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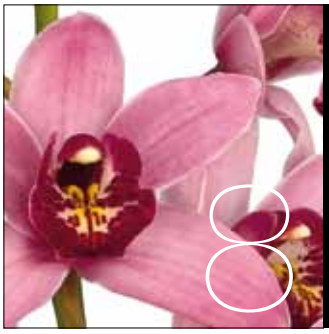

Phalaenopsis: crop production advice

Calling attention to water: a unique substance

Water: it's something we can't do without. Humans, animals - and plants, too - need water. We could probably devote an entire newsletter to this subject alone. Have you ever really considered what a unique substance water actually is? When you swim in a swimming pool and your body is supported by that transparent mass and you can see clear to the bottom, isn't that really pretty amazing? Here's a substance that you can simply push aside with your hands but can be as hard as a rock if you jump into it from a great height. At the same time, it's also the first thing we look for when we visit other planets. Is there water on the moon? Is there water on Mars? After all, life can't exist without water!

Watering

Everyone recognises the importance of using irrigation water of good quality. Sometimes, however, water from a source other than rainwater has to be used. This could be reverse osmosis, mains, surface and/or partly drainage water. In such cases, it is essential to know what elements are present in the water and whether it might contain contaminants. In short, using another kind of water will require making adjustments in crop production. The cultivation guidelines at our site provide a number of recommendations in this regard. To obtain more detailed information, you can always contact our crop production consultants. The main purpose of this article is to raise awareness, to stop and consider water (and watering) and everything associated with water. Is what you have always done all year round actually the right method? Evaluate this topic in discussion groups and/or with crop production consultants, and try to really understand all the ins and outs. Don't just stop at how many litres you should give per m^2 and what the EC should be, but keep asking questions. Ask, for example, what time of the day watering should take place? With or without the supplemental lighting on? How many rounds? With or without plain water before or afterward? What kind of source water - and what does it contain? How long should each section actually be irrigated? What

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else should be included to keep the pipes clean? What kind of iron? Which pH level? Which acidic or alkaline agent? Which nutrients and/or nutrient solutions in the tank? Is the disinfection unit or reverse osmosis device still functioning properly? Is your watering strategy the right one for your crop or its current stage of development, and is it right for your substrate? These are all factors that can have a major impact on your crop results.

How climate affects stomatal response

You often hear that growth depends on water. This is sometimes easy to see in plants that receive more water due to an extra pipeline on the side of the greenhouse. These plants are often visibly heavier. On the other hand, when pots become too wet, the result can be fungal infections, root problems, white worms or symptoms of stress such as signs of viral diseases. This means that water can be both beneficial and detrimental. Excessively dry cultivation can considerably delay growth by a matter of a few weeks to even a number of months and can lead to reduced yields. Circumstances can sometimes require drier cultivation but this will be at the expense of optimum growth.
A plant displaying turgidity can usually receive more light than a dry plant or one with poor roots. During extremely warm weather, however, a plant can close its stomata to protect itself from desiccation. This applies to both young and older plants. A more mature plant can usually recover somewhat more easily. This means that a plant watered during extremely warm weather may absorb little if any water. While you might think the plant would transpire large quantities of water, root problems could be right around the corner. This newsletter also addresses the other extreme: freezing weather can actually extract a lot of moisture from the plant. So in this case, it is particularly important to provide enough water!

Phal. '301767' ®

A plant can close its stomata for various reasons:

- high leaf temperature,
- low RH or high VPD/VD (Vapour Pressure Deficiency),
- dry substrate,
- insufficient supply of water from the roots due to root problems,
- substrate with a high EC,
- stress due to transport, lower plant density or relocating in the greenhouse,
- high CO_2 levels (sensitivity differs per crop),
- after taking crop protection measures.

Light intensity and wavelength also have a major impact on photosynthesis and the growth of the plant. Consider, for example, the composition of the light spectrum at the beginning and end of the day and the differing light spectrum during spring and autumn. Less well known is the fact that many plants absorb less water if the pH is too low. This can result in reduced elongation of the spike - and bud desiccation or drop - and will also have an impact on the opening and closing of the stomata.
Stomata have a characteristic day and night rhythm. This can be disrupted by moving the plants as well as an interruption in the shade cloth system, electrical power, lighting or CHP unit. Most plants close their stomata at night and open them during the day, though this is reversed in the case of CAM plants such as Phalaenopsis. Stomata also respond to changes in the greenhouse climate. Recent research has shown that stomatal response depends on more than just a single factor. The opening and closing of stomata is an outstanding example of a system involving a high level of protection built into it. This is hardly surprising; if such was not the case, the result could be highly detrimental with results that could ultimately lead to the damage or death of the plant.

