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Floricultura®
ORCHIDACEAE

Surprisingly, *day length determines flowering behaviour in Phalaenopsis!*

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It seems we know all there is to know about how to grow Phalaenopsis potted plants. However, day length studies in other orchids and the experience that spike initiation seems to occur spontaneously in one part of the year but not in another, gave rise to the idea to investigate this further in Phalaenopsis. So the question is: how does Phalaenopsis respond to a shorter (12 hours) day length before cooling and/or during cooling? Could this increase the percentage of multi-spiked plants?

Dutch growers habitually illuminate Phalaenopsis when the light intensity is too low to realise a certain light sum (PAR total). Throughout raising, usually lighting is applied at day lengths of 14 hours or longer. Also during cooling, the lights are switched on to lengthen the day sufficiently to achieve the desired PAR totals. But Phalaenopsis is a CAM plant. What will the effects be if we change the lighting duration (day length) in several stages of the cultivation process?

Floricultura developed this idea in cooperation with a number of growers who provided the necessary half-grown plants, knowledge

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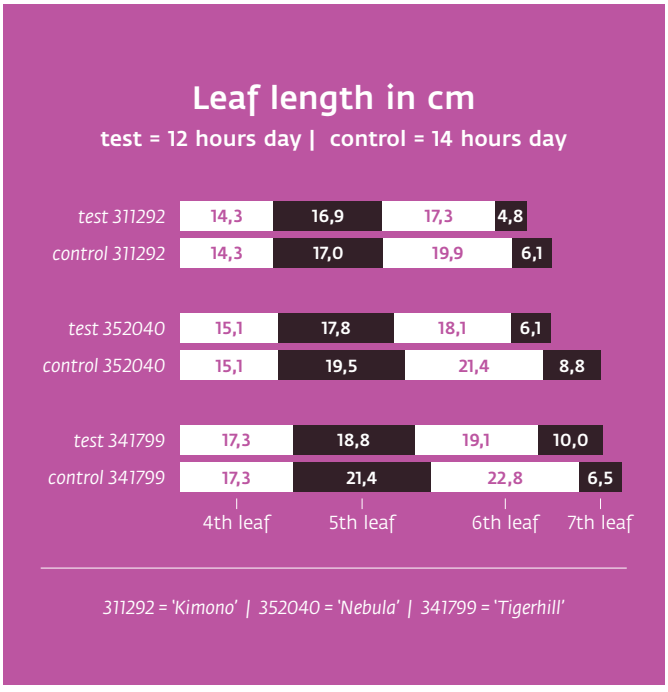
Surprisingly, *day length determines flowering behaviour in Phalaenopsis!*

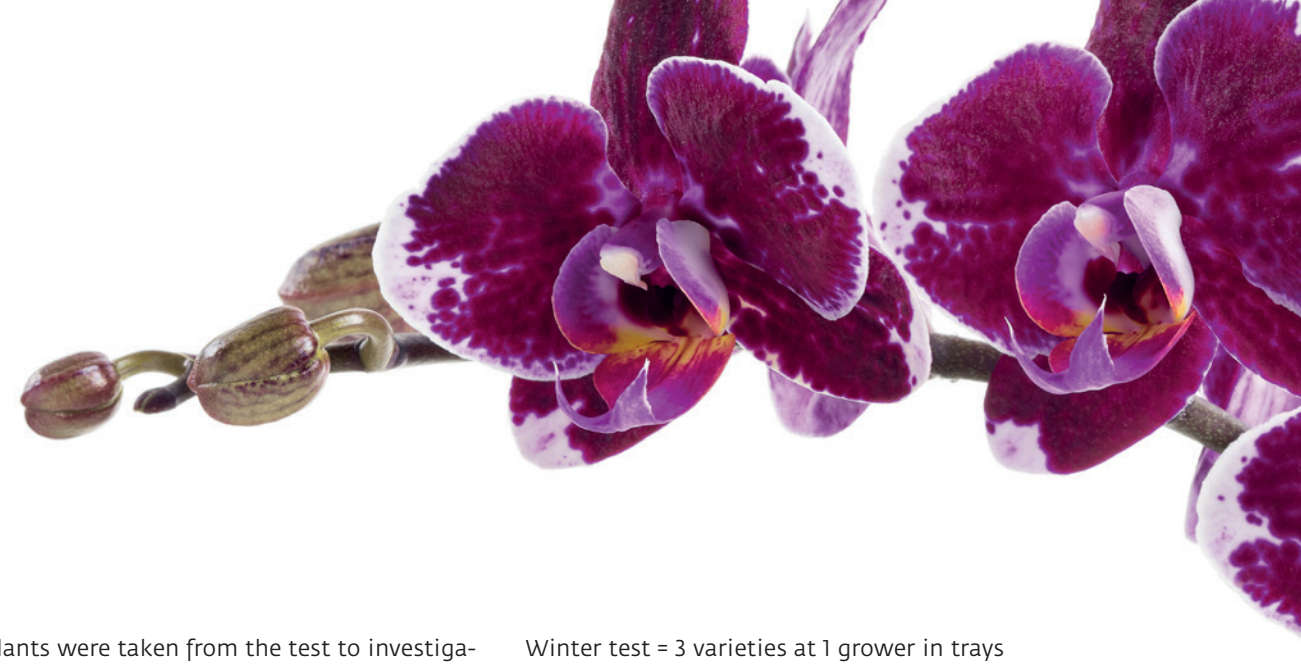
and participation. It was investigated what the effects were if during the last 2 months of raising and during the cooling period the day length was reduced (= day neutral = 12-hour day length). The results were surprising.

