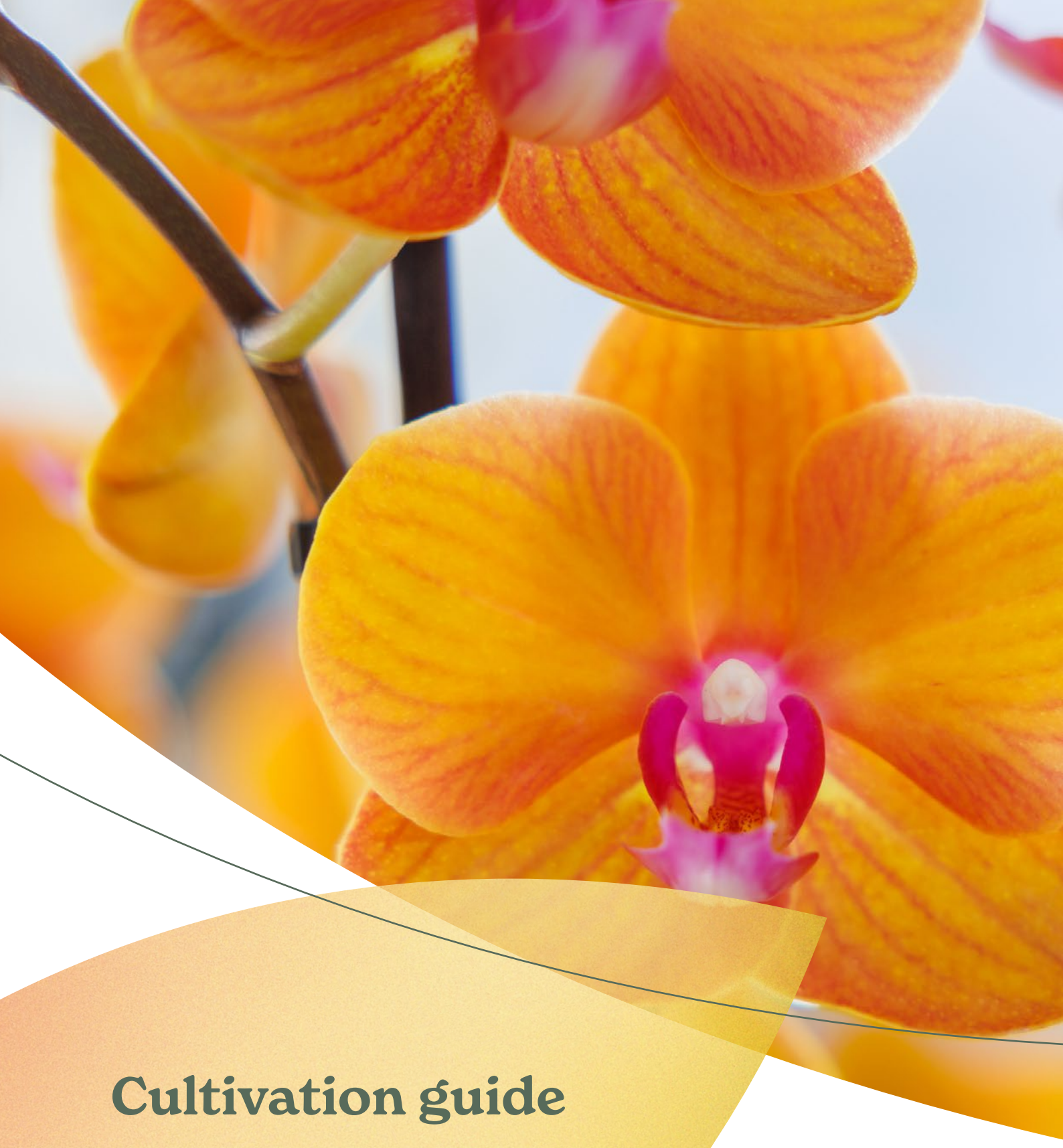

Cultivation guide

Phalaenopsis pot plants

Anthura®
Creating blooming happiness

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Introduction

This cultivation guide briefly describes the cultivation of phalaenopsis pot plants; a cultivation that is constantly subject to new insights and the use of new techniques.

For detailed information about the possibilities of phalaenopsis, please contact Anthura. For all your technical cultivation questions, our team and Delphy's advisers are happy to help.

Introduction phalaenopsis

Phalaenopsis belongs to the largest plant family in the plant kingdom, the orchids (Orchidaceae). This plant has a monopodial growth habit (no lateral shoots), with the main stem growing year-round, allowing one flower branch to develop per leaf axil. The leaves of phalaenopsis are fleshy and emerge opposite each other.