Factors in watering: start of cultivation and RH

Because a young plant needs less water, great care should be taken during transplanting. All operations such as loading, transport, unloading, watering, removal from the greenhouse, transplanting, transport into the greenhouse (and probably watering again), can induce stress and, thus, the closing of

the stomata. When this occurs, growth ceases; the plant is merely attempting to survive. Sometimes, the substrate and the plants in the seedling tray are dry when delivered. During extremely warm weather, it would then be better to allow the plants to acclimate first and then water them the next day. If a young, recently transplanted plant is sprinkled two or maybe even three times within a short time span of a few days, this, in combination with too little drying and/or moisture exchange with a new substrate in the pot can result in plant loss. The plant will lose a lot of moisture when its stomata are open during warm weather. But even when the plant is receiving a lot of light and its stomata are closed, a plant like a Phalaenopsis with soft leaves, can still become desiccated by losing moisture through its epidermis!

Using a misting system can partially compensate for a low RH; this helps the plant somewhat. But misting too often or for so long that condensation on the plant occurs, should be avoided. If misting fails to compensate for an excessively low RH during a spell of dry, windy and unseasonably cold weather, reducing light intensity by shading during the day is a feasible option. This can also be done if a misting system lacks sufficient capacity.

Unlike most plants, a Phalaenopsis opens its stomata at the end of the day when light intensity diminishes and RH increases. What is then needed for good CO_2 exchange is enough leaf pressure and air circulation. In our opinion, the inner leaves should not be allowed to lose their turgidity. Moisture shortage in a plant has to be corrected by more water intake from the roots. If the stomata start to close when root pressure increases, root pressure may build up to such an extent that the moisture cannot escape and the plant “explodes” by exhibiting a phenomenon termed oedema. For young plants, and particularly with Phalaenopsis, this is why we advise not sprinkling them the day prior to transplanting. The substrate in the seedling trays can be somewhat moist but not soaking wet. The best strategy is to have the most constant root pressure possible.

Phal. '332407' ®

Make sure that the substrate in the pot into which the plant is being transplanted is moist so that the young plant is not being moved directly into a “desert” and will thus be protected against immediate desiccation. A beneficial side effect of transplanting a somewhat drier young plant is that any damage or wounds on its roots will have time to dry and heal. After transplanting, a limited amount of water can be provided but it is sometimes better to wait for one or two days if the weather and the plant permit. It is still important to continue to assess the situation and respond appropriately by making the necessary changes in cultivation. Setting things on “automatic pilot” is usually not the best option.

Vegetative and generative growth in Phalaenopsis

Development of pre-flowering spikes

In many cases, the first spacing out of plants occurs in the vegetative period during the second part of early growth. Although the light intensity appears to remain constant during this phase, the plant clearly perceives it as more light, especially if the whitewash is removed from the roof at this time of year. Admitting even 1 additional mol of light during this phase increases the chance of premature spikes developing. To prevent an increasing temperature fluctuation between 24-hour periods during the autumn, increase it temporarily (depending on the heating temperature) by 1°C. The disadvantage of this is the added heating cost it entails. A temporary increase in temperature also means a necessary reduction later which runs the risk of pre-flowering spikes developing. Doing this at the beginning of cooling increases the shock effect which results in better flower initiation with more flower buds.