The test was based on developments in growing other orchids, such as Dendrobium nobile, Cambria and Miltonia. In tests with these orchids we did not focus on maximum lighting and PAR totals to be realised, but we studied the effect of day length control on growing and flowering behaviour of the plant. Spike initiation in shoot-forming plants was optimised by reducing the day length (darkening) before and/or during the cooling period. The benefits are uniformity (uniformity in shoot and spike initiation or flowering), improved quality throughout the year, and energy savings. Why shouldn't this work in Phalaenopsis? Particularly during the stage in which the bud dormancy is broken. Currently, the Phalaenopsis plant goes from raising (maximum vegetative growth) to cooling (abruptly to maximum generative). The idea is that maybe a short-day treatment before the cooling stage might improve the effect of cooling. Could the plant become more sensible for spike initiation? As a rule, we see premature stems appear around or after week 40 in the northern hemisphere at the slightest temperature drop. The sensitivity strongly decreases after January, in spring.

The study was started in November 2015 in cooperation with VAN OS research. The test was carried out with 3 varieties in trays from one grower. The tests were set up to go to maximum bud dormancy break in two steps. First reduce lighting during raising (from 14 hours to 12 hours) and then to cooling at a day length of 12 hours (SD - Short Day). Starting with a 12-hour day during cooling is a separate treatment in the test. The test was started in week 50 in 2015 and was continued until flowering in June 2016. The test was repeated in spring, when the cooling period starts around the longest day. The day length in that test was longer than in the control group, that is equal to the natural day length that runs to more than 16 hours. The treatment starts with pre-cooling, known as SD (Short Day) treatment. The last 8 weeks of raising, the climate is the same in the test greenhouse as at the nursery in raising, with the exception that the day length is 12 hours. The lighting capacity is 7,500 lux for additional illumination during these hours in winter. The PAR that is realised is not the same as at the nursery. That never was the intention of the test.

Both in winter (as from week 51) and in summer (as from week 19) the plants receive less light during the last 8 weeks of the raising period. Consequently, the cultivation result is that the plants have produced a smaller leaf area as can be seen from the following graph.





In week 5, plants were taken from the test to investigate the development stage of the flower spike buds. The microscope already reveals the flower spike buds before cooling. The flower spike buds of these plants were cut out and studied under the microscope. The flower spikes without SD treatment showed a nice round flower spike image under the microscope. But so far there was little development at the bottom of the bud. Only the base was a little thicker. The membrane around the bud stuck to the bud and was difficult to peel off.