Phalaenopsis is native throughout tropical Asia, where the plants grow at day temperatures of 28°C-35°C and night temperatures of 20°C-24°C, with high air humidity. Phalaenopsis also grows in shady environments. This plant is capable of absorbing nutrition through the root as well as through the leaf. The root also serves to anchor the plant.

Greenhouse and greenhouse equipment

A phalaenopsis must be grown in a modern greenhouse; this can be either glass or plastic.

- The greenhouse should be at least four meters high from the ground to the gutter and should consist of at least two different climate zones: one for the warm phase and one for the cool phase, at a ratio of 50:50. In practice, there are often four different sections: two for the growing phase, a separate one for the cooling phase (±17%), and one for the flowering phase (±33%). In addition, the greenhouse should be equipped with at least the following items:
- Heating tubes: separately controlled lower tube (2/3) and top tube (1/3);
- Moveable and open (rolling) containers (ideally), or moveable rolling tables with an open bottom;
- An overhead irrigation pipe with a release capacity of 0.5-0.8 l/m²/minute;
- Screens: at least two screens, a translucent screen (85%) for energy saving (lower screen) and one with a screen percentage of about 70% (upper screen);
- Equipment to control the temperature in the cooling phase. A pad-fan system and/or an air-conditioning system can be used for this purpose. The latter is very important when outdoor temperatures often exceed 30°C during the day;
- CO2 dosing (optional): growth and flowering rates can be improved by dosing CO2 in the greenhouse during the night. A concentration of ±800 ppm is considered most efficient;
- Assimilation lighting: when the winter daylight period is 10 hours or less, we recommended equipping the greenhouse with lighting to compensate for the lack of light during this time and on dark days at other times of the year.wordt geadviseerd om de kas uit te rusten met belichting om het tekort aan licht in de winterperiode en op donkere dagen in andere dagen van het jaar te compenseren.

Planting material

Anthura supplies plants as CupGrade (laboratory material) or in plugs.

CupGrade is the new standard in the production of phalaenopsis worldwide. Today's tissue culture plants are supplied in small round plastic cups. From now on, Anthura will supply tissue culture plants in Cup-Grade: plants will be taken out, cleaned of agar, graded and packed under sterile conditions. A CupGrade container contains many more plants.

Growing plants as CupGrade requires special conditions. Plants in plugs have the advantage of a lower risk of loss in the growing phase and a reduced cultivation time of 5-6 months compared to CupGrade plants.

CupGrade
THE NEW STANDARD

- ✓ Less labour
- ✓ Less transport
- ✓ Less waste

Treatment of plants on arrival

Upon arrival, the young plants should be unpacked and acclimatized under greenhouse growing conditions.

You can put the plants in the greenhouse and cover them with a screen to give the plants more shade. This acclimatization process takes several days, both in the case of laboratory material and plugs.

Plants in plugs

Young grown material is delivered in plugs.

Because the plugs easily retain moisture, it is important for initial root establishment and growth that the first few weeks of cultivation are actually a little drier. This requires careful irrigation. Watering once a week should be sufficient during this period. It is also important to start with a lower EC: an EC value of 0.5 mS/cm for the first six weeks is recommended. After six weeks, the plants can be grown normally. In other words, with an irrigation session of ±12 l/m² once every six days with an EC of ±1.0 mS/cm. Check the EC of the drain water at every irrigation session. This should not be too high.

Growing plants in plugs yourself

Due to economic considerations or local phytosanitary requirements, you may choose to purchase plants as CupGrade and undertake the growing phase in plugs yourself. This requires a different approach and specific knowledge. The growth period from tissue culture to a product ready to be potted in a 12 cm pot is about 20-25 weeks. The plants are grown in a tray with 60 plugs. It is important to first sort the plants according to “small” and “large” sizes. In doing so, aim for 80% “large” and 20% “small” sizes. Small plants need about five weeks more than large plants.

When placing plants in plugs, it is very important to position them at the right height. This means the leaves should be above the limit of the plug and all the roots below. Finally, all plugs should be pushed to the bottom of the tray. This is the only way of ensuring the plug is enclosed to guarantee homogeneity. If the plugs are not pushed to the bottom, there will be major deficiencies in the moisture content of the plugs. During the first weeks of cultivation, the plants should be watered frequently, about once every five days with about 4-5 l/m² and after a few weeks every six to seven days with 10 l/m². It is important that the plug has dried out thoroughly before you start watering.

Cultivation plan

The cultivation of phalaenopsis consists of four phases: the first growing phase, the second growing phase, the cooling phase, and the finishing phase.

