop, the amount of light the plant receives and the outside conditions. But I have developed a table as a guideline that shows the recommended Humidity Deficit for a tomato plant in a semi-closed glasshouse.

		Relative Humidity										
		95	90	85	80	75	70	65	60	55	50	45
	15	0.6	1.3	1.9	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.1
T	16	0.7	1.4	2.1	2.7	3.4	4.1	4.8	5.5	6.2	6.9	7.5
E	17	0.7	1.5	2.2	2.9	3.6	4.4	5.1	5.8	6.5	7.3	8.0
M	18	0.8	1.5	2.3	3.1	3.9	4.6	5.4	6.2	6.9	7.7	8.5
P	19	0.8	1.6	2.4	3.3	4.1	4.9	5.7	6.5	7.3	8.2	9.0
E	20	0.9	1.7	2.6	3.5	4.3	5.2	6.1	6.9	7.8	8.7	9.5
R	21	0.9	1.8	2.8	3.7	4.6	5.5	6.4	7.4	8.3	9.2	10.1
A	22	1.0	2.0	2.9	3.9	4.9	5.9	6.8	7.8	8.8	9.8	10.7
T	23	1.1	2.0	3.1	4.1	5.2	6.2	7.2	8.2	9.3	10.3	11.3
U	24	1.1	2.2	3.3	4.4	5.5	6.5	7.6	8.7	9.8	10.9	12.0
R	25	1.2	2.3	3.5	4.6	5.8	6.9	8.1	9.2	10.4	11.6	12.7
E	26	1.2	2.4	3.7	4.9	6.1	7.3	8.5	9.8	11.0	12.2	13.4
	27	1.3	2.6	3.9	5.2	6.5	7.7	9.0	10.3	11.6	12.9	14.2
	28	1.4	2.7	4.1	5.5	6.8	8.2	9.6	10.9	12.3	13.7	15.0
	29	1.4	2.8	4.3	5.8	7.2	8.6	10.1	11.5	13.0	14.4	15.8
	30	1.5	3.0	4.6	6.1	7.6	9.1	10.6	12.2	13.7	15.2	16.7

Generative Neutral Vegetative Exhaustion

Figure 1; Humidity Deficit for Tomatoes at 8-9 air exchanges per hour.

Besides the recommended levels it also shows at which level the humidity deficit becomes a vegetative action, and when it is a generative action. In last week's post (Post 7) we discussed the importance of knowing what the temperature and humidity of the air that is blown into the glasshouse is. It is really the difference between these two that gives a true reflection of the transpiration rate of the crop. I am working on guidelines for this difference so please stay tuned.

POLLINATION

The new language of humidity in a semi closed glasshouse also has consequences for pollination. In conventional glasshouses a humidity of 60-75% was preferred. In a semi-closed glasshouse the range is 70-85%. This is especially applicable when plants must be hand pollinated.

For now, we can use the table in figure 1 as an indication. The night-time humidity is marked as dark green. Conventional glasshouses cannot maintain these low HD`s but they are fine in a semi-closed glasshouse. Next week we will talk about night-time humidity. The areas in light green, blue and orange are optimal, but an additional guideline is given by indicating which HD causes generative growth (light green area) and vegetative growth (orange area). Blue is neutral. This helps a grower determine when to turn on the cooling pad wall. The area in pink and dark red causes exhaustion in the plant and should be avoided. For conventional glasshouse growers this table maybe interpreted as HD`s being acceptable from light green to pink. The reason is that in a conventional glasshouse most of the air exchange happens in the top of the glasshouse, whereas in a semi-closed glasshouse the complete glasshouse air is exchanged. This is one of the fundamental differences between the two types of glasshouses.

The HD values described in the table above is based on of 8-9 air exchanges per hour. It makes sense that at higher air exchange rates a lower allowable HD should be applied. This also means that at lower air exchange a higher HD can be applied. Less air passing by the plant means there is less dry air sucking moisture from the plant. The relationship between HD and air exchange is reflected in figure 2. At a low fan speed, a higher HD can be maintained. This is particularly useful during dark humid weather, when the fans can be used to improve transpiration to keep the roots healthy. Similar tables like this one and the one in figure 2 need to be developed for other crops