The microscope image of the flower spikes of a plant that was kept at a day length of 12 hours during the last 8 weeks of raising, showed that the bud was also round and bulbous, but there was activity at the bottom of the bud The central growing point could clearly be observed and was separate from the leader bud. Also at the bottom of the bud on the sides, separate lobes appeared separate from the leader bud. A cross section also showed more action in the bud. Cooling ensures that the buds open, but the bud as such is mainly initiated during raising.

After raising, a next batch was added to the test in the greenhouse where the day length was 12 hours. Day neutral means illuminating only when the intensity is too low, but also darkening to keep the day length at a maximum of 12 hours. After 7 weeks of cooling, all plants were placed together in spike initiation at the nursery. On placing sticks – almost flowering – a count was taken. The results were astonishing. Give a plant less light (shorter day) and it flowers more.

In winter, we found 100% multi-spiked plants at SD before and during cooling. The number of 3-spiked plants dropped at a 12-hour day, but the number of multi-spiked plants and the number of flowers per plant increased, just like the uniformity.

Winter test = 3 varieties at 1 grower in trays
Summer test = 7 varieties at 3 growers in vases

% multi-spiked plants at	control	12 hours day length in 2nd stage raising and cooling	12 hours day length in cooling
winter 3-4 spikes	43	19	24
summer 2-3 spikes	81	94	91

No plants were grown in vases during the winter. Not at the grower either, where the other plants, apart from the test, were in vases. At the grower, the plants in the trays were between the vases with a lot of light. The control batch in vases counted between 10 and 15% single spike plants. Cooling in summer resulted in a reduced spike initiation in practical circumstances. But with darkening and 12 hours day length, for 3 growers the test yielded an average of 90% multi-spiked plants. That is 10% higher than the control batch! In this process the broken branches were in all cases counted as okay.

% plants branched	control	12 hours day length in 2nd stage raising and cooling	12 hours day length in cooling
winter	52	70	72
summer	47	57	54

Both in summer and in winter, the tests with shorter days of 12 hours in raising and cooling gave positive results for the percentage with lateral spikes.

Number of flowers per plant	control	12 hours day length in 2nd stage raising and cooling	12 hours day length in cooling
winter	21	23½	23
summer	16	19½	18½

The results of the tests vary between growers. The number of spikes, the number of lateral spikes and the spike length determine the number of flowers per plant For instance a 3-spike without lateral spikes may have

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just as many flowers per plant as a 2-spike with lateral branches.

De spike length differed per grower. At one grower, the flower spikes of all test treatments within a variety all had the same length. The batch with a day length of 12 hours during the last 8 weeks of raising and a day length of 12 hours in cooling, was 1 week quicker than the other batches, in winter as well as in summer. At the second grower, the flower spikes of the control batches were the longest. The only exception was the variety Limelight. This one was longer at 12 hours raising and cooling. At the third nursery, the spike length at 12 hours raising and cooling treatment was the longest. No production acceleration between batches could be observed. At this nursery all batches were cooled one week longer at natural day length. It is not clear whether this had a negative effect on budding.

Phal. 'Limelight'
left = control, centre = SD cooling, right = SD raising and cooling

Phal. 'Pink Twilight'
left = control, centre = SD cooling, right = SD raising and cooling

Conclusion

A regulated day length in the period towards budding in the last stage of raising and during cooling (bud dormancy break) has influence on the final result. In winter as well as in summer it has an influence on the development of the spikes and the rate of growth. More lateral spikes, a more uniform product with up to 70% of the plants within one grade (higher % 2-spike, fewer 1- and 3-spike) and longer spikes can be realised. Particularly the increased uniformity means savings in grading work.

Options

Winter cooling	
No SD treatment	more 3-spike without lateral spike
With SD raising + cooling	higher % 2-spike + lateral spike + uniform + higher number of flowers

Summer cooling	
No SD treatment	higher % 1-spike (20%)
With SD raising + cooling	over 90% 2-spike, remainder is 3-spike, longer spike, highest number of flowers
Only SD cooling	effect partly equal to b but much more variation, so more grading

About pH
and more

When you Google the internet for pH, you will find the following explanation on Wikipedia:

> *"The pH is a numeric scale used to specify the acidity or basicity of an aqueous solution. (...) Solutions with a pH lower than 7 are acidic and solutions with a pH higher than 7 are basic. Pure water is neutral, being neither an acid nor a base."*

Though various theories and explanations exist, the 'potentio Hydrogenium' really means the number of H+ ions in a watery solution. Since this value is stated in a mathematical expression as a negative logarithm, it often seems confusing to those who are not familiar with the subject.