Aim for ±85% space utilization in a system with rolling containers. After potting, the plants stand against each other at a planting density of ±80-90/m² for a period of 15-20 weeks. Then the plants are spaced to a planting density of 60-70/m². The plant goes from the growing to the cooling phase when it has a total of 6-7 leaves. At this stage, the plants are spaced slightly wider to 40-50/m². Cooling can usually be done year-round, provided the cooling temperature can be achieved. A shorter cooling period results in less uniform flowering. Good flowering induction is achieved by cooling at an average temperature of 19°C-20°C for 6-8 weeks. After the cooling phase, the plants go to the finishing phase at an average temperature of 20°C-22°C. If the desired cooling temperature can always be achieved, then six weeks of cooling will suffice. If the average temperature is higher, the advice is to cool for longer, up to eight weeks.

Growing takes place in a separate section, which occupies about 50% of the total space. Cooling and finishing occupy the other 50% of the space, which is divided into a separate cooling (one sixth of the total) and finishing/flowering (two sixths of the total space). Cooling and finishing could also be accommodated together in one section but using two separate sections is preferable. Because mechanical cooling is often used, it is more economical to cool in a smaller space. A slightly higher 24-hour temperature can also be maintained in a separate finishing department, which improves flowering speed.

Cultivation in 12 cm pots

When the plants in the plugs have 2-3 good leaves (leaf span >10 cm), they can be potted. Before potting, it is important to sort the plants, in the same way as when potting small plants in plugs. Generally, we work in two grades: larger plants and smaller plants. You might choose to give the smaller plants an additional ±4 weeks of cultivation time.

When potting, it is important to ensure the plants are straight, centered and at the correct height. This means that all the roots should be inserted into the pot and all leaves should protrude above the substrate. Planting too deep has the disadvantage of making the growth point more susceptible to disease. Planting too high will result in poor anchoring, making the plant unsteady. When potting, it is also important not to squeeze the growth point too hard. This can lead to deformation in the leaf or permanent damage to the growth point.

After potting, the smaller grades are separated. This is necessary because small plants have different irrigation needs. Small plants often require an additional 6-8 weeks of cultivation time. All plants should be placed in a triangular arrangement (Ø12 cm pot with 80-90 /m², Ø9 cm pots with ±120 /m²) to achieve the right microclimate. The sooner the plants make leaf contact with each other again, the better it is for microclimate and thus growth. Timely planting out is important to avoid a poor structure with long narrow leaves. In addition, small plants overgrown by other plants do not continue to grow, resulting in less uniform batches.

Substrate

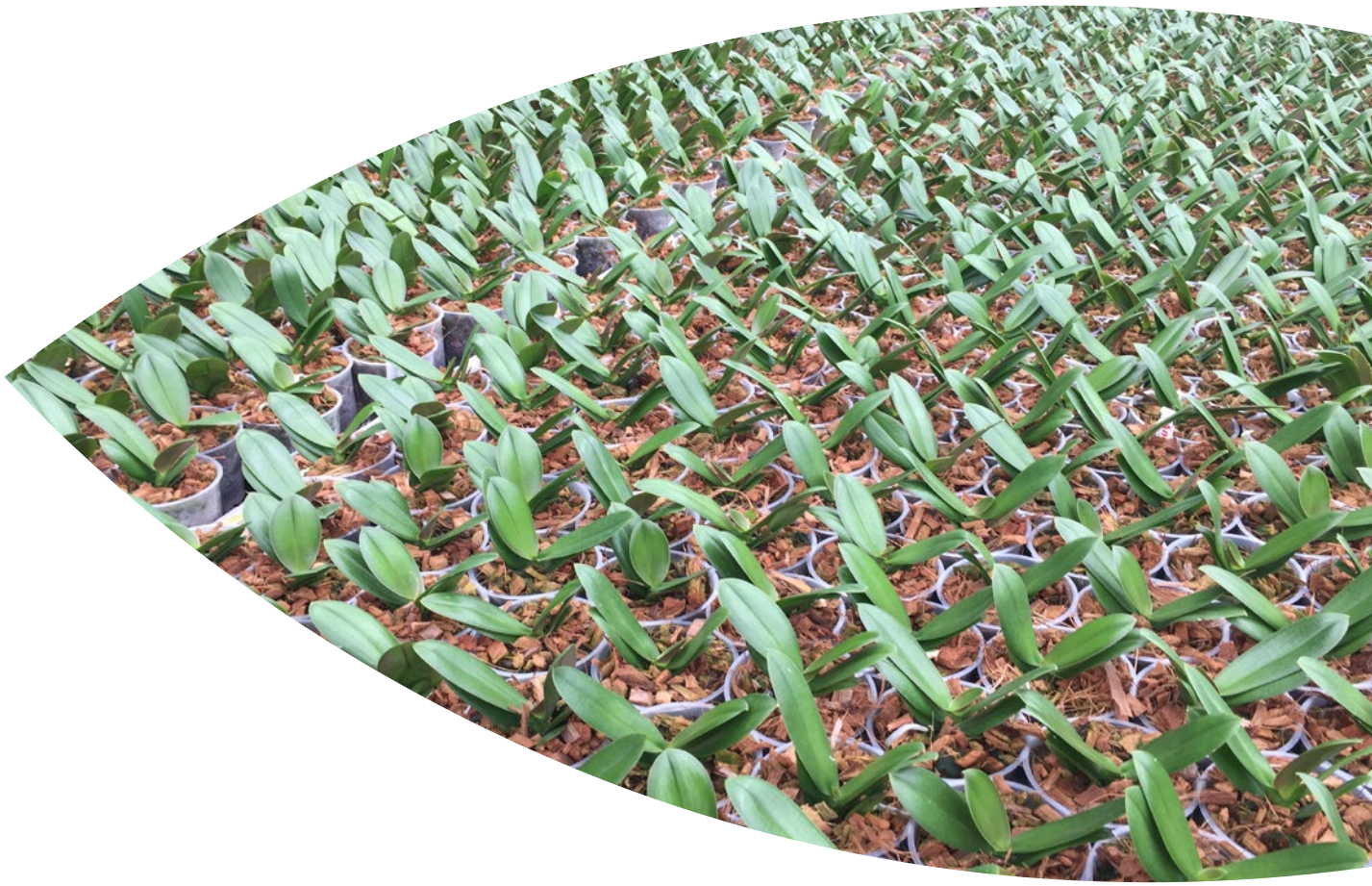
The important thing for substrate selection is to include coarse particles for drainage and fine particles (but no dust) for water and nutrient retention and distribution. The substrate should not contain too much dust as this will cause the structure at the bottom of the pot to collapse and segregate. A mixture commonly used in the Netherlands consists of bark (12-16 mm) and 2-3 kg/m3 of sphagnum. A mixture of bark and coconut pellets (in proportions of 75-25 to 50-50) is now also common.