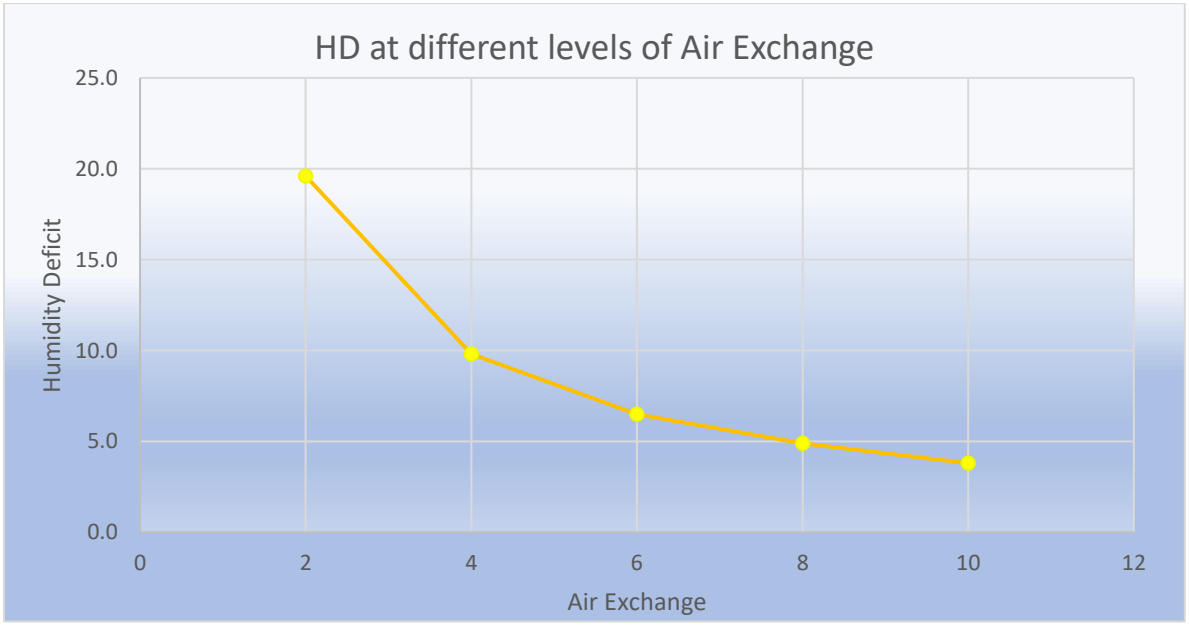

Figure 2; At lower Air Exchange a higher Humidity Deficit can be maintained.

The table in figure 2 shows that at 10 air exchanges per hour and an HD of 4, the air extracts the same amount of moisture from a leaf as at 2 air exchanges at an HD of 20. Of course, when the HD is 2, the radiation is low and increasing the air exchange is an effective way to encourage transpiration to keep the roots healthy.

While currently most crops grown in a semi-closed glasshouse are tomatoes, there are also pepper and lettuce crops being grown with great success. The HD problem expresses itself very profoundly in lettuce where high HD leads to tip burn. The combination of high HD and high air exchange around the leaf causes extra transpiration of the plants. Calcium distributes itself through the plants following the water transport. As older, larger leaves can transpire more water, the calcium does not get to the young leaves leading to tip burn as they expand.

Tim van Hissenhoven, expert lettuce grower and consultant, has developed an HD table for Lettuce for semi-closed glasshouses. He was kind enough to share the table in this post. In lettuce we only want vegetative growth. At high HD the chance of tip burn increases. In figure 3, the pink and red areas should be avoided. Of course, the table is only a guideline and tip burn can also occur through different causes.

		Relative Humidity										
		95	90	85	80	75	70	65	60	55	50	45
TEMPERATURE	15	0.6	1.3	1.9	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.1
	16	0.7	1.4	2.1	2.7	3.4	4.1	4.8	5.5	6.2	6.9	7.5
	17	0.7	1.5	2.2	2.9	3.6	4.4	5.1	5.8	6.5	7.3	8.0
	18	0.8	1.5	2.3	3.1	3.9	4.6	5.4	6.2	6.9	7.7	8.5
	19	0.8	1.6	2.4	3.3	4.1	4.9	5.7	6.5	7.3	8.2	9.0
	20	0.9	1.7	2.6	3.5	4.3	5.2	6.1	6.9	7.8	8.7	9.5
	21	0.9	1.8	2.8	3.7	4.6	5.5	6.4	7.4	8.3	9.2	10.1
	22	1.0	2.0	2.9	3.9	4.9	5.9	6.8	7.8	8.8	9.8	10.7
	23	1.1	2.0	3.1	4.1	5.2	6.2	7.2	8.2	9.3	10.3	11.3
	24	1.1	2.2	3.3	4.4	5.5	6.5	7.6	8.7	9.8	10.9	12.0
	25	1.2	2.3	3.5	4.6	5.8	6.9	8.1	9.2	10.4	11.6	12.7
	26	1.2	2.4	3.7	4.9	6.1	7.3	8.5	9.8	11.0	12.2	13.4
	27	1.3	2.6	3.9	5.2	6.5	7.7	9.0	10.3	11.6	12.9	14.2
	28	1.4	2.7	4.1	5.5	6.8	8.2	9.6	10.9	12.3	13.7	15.0
	29	1.4	2.8	4.3	5.8	7.2	8.6	10.1	11.5	13.0	14.4	15.8
	30	1.5	3.0	4.6	6.1	7.6	9.1	10.6	12.2	13.7	15.2	16.7

Safe Neutral Not Safe

Figure 3; Recommended HD for Lettuce in a semi-closed glasshouse at 8-9 air exchanges per hour.

On my website *http://www.glasshouse-consultancy.com* you can also download a spreadsheet that calculates the acceptable and non-acceptable HD at different air exchanges.

If you like to be copied in on future articles or would like to know more and have questions, follow me on LinkedIn Godfried Dol, or email Godfrey@glasshouse-consultancy.com or go to my website; http://www.glasshouse-consultancy.com. You can also download previous posts from the website.