A low pH = a high concentration of H+ ions
= a more acid solution

A high pH = lower concentration H+ ions
= a more basic solution

A clearer example: a solution with a pH of 5, contains 1,000 x more H+ ions then one with a pH of 6.

As a rule, most plants thrive at a pH between 5 and 6, because in that bandwidth almost all nutrients are absorbed effectively. Most elements are absorbed at a pH that is closer to 5. However, the risk is that such absorption may be so strong that it causes the pH to drop abruptly. That is because when a positive ion is absorbed, such as K+, Ca++, Mg++ or NH4+, the plant (root) releases an H+ ion. So more + absorption = more + release, so quicker drop . Now monovalent ions such as K+ and NH4+ are absorbed easier and quicker than divalent ions such as Mg++ and Ca++. That has to do with the size of the ion. So the more monovalent ions in the fertiliser, the more chance that the pH will more easily drop and become too low (below 5), than with divalent ions. If the pH becomes too low, there is a considerable risk that roots are scorched. That may cause fusarium or pythium because the roots take up less moisture, the substrate becomes wetter and fungi develop more easily.

A too high pH may also be due to properties of the substrate, tap water, or incorrectly functioning osmosis membranes. At a pH of 6.2 and higher, certain ions will flocculate, such as calcium phosphate and calcium sulphate, even at low ECs. Then the plant can no longer absorb these elements. The same applies to certain spore elements. If you lower the pH with an acid such as HNO3 (nitric acid) you suddenly see calcium and phosphate reappear in the analysis while you have not additionally administered those. In this case the roots will not scorch, but the plant produces much more roots which often also look whitish. In the past many Cymbidium growers interpreted this incorrectly, that is as positive, on switching from polyphenol foam (Oasis) and peat mixtures to rock wool. As a rule it applies that when the nutrient uptake is balanced, just as many + as – ions are absorbed. When a plant takes up nitrate, NO3-, the plant releases an OH- ion. OH- + H+ = H_2O!

There are various factors that may send the pH in the wrong direction:
- Plant stage
- Substrate
- Nutrients composition
- Water

Plant

Plant uptake depends on evaporation, temperature and stage. At high evaporation, more elements are 'carried along' in the water flow. A prime example is the element Calcium, the best insurance against problems. The evaporation depends on various factors such as light

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About pH
and more

(leaf temperature) and RH. Another widely underestimated factor is the plant stage. As soon as many fruits (tomato, cucumber) and so also flowers appear and/or develop on the crop, the potassium uptake increases. Increased potassium uptake makes the pH drop. In cucumber that is perceptible if it is full of stem fruits, in Cymbidium we see a higher potassium uptake as soon as the spikes start elongating. A downward tendency of the pH may also be observed. This uptake starts rather abruptly within a week and if it is not noticed, the pH collapses and the EC increases. That makes plants loose their roots at the moment the plant load increases, or rather when the flower spikes or fruits must develop. Consequence is, that the flower colour is affected, spikes become weaker and the keeping qualities deteriorate. This can be prevented by strongly reducing the EC in time. The process happens in all plants, so also in Miltonia, Phalaenopsis and other orchids.

Substrate

Each substrate has its particular characteristics and features. Not only as regards water-retaining capacity, but also as to whether or not they (the temporarily) retain elements and as to the pH. Car tyres for instance, make a good comparison for substrate. Regular drivers know all about summer, winter or all weather tyres. If you are into Formula 1, you talk about slicks, rain tyres, softs, ultrasofts, hard and who knows how many more. Every type is used for certain conditions and they influence the handling of the car. It is not much different for substrate. If you are growing on peat mixtures, you will have to use less urea/ammonia than on bark mixtures. If you use coir mixtures, you have to make allowance for it in potassium, calcium ammonia/urea metering. When in the early eighties Cymbidium growers switched from peat mixtures to rockwool or polyphenol foam (Oasis), special schedules were produced for those substrates. Rockwool has a tendency to make the pH increase, so more ammonia is given, while polyphenol foam and to a lesser degree peat and coir tend to make the pH drop. For that reason hardly any ammonia is given, but more nitrate. Basically, every substrate must be treated to reach a stable pH. That is done by mixing lime through the substrate This is not necessary for rockwool, but it is for organic mixtures and polyphenol foam. Various lime types are available, but Dolokal is and remains the most recommended. For bark and peat mixtures 3 kg per cubic metre substrate is usually the starting point. For varying reasons, this is often deviated from, usually lower. Though growth at the start is a little slower at 3 kg, it does prevent problems later, on flowering.