The substrate can also consist of 100% coconut pellets. In this case, it is very important to rinse the coconut pellets well before use to remove the sodium, potassium, and chloride salts. Rinsing fills the coconut complex with calcium and magnesium.
When a base fertilizer is used with the substrate, it is important to incorporate Dolokal (< 3-4 kg/m3) and PG mix (an NPK base fertilizer). Dolokal (containing $CaCO_3$ and $MgCO_3$) keeps the pH of the substrate stable during most of the cultivation.
In the first month, make sure the top layer does not dry out too much. Large differences in pot moisture in the first few weeks are difficult to correct later in the crop.

Pots

Plants are predominantly grown in a pot size of 12 cm. In addition, the 9 cm and 6 cm pot sizes are also common.

The pots are transparent and have a cone in the middle of the bottom for better water drainage. Good water drainage keeps the EC value of the substrate stable. Within about 5-7 days, the substrate should be ready for the next irrigation session.



Water and fertilizers

Watering from above with a sprinkler system or watering boom is important. The preferred option is a sprinkler system. The water should be free of chemical and visible contamination; elements such as sodium and chlorine should be below 100 mg/l and bicarbonate should not be too high either. The EC of the starting water should be lower than 0.2 mS/cm. In the absence of sufficient rainwater, osmosis water should be used. In this case, keep a close eye on the amount of boron: any excess can cause crop damage. The watering system should be capable of delivering ±0.5 liters of water per square meter per minute. If bicarbonate (>0.5 mmol/l) is present in combination with a high pH (>6.5), the water should be acidified.

Watering is one of the most important parts of cultivation. The minimum water requirement is 10-15 l/m² per week. An average of 12-14 l/m² is administered per irrigation session at intervals of between six and eight days. The irrigation timing must be quite precise: it is important that the substrate has dried out well at the time of watering. The minimum temperature of the water should be 20°C.

In phalaenopsis, both compound and single fertilizers can be used, with a system of separate mixing tanks for the fertilizers. General advice based on the use of separate fertilizer mixing tanks is attached to this guide.
The pH of fertilized water should range between 5.2 and 6.2. The EC value of the nutrient feed is between 0.8 and 1.2 mS/cm. Be careful not to fertilize with too much nitrogen in the form of ammonium and urea; this can lead to very lush growth.

Climate

Controlling the greenhouse climate using a climate computer from Priva or Hoogendoorn is the best option.

You can also use a local system, but then the options are limited.