Cooling effect also produces stress

When cooling begins with lowering the plant temperature by almost 10°C, this reduces the plant’s growth rate. The effect of cooling on the number of spikes and flower buds will be greater at a temperature difference of 9°C than that of 6°C. For some varieties, it would be better to maintain a minimum plant temperature of 18.5°C in order to prevent cooling damage. With the PAR sums then being realised, the minimum average daily temperature will have to be around 19.5°C. A plant

temperature below 18°C can result in leaves that turn entirely purple and sometimes even start to guttate. When this happens, it is a sign that factors such as substrate and nutrients as well as a stable rate of drying and VPD (vapour pressure deficiency) are out of balance. When the crop is not transpiring that much, the plant is insufficiently capable of transporting the sugars it has produced to its generative parts. This is when air circulation and a high VPD are indispensable. We see differences between nurseries in their capacity for cooling and the impact this has on achieving desirable air temperatures. Once the cooling effect has been achieved and enough eyes have been induced to spike, the temperature towards the end of cooling can be increased by, for example, one degree, depending on the cultivation method (duration of cooling) and the options available to the nursery. The purpose of this can be to encourage the plant to turn green again and thus stimulate its development and growth rate.

Phal. '312936' ®

Light and CO_2 intake

Clearly, daylength is the determining factor in maximising the quantity of the products of photosynthesis. Factors contributing to this are the amount of light received during the day, the potential to recover from photosynthesis, and the intake of enough CO_2 during the night. During the recent months, the length of the night has been no problem for the plant when it comes to recovery and sufficient CO_2 intake for the day. As summer comes to an end and the winter solstice approaches, it will become more difficult not to extend the day in such a way that the night period is not long enough for an optimum CO_2 intake. In general, Phalaenopsis perceives light intensities of below around 30 µmol/m²/sec as dark and will then begin preparing for the process of CO_2 intake. During the autumn, depending on the time of sunrise, this will have happened as early as 5:00 p.m. By providing CO_2 as early as that, the plant has more time for CO_2 intake

Cymbidium: crop production advice

Early varieties

The varieties intended for flowering prior to 1 November have to enter dormancy in November. Spacing out plants and cleaning are activities that should be done before Christmas and no later than right after New Year's Eve! This greatly improves their chances for flowering in September-October next year.
Stick to 24-hour averages of 13°C: 13-14°C in the daytime and 11-12°C at night. Lower temperatures are not desirable. During extremely cold weather like we had last winter, you can maintain the temperature a few degrees lower for almost two weeks. Research conducted at Wageningen UR in Bleiswijk showed that this can be an average daily temperature as low as 7°C, but this will be too cold for certain varieties. Which ones these are, other than the varieties included in the research which were Earlisue 'Paddy' and Beauty Fred '60', are unknown. We think that a short period of lower temperatures during extreme cold need not have major adverse consequences and would be a way to save on energy and costs. We should emphasise, however, that this should only be for a short period of time, lasting not more than 1 to 2 weeks during extremely low temperatures. Always ensure a sufficiently active climate no matter how low the temperatures are. The crop has to keep transpiring and absorbing water from the substrate. Measuring water intake is then a good way to check whether the plant is still sufficiently active. In the event of warmer weather conditions such as outdoor temperatures of 12°C or higher, stimulate your plants by