Miltonia '7004'®

Phalaenopsis 'Monroe'®

The lime contains calcium carbonate and magnesium carbonate. Those slowly dissolve in water to form bicarbonate HCO_3^- and Ca^{++} or Mg^{++}. The bicarbonate content determines the buffering capacity of the substrate. In other words, the capacity to compensate a drop in pH. At a high pH, there is more bicarbonate so many H^+ ions can be captured, but at a low pH that buffering capacity has been exhausted and the pH can drop more rapidly. For multi-annual production such as cut flower Cymbidium, the pH may differ per variety. In varieties where it is too low, it is recommended to thoroughly flush the pots once or twice with clean water and to subsequently apply 3 grams of Dolokal per litre substrate on the pot/plant and to rinse it in manually (so 30 grams per 10-litre pot). Adding nutrients must not be started again until new roots appear.

Another frequently neglected effect is the water retaining capacity of the substrate and the quantity of water that is given. In compact substrates, the substrate is not so easily flushed, so refreshment (dilution) is less which may result in a too high EC and a too low pH. That can be solved by administering more water. So monitoring of application and drain for EC, pH and water quantity is of vital importance. Scales have proved their usefulness time and time again. Using urea at higher temperatures will speed up the conversion process, resulting in acidification. Of course this process will be enhanced if the if the water application is too thrifty.

Nutrients composition

The influence of nutrients on the pH is considerable, but only in combination with the factors mentioned above. Too much nitrogen in the form of urea has little effect in a dry substrate. The effect of urea appears most rapidly in aqueous environments at higher temperatures (above 20° C). The ratios between potassium and calcium or ammonium and calcium also have a major influence. Too much potassium inhibits the uptake of calcium. The crop becomes darker green and firmer, but also more sensitive to breakage. On the other hand, too much ammonia may reduce the calcium absorption and lead to blossom-end rot in peppers. In short, quite some experience and knowledge regarding all these aspects is required if you want to realise a satisfactory result. If you do not have sufficient knowledge of a car engine, you had better not meddle with the tuning, otherwise it will not perform properly.

Water

Rainwater or high-quality osmosis water are the best for orchids. However, under warm and sunny conditions in spring, algae may develop in your basin. The pH increases in the course of May – June. If the osmosis system is ageing, the membranes will wear and let ever more bicarbonate through, causing the pH to increase as well.