Temperature

Growing phase

For optimum growth, every effort should be made to maintain an average temperature of 28°C during propagation. The minimum temperature in the propagation room should be 27°C and the maximum temperature should be around 30-32°C;

Cooling phase

For good spike induction with a high multi-branch percentage, it is necessary to maintain a temperature of between 18°C and 20°C. A night temperature of 18°C or even slightly lower is preferable if daytime temperatures are above 22°C. A slightly lower temperature can be maintained at night to compensate for a high daytime temperature. There is a limit to this, however: from a temperature lower than 17°C, the risk of serious leaf damage increases dramatically, especially when the daytime temperature is below 20°C.

Finishing phase (flowering)

To speed up the flowering process and obtain beautiful large flower branches, the temperature in the finishing phase should be higher than in the cooling phase: 19-24°C. With an average temperature of 20-21°C, plant quality is at its best. The greater the temperature difference between day and night, the longer the stems will grow.

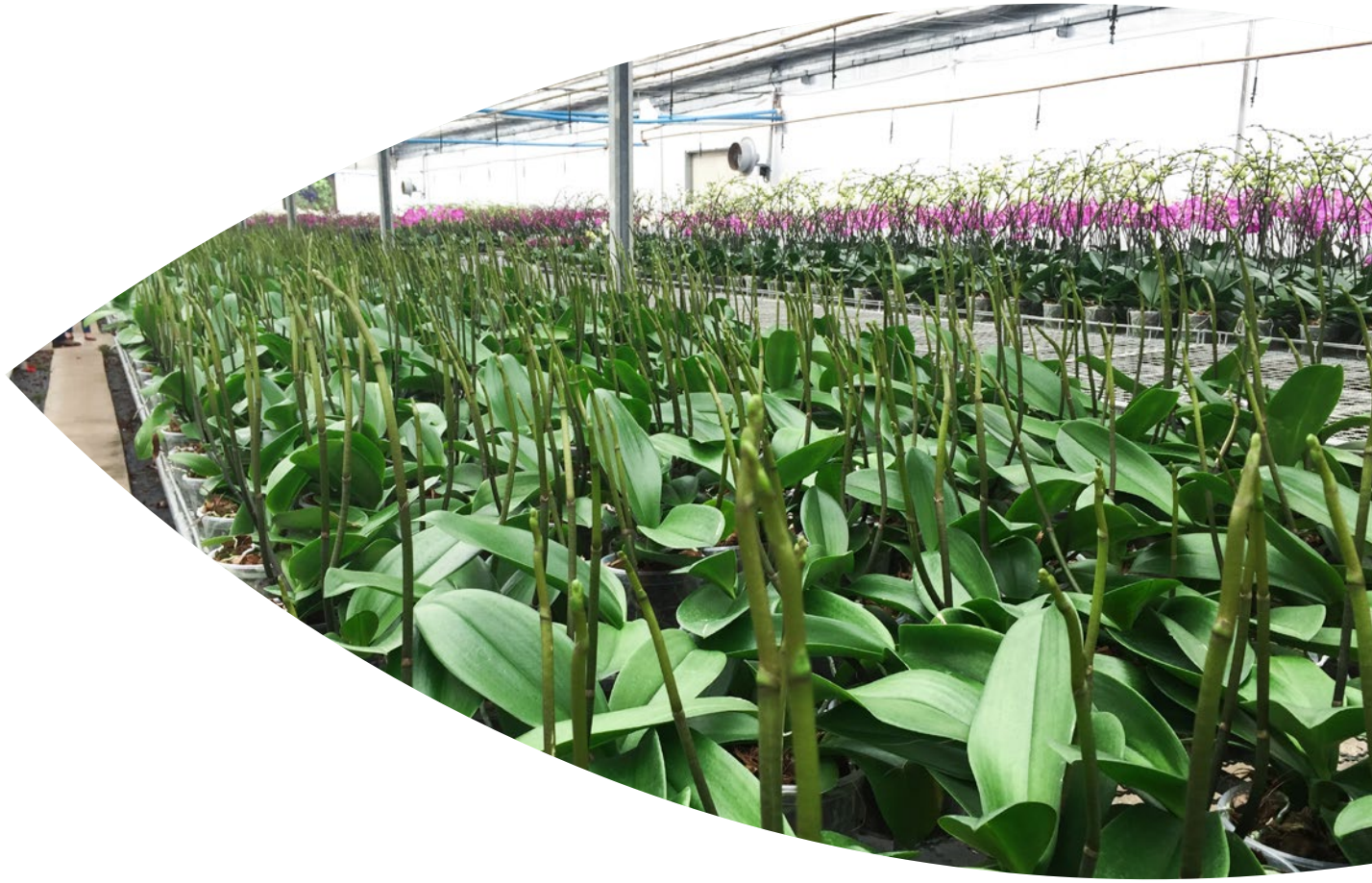
Low temperatures

Low temperatures (combined with high light intensities) required for flower branch development may result in the leaves turning slightly red. It is not a problem if this occurs during cooling. After the cooling period, the plants are in the finishing phase at somewhat milder temperatures, allowing the leaf colour to recover.