ventilating and switching on the heating tube with the lowest capacity for 1-2 hours in the morning but beware of it becoming TOO WARM.
Some growers have restricted the maximum temperature of their heating tubes to 40°C. To do this, they control the temperature by means of a computer which is sometimes linked to the RH controls. If we have a very mild winter, however, we run the risk of an average daily temperature being too high. When this happens, not enough cooling is accumulated and the ultimate result will be a lower yield and a delayed production distributed over a longer time. Before this happens be alert to adjust the control settings. Cooling should be maintained for around 90 to 100 days. Research conducted from 2001 to 2003 supported this: when this period was too short, it resulted in reduced flower production.During this phase, give the plants plain water with an EC no higher than 0.25. If you fertilise your plants, continue to check the run-off water!
At the end of January at the earliest, to mid-February, raise the average daily temperature to 20°C. You can also do this 1 to 2 weeks later if that would be acceptable for reasons of reducing heating costs, varying theheating schedule or desired flowering time, etc. But if you do it later, you will have to pay extra attention to ensuring the desired temperature sum. If you “get behind” due to excessively low temperatures, you can compensate for this by maintaining a somewhat higher average daily temperature than 20°C such as 20.5 to 21°C but do this over a long period lasting 2 to 3 months. Try not to achieve higher temperatures in a shorter period because this would be like leaving home too late and driving 180 km/h on the motorway to get to work or make an appointment on time: you then run a high risk of being fined or having an accident!
Last winter, a few nurseries still attempted to make up the difference in just 2 to 3 weeks by achieving average daily temperatures higher than 21°C. This leads to a loss of eyes that should have developed into spikes. We repeat: it is better to maintain a temperature of 20.5°C for three months than 23°C for three weeks!
To achieve the right plant temperature, it is important to make use of an anti-condensation shading film from January to mid-March inclusive. This also saves considerably on energy. During the periods of strong sun and high temperatures that can occur in March, it is important to open the windows for certain periods of time, but then to shut them in time during the afternoon to conserve heat and save on energy.
Some nurseries turned up the heat but this has still not contributed to earlier flowering. If this happens, take a look at the average daily temperatures being achieved. This year, it was cooler and wetter than usual until the beginning of August. Was it perhaps too cool then? If temperatures then exceed 21°C, this deters spikes from elongating. When flower spikes are shorter than around 10 cm, and temperatures become too warm, the spikes will remain at the same length. Spikes longer than 10 cm elongate faster during periods of high temperatures. A wet overcast autumn will delay elongation, especially if the whitewash is still adhering to the greenhouse. The plant temperature is then simply too low.
In conclusion, just one more point: light. In the previously quoted research conducted at the Aalsmeer Research Station, maintaining a high temperature was begun during week 7 of the year: 15 February! We are now seeing growers starting to maintain an average daily temperature of 20°C as early as 15 January. What they are not considering is that the PAR sum is much lower and that this will also reduce the number of spikes. To see a good example of this, take a look at the research conducted at the research station in Aalsmeer during the 1990s that focused on cool treatments for Phalaenopsis. For flowering by Mother’s Day (second Sunday in May), induction has to begin around 10 January: 18°C at night and 21°C during the day for 6 weeks. Cooling was applied using the traditional method (without lighting), with 4,000 lux and with 7,500 lux.

without lighting	: approx. 60% with a spike after approx. 8 weeks,
4,000 lux	: all with 1 spike and some with 2nd spike after 6 weeks,
7,500 lux	: all with 2 spikes after 6 weeks.

This shows that there has to be enough light at high temperatures to prevent the loss of generative eyes.

Cym. 'Stanley Flor' ®

Christmas varieties

Actually, the scenario here is more or less the same as for the early varieties, but simply carried out 1.5 months later. With these varieties, make sure the plants are in their intended place by Valentine's Day. If you do this any later, you will be running a risk if the weather turns unseasonably warm in early March. You are thus taking a risk if you wait until after Valentine's Day to spread out your plants. If you do this in time, they will become acclimated before daytime temperatures increase too much and the RH drops too far. Should That occur, there is a very good chance that flower spike buds will dry out. Water intake during the first 14 days after moving Cymbidium plants is 50% less than normal. In this situation, the average daily temperature can also be set at 20°C starting in early April. Generally, things progress normally, but in case of a prolonged period of cold bad weather, it would be advisable to respond with a variation in climate control.

Keeping a close eye on water intake is important. The water intake for some cultivars that flower around Christmas is very high during the spike elongation phase. If the weather turns sunny and you are one of those growers who minimises their water consumption, you will have to insert an extra irrigation round. Otherwise, you will wind up with bud drop. On the other hand, if the weather stays mild and humid and you generally water generously, it would be better to skip a round of irrigation; otherwise, you may destroy the roots of some varieties. Measure the quantity of irrigation water and discharge water once a week and monitor the EC of that water for the different varieties. Doing so can prevent a lot of problems because you will observe in time that certain varieties are absorbing more or perhaps even less water. And, by checking the EC of the drainage water to see if it increases, you will know whether the plants need reduced or even no fertiliser. If you see the EC increasing, reduce it! This will keep the roots in better condition. Make sure that the water temperature is at least 12°C. Even this is too cold when it freezes and you are pumping in water from below the ice in the reservoir. It's OK if the roots remain white, but the spike will become weaker.

Mid-season varieties

In principle, the plants of the mid-season varieties already undergo adequate cooling to flower the following year, during spike elongation and flowering (from November onwards). This will usually suffice, certainly in the case of plants with flowering periods extending into the 1st week of March. If you should nevertheless have to increase heating to ensure flowering by Easter, you will then run the risk of being unable to provide these varieties with enough cooling. This may lead to further delays in these varieties during the following flowering year.