Autumn tips
Phalaenopsis

The best part of summer is behind us. It means that too high light levels are a thing of the past. At least light peaks become ever shorter and less strong, so it also becomes more acceptable to let them through to still achieve a certain light sum. In addition, the plant has got used to a lot during summer, of course dependent on what the goal has been at your nursery over the past period. There is more moisture in the air, so misting will also be needed less frequently. However, in easterly winds or cold freezing weather, still much moisture will be abstracted from the greenhouse air. At lower solar radiation, artificial illumination will become relatively more important in the coming months. Think of the prevention of salination of the top layer caused by more hours of lamplight. We still remain a strong supporter of a regular (complete) clean water application. It always enormously freshens up the roots as well as the top layer. If you give clean water, that is never completely clean for the plant, since part of the salts from the top layer dissolves again. Hopefully everything is ready for the winter and the necessary maintenance on doors, cover, screens, exterior walls, lighting, heating, boiler and CHP is complete. In the past, when we illuminated less, week 39/40 was infamous for its premature stems. That visible effect in week 40 was caused by events of the preceding weeks. Then we should think of causes such as removing the chalk, lower plant temperatures and, of course, the shortening days. These days we keep the days longer with illumination, so the premature stem effect is less prevalent. Research has shown that the optimum day is 16 hours in raising Phalaenopsis. This does require gentle increase and decrease at the end of the day. However, that applies to light levels under lab conditions that may be achieved more or less in winter under practical conditions. When the light as well as the peaks begin to increase again, we think it is recommended to keep a shorter day than that 16 hours. This will still be investigated in practice. The beauty of it is that around week 40, growers also notice that nature seems to break. Of course that is true because counting in number of hours, exactly around that time the nights get longer than the day. Experience has shown that it is certainly not wrong to reduce the nitrogen quantity to make the plant a little more hardy. The can for instance be achieved by replacing a number of kilos of compound fertiliser by calcium nitrate. The EC can also be fine-tuned throughout the year. Urea is a very important factor. That application can be reduced by 30-50% in autumn/winter, for instance by replacing part of the 20-20-20 by 7-11-27. Of course plant temperature is of the greatest importance during autumn and winter, in particular to gain insight into the lowest temperatures. Certainly when switching off the lamps at the end of the day or afternoon, sudden cooling of the plant must be prevented. That can be achieved by increasing the pipe temperature, timely closing (more) screens or windows etc. Also think of your irrigation water that

Phalaenopsis 343358®

must not be too cold (not below 20 degrees), certainly when you have to take it from under a sheet of ice. Do not forget either that the differences within the plant must also be as little as possible. So try to keep the temperature differences between pot, leaves and room not too great. Fortunately, the pest pressure in Phalaenopsis is usually quite low. However, recently we have seen are regularly seen infestations by caterpillars and thrips. Both pests can easily be monitored with light traps and sticky traps. If these are checked regularly, measures can be taken in time and it also shows how the pest is developing. Try to clear up the pests as thoroughly as possible so you can start with a clean greenhouse in spring. However, thrips may cause a problem because in the flower bud they cannot be touched by the agent. So far, no effective measures have been discovered to deal with Lyprauta (white worms). Yet investigations are still going on and they now do have the knowledge to deliberately grow white worms. That is the start to finding a satisfactory agent and testing whether for instance a natural enemy is effective against the worm or maybe against the mosquito. So far the possibilities remain limited to growing dryer and a space treatment. Predatory mites may also make a positive contribution, but in many cases large numbers are required that need to be deployed regularly: 250-300/m^2. For several exclusive orchids, growers have switched to finer mixtures that the mosquito cannot penetrate. That appeared to be a considerable improvement to reduce damage by Lyprauta larvae to the minimum. It is a well-known fact that control results, both chemical and biological, may deviate strongly between nurseries. No two nurseries or growers are and act the same. ⬟