Premature flowering

Most flowering is scheduled to be induced by the cooling period. However, sometimes this also occurs spontaneously and this is called premature flowering.

When this happens with plants that are large enough, the flower stems will grow due to the lower temperatures. The critical temperature is around 26°C, with plant temperature being the most important factor. When the greenhouse temperature drops in the evening, the plant temperature is about 1°C to 2°C lower than the greenhouse temperature. It is important to take this into account. If the plants are still too small, the premature flowers should be removed. If this is done at the youngest possible stage, the flower branch is still soft and can be pinched away. If the branch is older, it will need to be cut. If the lower bud of the flower branch is not cut away, it may still shoot; these side spikes are generally of lower quality.



Light level

For proper leaf and root development, sufficient light is important during cultivation. Excessive light can cause leaf burn. Insufficient light produces an over-stretched and low-quality plant with a light flower branch and moderate rooting in the pot.

The light level recommended in the different phases:

Cultivation phase	Light (PAR-PPFD)	Light sum (PAR-mol/m²)	Light (LUX)
Tray-Nursery phase	80-100 µmol/s/m²	4,0-5,0	5.000
Growing phase 1 (week 1-15)	80-100 µmol/s/m²	4,0-5,0	5.000
Growing phase 2 (week 16-28)	100-120 µmol/s/m²	5,0-6,0	6.500
Cooling phase	130-160 µmol/s/m²	6,0-7,0	8.000
Finishing/Flowering phase	140-180 µmol/s/m²	6,5-7,5	9.000

Outer screen

At a maximum irradiance of 1000-1200 watt/m² on sunny days, a screening percentage of 70%-80% is needed to achieve the desired light level in the greenhouse. This can be achieved by using whitewash for the summer period, or an outer screen. Ideally, a movable outer screen is recommended for cultivation in tropical countries.

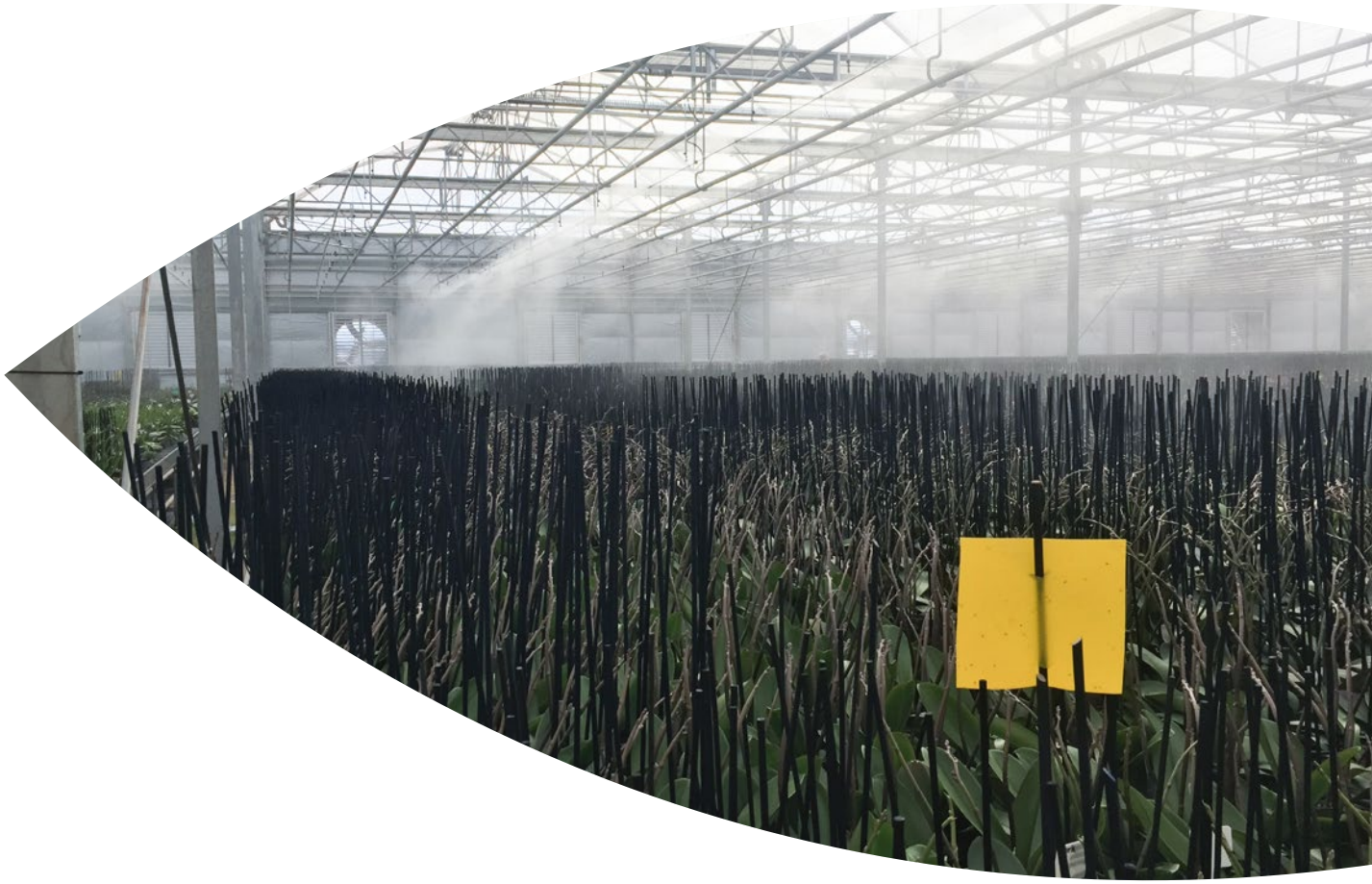
Inner screen(s)