We would like to call your attention to the fact that Easter will be very early next year: 31 March and 1 April. This means that you will have to decide now whether to increase temperatures somewhat and accelerate production or whether you will start keeping the greenhouse climate as active as possible and minimising temperatures as early as November in order to delay production. By "active", we mean not only growing at a minimum temperature but also considering RH and outdoor

Cym. 'Wish Flor ®

temperatures. Ensure that the plants continue transpiring at the rate of at least 2-3 litres/m²/week.

Late varieties

The late varieties are still being kept warm in Autumn at an average daily temperature of at least 20°C-21°C. For very late flowering, they will have to be kept warm (for purposes of delay) until Christmas; some growers even continue this until early or mid-January. Growers who can also achieve a good climate control in June by means of taller greenhouses and a misting system and/or an exterior shading system will be able to retain good spike quality even at high temperatures. Without such facilities, the risks associated with such late flowering could be too great. During a warm spring, these risks involve accelerated flowering, smaller flowers and paler colours.
Lowering the temperature should be done in phases over a time period of 10 to 14 days. Although the temperature may then be lowered substantially (8-10°C), you will have to consider the outdoor conditions and the RH. If it is freezing, the temperature may easily be lowered to below 10°C. Under those conditions, transpiration will be more than satisfactory. If the weather is unseasonably warm, however, you will have to keep your greenhouse well ventilated and switch on the heater with the lowest capacity every day for 1 to 1.5 hours to encourage transpiration. The varieties being kept in the late section of the greenhouse can still be absorbing considerable quantities of nutrients until mid-January at least. It is quite possible to be giving your plants a nutrient solution with an EC of 0.7 and finding drainage water with an EC of just 0.4. Yet this activity can cease within a week, after which the plants will not be absorbing any more nutrients. At that time, you will notice an increase in the EC of the drainage water. When this happens, cut the EC in half immediately! Keep checking the EC and pH of the drainage water being emitted from pots holding different varieties; do this every week and make sure that the plants are transpiring an average of approx. 2-3 litres/m²/week - i.e. almost as much as on an average summer day!

Pest control

The pest that requires control even during winter is the spider mite. The part of the greenhouse holding the late varieties will then be heated over a long period of time. Every greenhouse has areas where a stubborn population of spider mites can persist. Especially when heated, greenhouses offer the dry environment where these pests can thrive, so it's not surprising to find an infestation (hopefully only minor), particularly among varieties more susceptible to them. Be sure to scout these areas; nipping this problem in the bud is much easier and more effective. If you let things go, you won't be aware of spider mites until the time comes to tie up the spikes. By then, controlling these pests will be very difficult indeed. The same holds true for the early and mid-season varieties. And the very early varieties will require extra attention when temperatures are increased again.

Cym. 'Beauty Fred 60' ®

Regular scouting will keep things from getting out of hand quickly and enable you to produce plants virtually free of spider mites while having to take minimum control measures.

Snow

When it snows, the humidity of the greenhouse climate drops to the level of a beautiful day in early April and the greenhouse acts like a condenser clothes dryer. Melting ice or snow at 0°C takes ten times more energy than raising the temperature of the same amount of water or ice by just 1°C. Even though the temperature in the greenhouse doesn't feel warm, its climate is drawing more moisture out of plants and pots than you think. And that means having to give your plants more water!

RH

It's now autumn. In general, you can divide the year into two parts when it comes to RH:

- too low during spring-summer,
- too high during autumn-winter.

Starting at the end of July to mid-August (depending on weather conditions), growers will have to maintain an active RH policy: keep moisture moving through the greenhouse by ventilating and heating on time. It's simply impossible to keep a greenhouse closed as much as possible to minimise the consumption of natural gas per square metre and still turn out a high quality product!
In general, a greenhouse has to provide an "active climate". If you charted this on a graph, the line representing ventilation would be on or below the line representing heating. As soon as the weather turns colder, and you have to don your winter coat and gloves to venture outside, the greenhouse has to be heated. This is also the time that climate problems simply vanish. Somewhere in January to early February, the RH in the greenhouse can become too dry, particularly during freezing weather and/or wind from the polar region. Then it's time to think about retaining moisture in the air: waiting a bit to ventilate and making more use of shading to let less moisture escape from the greenhouse.