Phalaenopsis 'Beach Girl'®

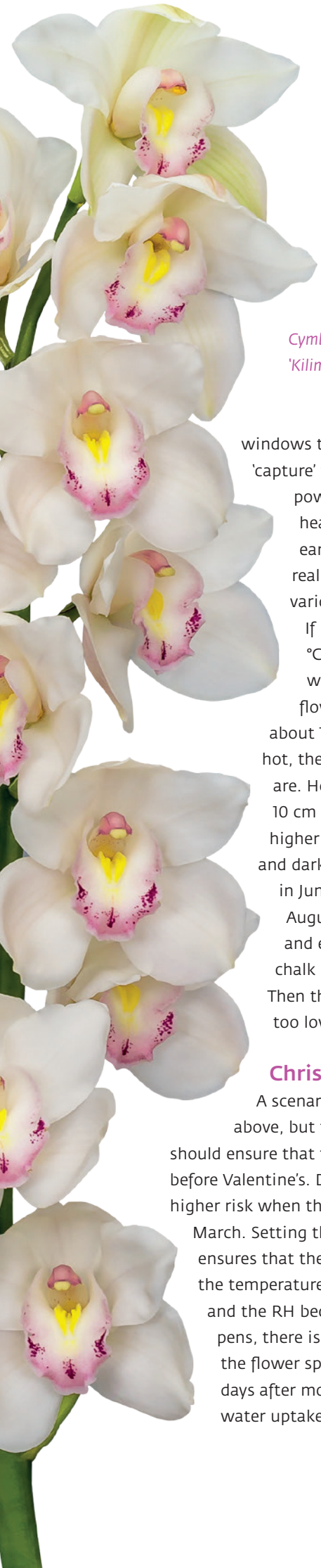
Autumn and winter tips
Cymbidium

Preview

It is difficult to give a clear prognosis for the coming season, certainly for Christmas production. Main cause is the peculiar weather of 2016. A very mild winter so the early flowering crops could be given little cold, the cold spring months with a very cool, dark and wet month of June, interspersed with the occasional few days of warm weather. The high night temperatures in August and particularly in September will have consequences for flowering. The very early range will be a little early because of the weather in August and September Spikes longer than 10 cm will elongate earlier. The high night temperatures may have delayed the spikes for Christmas flowering. Production for the middle and late ranges will be good. In particular for the late range, the spikes will not appear until December.

Early range

The range that must be producing in September – October 2017, must go to the dormant stage (cool) in November. The range that flowers even earlier, should in fact go to the dormant stage even earlier but then it must be cool enough outside. It is important that the average 24-hour temperature drops to 12½ - 13 °C for a period of at least 90 days, preferably 100 days. The jobs to be done then are setting wider apart and cleaning. That must have been done at least a month before the temperature is increased. Christmas is a deadline of course. The average 24-hour temperature is 13 °C. By day 13 – 14 °C and by night 11 – 12 °C. In extremely cold weather, several degrees lower is acceptable for a short period for instance for 2 weeks. Down to 7 °C 24 hours average is acceptable, but for some varieties this is too low. Do ensure a sufficiently active climate at all times, no matter how low the temperatures are. The plants must evaporate and take up water. Water uptake is a monitoring tool to see whether the plant is still active. In a mild winter with 12 °C and higher outside, make sure the plants are activated a little by ventilating sufficiently and maintain a minimum pipe temperature, but be careful not to overheat. If too little cooling is accumulated, this will result in lower and later production, with plants flowering over a longer period. The required cooling period is about 90 – 100 days. A too short cold period affects production. Apply clean water with a maximum of 0.25 EC during the cold period. If you also apply fertiliser, do always check the drain for EC, pH and drain quantity!
At the earliest as from late January to mid-February, the average 24-hour temperature must go to 20 °C. Because of heating costs, heating schedule, undesired flowering time, etc., you can also start this 1 to 2 weeks later. If you start later however, do ensure that you achieve the desired temperature sum. If you have run up a 'backlog' you can 'catch up' by setting the 24-hour average a little higher than 20 °C , for instance 20½ to 21 °C, but do spread it out over a longer period, preferably 3 months. Do not try to set higher temperatures during a shorter period. That will cause loss of eyes that should have become spikes. These flower spike buds will wither and the plants will start making new shoots. Again, setting 20½ °C for 3 months is better than 23 °C for 3 weeks! Starting early, in January, may work out badly for some varieties because at that higher average 24-hour temperature on darker (also shorter) days, the energy consumption of the plant (sugars), is higher than the synthesis. That may cause withering of flower buds, as a result of which shoots will appear rather than flower spikes later in the season. The light quantity is sufficient after mid-February, so this problem no longer exists. In order to realise the right temperature, it is important to install anti-condensate film from January up to mid-March, unless you have double glazing. That also saves a lot of energy and it improves the climate (more humid)
It is important to open the windows in a carefully controlled manner when the sun is out and temperatures may rise too high, as may happen in March. Close the



Cymbidium 'Kilimanjaro'

windows timely in the afternoon to 'capture' the thermal energy and save power. Some nurseries do use heating, but still those are not earlier. Then have a look at the realised 24-hour averages during various periods of the season. If it becomes warmer than 21 °C, flower spike elongation will be hampered. When the flower spikes are smaller than about 10 cm and it becomes too hot, the spikes will stay where they are. However, spikes longer than 10 cm elongate more quickly at higher temperatures. In cold, wet and dark weather, such as this year in June, but sometimes also in August, elongation is delayed and even more so when the chalk is still on the greenhouse. Then the plant temperature is just too low.