The preferred option is to use two screens, both movable. The bottom screen is to save energy and is translucent (screen percentage is 15%-20%). The top screen requires a screen percentage of 60%-75%.

Air humidity

Although a phalaenopsis can reasonably protect itself from overly low humidity, it is better for growth when it is not excessively low for too long. However, excessive humidity combined with high temperatures again creates the risk of problems with bacterial diseases.

Humidity levels between 60% and 75% should be aimed for. If there is low humidity, especially when combined with high temperatures, it is important to install systems to increase humidity. Systems which do not cause the crop to get wet (high-pressure humidification at the top of the greenhouse, sprinkler system below the cultivation system, pad/fan systems, etc.), are preferred.



Diseases and pests

Good hygiene measures and weekly removal of any diseased plants prevents the spread of most diseases and pests. Bacterial diseases, in particular, spread through splash water and crop treatments and can barely be controlled chemically. Below is a list of the most important diseases and pests.

Bacterial diseases

- Acidovorax: Acidovorax avenae spp cattleya (formerly known as Pseudomonas): This is the most important bacterial disease in phalaenopsis cultivation. The disease can be recognized by the characteristic brown-black spots on the leaves with an oily core or dot surrounded by a yellow border. Acidovorax infection begins with a small dark pit in the leaf. By adjusting the nitrogen dose, taking hygiene measures (removing diseased plants) and ensuring constant humidity, the expansion can be somewhat contained. Appropriate hygiene measures help prevent problems caused by this bacterial disease. Most growers add a disinfectant to the water, such as hydrogen peroxide (H_2O_2), chlorine dioxide (ClO_2), copper ions (produced by electrolysis) or other additives to prevent problems with these bacteria.

- Erwinia: Erwinia chrysanthemi and Erwinia carotavora are destructive bacterial pathogens in orchid cultivation that cause soft rot by secreting cell wall-degrading enzymes. This pathogen occurs when the greenhouse climate is unstable. Large fluctuations in humidity and/or temperature can lead to problems with this bacterium. As with an Acidovorax infection, the spread of this disease can be prevented by removing diseased plants and disinfecting all neighboring plants.

Fungi

- Fusarium: This fungus has two types: F. oxisporum and F. solani. The former often causes root rot, while the latter attacks the plant more from the base of the plant: it turns black and results in yellowing of the leaves. Sometimes orange sclerotia can be found: these are the survival structures of the fungus and are difficult to control. The fungus is a parasite that takes advantage of the plant's weakness. An infestation with this fungus is secondary in most cases. It occurs most often in the cooling phase, when plants are stressed. In this regard, a warm and humid environment will lead to an increase and spread of this fungus.

- Rhizoctonia: this fungus can be recognized by the brown web structure around the substrate. Sometimes a brown discolouration of the base and lower leaves of the plants can be seen. Large fluctuations in the moisture content of the irrigation water, poor evaporation due to excessive RH and high EC levels can weaken roots and render them inactive. When this happens, Rhizoctonia has a chance to attack the roots of phalaenopsis. If this fungus has developed parasitically, control is difficult. Since Rhizoctonia is, in most cases, the result of a cultivation problem, it is fairly easy to prevent. Allow the substrate to dry out for 5-7 days and keep the EC of the drain water below 1.3 mS/cm.