Producing Cymbidium year round: a dream or actually feasible?

For many growers, timing the cultivation of Cymbidium for producing cut flowers or pot plants was often extremely difficult until just a few years ago. Only a few succeeded in getting Cymbidium to flower 1 to 2 months earlier or later than usual so that they could achieve a better than average resultant market price. The factor determining whether production would be good or mediocre and whether it would be spread out over time or not was the weather during spring, summer and autumn. When production could be distributed over time, pricing was more stable, but prices were disappointing when flowering peaked without much distribution.

Various studies had been conducted into cause and effects, but one of the most pioneering was the flowering study conducted a number of years ago at the former Research Station for Floriculture in Aalsmeer. The findings of this study made it obvious that to achieve early flowering during week 40 required achieving an average daily temperature of 13°C starting in early November and maintaining this for around 90 to 100 days. An average daily temperature of 20°C would then be initiated early in February. Lower averages (between 18°C and 20°C) would delay flowering, while higher averages (up to 21°) would accelerate flowering.
As long as the spikes are shorter than 5 cm, an average daily temperature higher than 21°C delays flowering in the same way that this occurs when the plants are kept cold (an average daily temperature of <13°C) but if the spikes are longer than 5 cm and the average daily temperature is higher, spike elongation occurs at a faster rate but with resultant lower flower quality.

Depending on the cultivar, especially in the early varieties, red lips can be produced as the result of temperatures that fluctuate too much between day and night. The risk of red lipss increases with a fluctuation of 8°C or more within a 24-hour period. Temperatures that vary too little between day and night will delay elongation. We applied all of this information and research findings to the varieties not included in the research, and we also included their flowering periods. Earlier issues of our newsletters included articles about this. Growers have since applied this information and demonstrated that it really works. We notice that more growers are starting to grow early as well as late varieties; some nurseries can even overlap flowering spikes from late-flowering varieties with the spikes from the earliest-flowering varieties.
This provides more advantages than many would think. Spacing out the supply to the market results in more stable prices, prevents excess production during times with fewer sales opportunities (such as the month of January), and also allows nurseries to schedule their labour and energy better. Production during the winter period is extremely expensive since more heating is required to compensate for the climate

Cym. 'Dream Bisque Golden Wish' ®

conditions, while in an area of the greenhouse where there is no production of flowers, plants can be kept cool. Studies have even been conducted into using average daily temperatures of 7°C. This is quite possible for some cultivars though others still require approximately 13°C. Even so, if temperatures outside plummet to far below freezing and you can let the temperature in one part of the greenhouse drop to 7°C instead of having to keep it at 13°C, this will mean a considerable savings on the heating bill. It will still be better for some cultivars, however, to maintain 13°C. Earlisue 'Paddy' is one of those varieties, and varieties having this Earlisue as a parent are expected to respond similarly. With spikes present on the plant, you still have to stay around 15°C for highest quality. Our updated crop production manual that will soon be available at our website includes a schematic model for year-round flowering. This is a supplement to spoken and/or written explanations and is intended to make all of this more comprehensible. This information is applicable to the production of large-flowering and small-flowering varieties of Cymbidium grown for cut flowers or pot plants.

The soft pink bar indicates the weeks during which flowering is possible. **The year round flowering of Cymbidium isn't just a dream: it's really feasible.**

Temperature and time period in weeks per phase and flowering period

Flowering period	Flowering time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Okt	Nov	Dec
Very early	Aug-Okt												
Early	Nov-Dec												
Mid-range	Jan-Mar												
Late	Mar-Apr												
Very late	May-Jun												

Cym. 'Hazel Flor' ®

Growth and flowering periods per month

Temperature	Per phase	Time period in weeks	
in °C		Large flowering	Small flowering
10 - 13 °C	Spike initiation	12 - 16	12 - 16
20 - 22 °C	Shoot growth	14 - 19	10 - 14
13 - 20 °C	Spike elongation	16 - 27	12 - 23
13 - 19 °C	Flowering	4 - 8	4 - 8
10 - 14 °C	combination spike initiation/elongation	22 - 27	18 - 23

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