Christmas range

A scenario comparable to the one above, but then 1½ months later. You should ensure that this section is in its place before Valentine's. Doing it later it means a higher risk when the weather is very nice early March. Setting the plants wider apart timely, ensures that they have acclimatised before the temperatures during the day get high and the RH becomes too low. If that happens, there is great risk of withering of the flower spike bud. During the first 14 days after moving Cymbidium plants, the water uptake is 50% lower than usual.

As from early April, the average 24-hour temperature can also be set at 20 °C. Generally this will happen the natural way, but if the weather is cold and bad during an extended period, it is wise to compensate that with the use of climate control. It is important to carefully monitor the water consumption. There are cultivars that flower around Christmas and take up a lot of water during the spike elongation stage. If you are a 'dry' grower and the weather gets sunny, you have to arrange an additional drip watering. Otherwise your plants may drop their buds. However, if the weather remains mild and humid and you are a 'wet' grower, you had better skip one watering because some varieties may lose their roots. Measure the application and drain every week and check the drain EC for several varieties. That way you can prevent many problems, because you will timely notice that some varieties take up more or less water. Moreover, when you notice that the drain EC increases, you know that the plants use less or no nutrients. Then lower the EC! That improves root health. Ensure that the water temperature is not lower than 12 °C.

Mid-range

The mid-range must build up its cold for next year's flowering during spike elongation and flowering as from November. As a rule, this will suffice, certainly with flowering time up to and including Women's Day (1st week of March). Easter 2017 is quite late, that is on 16 April. This this means that you will now have to choose. Either for flowering at Easter 2017 by delaying through extending and intensifying the cold period, or flowering early March 2017, but then you will have to keep it warm during the winter. You can do that by already raising the temperature a little as from mid-November. This is only possible when you can heat the sections separately. For the cold period this must be done 'actively, so not only grow as cool as possible, but also allow for relative humidity and outdoor temperatures.

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Autumn and winter tips
Cymbidium

Cymbidium
Summer Pearl 'Suzy'

Late range

The late range is now heated intensively to a 24-hour average of at least 20 °C – 21 °C. For really late flowering (June- July) this must be persisted until Christmas. Some growers even continue that until early or mid-January. Nurseries that have the possibilities to realise a good flowering climate in June, are also able to realise a good spike quality at high temperatures. That is possible with higher greenhouses with a misting installation and/or an external screen. Without those, the risks will be too great. In this case, a warm spring will lead to accelerated flowering, smaller flowers and paler colours. The transfer to cold must be done gradually over a period of 10 to 14 days. Then cold can be very cold: 8 – 10 °C, but it also depends on the outdoor conditions and the relative humidity. It is freezing, temperatures below 10 °C are no problem. Evaporation is more than sufficient under those circumstances. If the weather is too warm for the time of year, you must not only ventilate a lot, but you must also switch off the heating at minimum level every day for 1 to 1½ hour to activate the plants. In the late section, the plants may take up rather a lot of nutrients at least until mid-January. It may happen that at an application of 0.7 EC, only 0.4 EC returns in the drain. If the drain EC increases, then cut the EC by half at once! Keep monitoring the various varieties every week for EC and drain pH and ensure that the plants evaporate an average of about 2 - 3 litres/m²/week. So that is almost as much as on an average summer day!

Relative humidity

Two main lines can be distinguished with regard to the relative humidity in the greenhouse throughout the year. Too low in spring/summer, too high in autumn. As from late July – mid-August, dependent on the weather conditions, an active relative humidity regime must be maintained. This means ventilating and heating timely. Keeping the greenhouse shut as much as possible to use as little gas as possible per m² to still realise a good quality, is not an option. It will affect the quality! So keep the ventilation lines on or below the heating lines. When it is getting colder outside and you have to don your winter coat, heating will automatically increase and most climate problems disappear. In freezing weather and/or north-easterly winds, the RH in the greenhouse may drop too much. Then you have to switch to "saving moisture". So do not ventilate as much and keep the screens closer (cutting back) to lose less moisture from the greenhouse. AM (Absolute Moisture) may be a good tool to see what the differences are between indoor and outdoor moisture and for adapting the heating and ventilating regime accordingly.

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