- Botrytis: with gray mold (Botrytis), many small brown spots appear on the flowers, which are the result of keeping the flowers wet for too long or excessive humidity. Keep humidity below 80%. It is important that the flowers are dry five hours after watering.

Viral diseases

In phalaenopsis, poor growth due to viruses can sometimes be observed, with symptoms such as smaller flowers and slower development, but there are also species that hardly suffer. Viruses often manifest in or after the cooling phase because the plants have been slightly stressed during this growing period. Loss due to virus can also occur in poorly growing batches. Viruses can sometimes be tolerated in phalaenopsis, as they are not very contagious provided that no flowers are cut. If the infestation is severe, removing the affected plants is the only control. The same applies here: buy healthy planting material.

Pests

Several organisms are found in phalaenopsis that can cause damage to the crop to a greater or lesser extent:

- Lyprauta (pot worm): the larvae of the Lyprauta mosquito feed on root tips, which can cause major problems in cultivation. Underground development comes to a halt and also leads to growth retardation above ground. In addition, damaged root tips also provide entry points for fungi such as Fusarium. Lyprauta develop quite rapidly in humid environments. Therefore, it is important to pursue a drier climate and only proceed with another irrigation session when the substrate has dried properly.

- Mites: there are two types of mites that cause problems in phalaenopsis cultivation:
  - Bark mite/moss mite: a small, round, dark brown, almost black mite present on the base of plants and root tips. If they occur in large numbers, all the roots can be affected, causing severely corked root tips. Young leaves can also be damaged, as can flowers. The mite can be controlled by a pesticide such as Abamectin (see control of Brevipalpus)..
  - Tenuipalpus pacificus (red false spider mite): this mite causes slight distortion and silvery discolouration of the leaves. The mite is more localized and can only be controlled by pesticides such as Vertimec (e.g. Abamectin 18 g/l), 50-75 cc per 100 liters of water;

- Thrips (Chaetanaphotrips orchidii and Dichromotrips corbetti): thrips can cause damage to young leaves and flowers. Western flower thrips are responsible for transmitting viruses;

- Soft scale and mealybug: these mites are usually found on the underside of leaves. During flowering, they are also visible on the branches and in the flowers. Control is difficult: the best solution is to remove the affected plants;

- Slugs: slugs cause round feeding holes in young plant parts. Within a few days, many plants may have been eaten. The root tips can also be eaten by small slugs, causing damage. With slug pellets on the pots and subfloor, slugs are easy to control;

- Fungus gnats (Sciara): sciara larvae feed on root tips in large numbers. Larvae of the fungus gnat are found in large numbers, especially at the start of a batch. Preventive release of the soil predatory mite Hypoaspis (100-150/m^2) is often sufficient.

Deviations due to poor climatic conditions

Bud fall

In the finishing phase, bud fall can occur if the temperature is too high in relation to a light intensity that is too low. Bud fall is also possible if root or plant quality is poor or delivered too raw. Another cause is a dry greenhouse climate.

Cooling or transport stains

When plants are moved from the growing to the flowering department, sunken spots may appear on the leaves, caused by the death of some or all of the cells. These cooling or transport stains sometimes occur as a result of stress and light excess after plants have been moved.

Phytotoxicity

Beware of phytotoxicity; not all chemical agents can be applied in phalaenopsis without causing harm. For the optimum control measures, contact Anthura's team or Delphy consultancy. Before a new pesticide is applied, it should be tested on a few plants before extensive use. When assessing treatment efficacy, take into account the slow response of the crop.

Sale

The flower branches of phalaenopsis are staked to provide support. Staking takes place when the lower bud on the branch begins to swell (to marble size); then the branch length is determined. At that point, it is also easy to estimate how many flowers the branch will produce. The stake should not protrude above the flower branch and should be inserted right next to the plant for sufficient strength.

Many grades can be used in phalaenopsis. In addition to colour, they are sorted by branch length, number of buds, branching and number of branches per plant. The number of branches per plant is most important, followed by branching and the number of flowers per branch. In general, the more branches and buds, the better the pricing.

The plants are ready for sales when the flowers are sufficiently developed. In the dark time of year, the trade wants 4-5 flowers per branch open upon delivery; fewer open flowers are needed in other periods. During preparation, damaged leaves are removed and plants are sleeved if required. During transport, it is important that the temperature does not drop below 18°C.

Conclusion

We hope you have gained an understanding of phalaenopsis pot plant cultivation after reading this brief cultivation guide. This specialist cultivation is simple to perform, provided that certain conditions are met. If you meet these conditions, the result is a beautiful, highly durable plant that deserves a good place in the market.

If you have further questions or if there are issues that are not clear, please feel free to contact us.

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