Cymbidium cut flower

large- and small-flowered

Production procedures

Substrate

Cymbidium cut flower production commonly uses synthetic substrates such as rockwool or mineral wool in flakes, pellets or sometimes mats. In addition, mixes of rockwool and polyphenol foam can be used. It is possible to use just polyphenol foam, provided that spray tubes are used and the pH is monitored closely. Perlite or lava lumps are used as well just like natural substrates such as bark and/or coir mixtures. The disadvantage is that the material decomposes after a number of years and then becomes too humid and uncontrollable. An airy substrate is vital to Cymbidium. The pot must not be placed on dense or sealed surfaces such as gutters, ebb-and-flow benches or concrete floors. This will inevitably cause plant losses.

First vegetative phase

- Vegetative phase plantlets delivered in flasks
  We supply Cymbidium plantlets in flasks direct from the laboratory. These plantlets can directly be deflasked into small pots or plugs filled with sphagnum. Use overhead or manual watering for irrigation. After 6-8 months, the plants will usually be large enough with a leaf length of 10-15 cm to be planted in a 14-15 cm (2 litre) pot. The optimum temperature is 18-22°C (Night/Day).
- Vegetative phase plantlets delivered in plugs
  Plantlets delivered in plugs (plug trays) with a leaf length of 10-15 cm are transplanted to 14-15 cm (2-litre) pots with one drip tube in every pot. One net m^2 can then accommodate approx. 48 plants for the next 6-8 months. It is important to use a well-drained substrate such as one that consists of an organic mixture of peat, bark, pieces of coconut shell or coir, but pure rockwool is excellent as well.

Second vegetative phase:

The plants remain in the 14-15 cm pot for no more than a year. As a rule, early-flowering varieties are supplied earlier than mid- or late-flowering varieties and, in addition, the plants develop in such a manner that early-flowering varieties grow more rapidly and have to be transplanted sooner than mid- and late-flowering varieties.
Early-flowering varieties that have been in 14-15 cm pots for 12-14 months must be transplanted in winter, from December but no later than mid-February, into a 5-litre pot The mid- and late-flowering varieties follow in the course of time, while late-flowering varieties can still be transplanted in April or May.
In order to get them in the right rhythm, the plants can already be placed in the section where they will flower later, but they can also be grown in a separate section to produce a larger plant quickly. After 2 years they are transplanted from the 5-litre to a 7- or 10-litre pot. After another two years to a 10- or 12-litre pot respectively. For mid-flowering and certainly late-flowering varieties subsequently transplanting to 15- or even 20-litre pots is also possible.

Temperature

The target temperature depends on the growth stage of the plants or the growing areas and the season. During the vegetative phase, plan to maintain at night 18°C and 20-25°C in the day with an average daily temperature of 20°C. During the winter period (late October to late January) maintain at night 16-18°C and a day temperature of 18-20°C.
In the production sections temperature distinctions must be made as to flowering period. For flowering it is recommended to achieve a period of at least 10-12 weeks with an average daily temperature of 13°C (11°C Night-14°C Day).

Spike initiation stage

A temperature of 10-13°C prior to the vegetative stage is ideal for spike initiation. This period should be of at least 3 months. The response to the low average daily temperature differs for every variety. Some varieties prefer 13°C and others prefer 10°C. In the early flowering range this becomes evident AFTER flowering, in the late range on the contrary, BEFORE flowering!

Vegetative stage

The following climate conditions are important during the vegetative growth.
1. Light
2. Temperature
3. Nutrients

To 1: For shoot production as much light as possible should be admitted, but it must remain below the values listed earlier. At higher light intensities the plant temperature will be higher than the greenhouse temperature.
To 2: For vegetative growth, a daily average of 20-22°C appears to be the optimum value.
To 3: For an additional stimulus extra nitrogen in the form of urea and/or ammonium nitrogen can be applied. This period lasts from 13 weeks for large-flowered to 10 weeks for small-flowered Cymbidiums.

Spike elongation stage

For the first stage of spike elongation the average plant temperature must remain higher than 18°C and lower than 21°C. Light values must be limited, because they increase the plant temperature. Usually this requires whitewashing or screening. Excessive evaporation results in loss of spikes and bud abortion. The daily average temperature can be lowered to 11°C to delay spike elongation. Some varieties cannot cope with temperatures as low as this or even lower temperatures. Spike elongation for large-flowered varieties is roughly 4 weeks longer than for small-flowered ones. In addition, the temperature during the elongation phase determines how long this takes.

Light

Vegetative phase

During the vegetative phase, plantlets require exposure to 20,000 to 30,000 lux (300-500 μmol/m^2/sec) on the plants for optimal growth. During the winter months (and also for day length extension), providing plants with supplemental growth lighting of 3,500-4,000 lux (40-50 μmol/m^2/sec) during this growth stage is recommended. As soon as the plants become larger so that fewer of them occupy each m^2, the economic benefits of providing lighting for growth decrease. The maximum day length for Cymbidium is 16 hours.
The maximum light intensity for Cymbidium, depending on temperature and humidity, is between 35,000 and 50,000 lux (630 and 900 μmol/m^2/sec) at the plant, dependent on temperature and RH. We recommend to keep the plant temperature below 27°C and the VPD lower than 1.25 kPa (ca. 65% RH).

Production phase

The target should be at least 35,000 lux. If the light intensity exceeds 50,000 lux (900 μmol/m^2/sec), it will have to be reduced by a light whitewashing or shading. Here too, we recommend to keep the plant temperature below 27°C and the VPD lower than 1.25 kPa (ca. 65% RH).

RH

Providing the proper RH level ranging from 50 to 80% is important for good growth and flowering. At low temperatures (below 20°C) the RH (relative humidity) must be lower than 80%. At higher temperatures (above 20°C) the RH must be above 65%. If it is not, the plant transpiration will be inhibited and growth may stop.
Maintaining the recommended levels 24 hours a day is not necessary. Temporarily higher RH values than 80% are acceptable and will not result in problems provided that measures are taken for sufficient dehumidification.
Keeping the heating line the same or almost the same as the ventilation line will ensure a sufficiently active climate, certainly when the plants have spikes.
Cymbidium has a fair resistance to a lower RH. At values below 60% , shading and possibly air humidification can be used. As long as the Cymbidium leaves that directly catch light have a lower temperature than approx. 27°C, the plant will keep taking up and evaporating water.
These days more and more growers use HD (= Humidity Deficit), for which the target value is 3.0-9.0 grams/m^3. If the proper temperature can be measured as well, using the VPD (Vapour Pressure Deficit) is recommended. The target values are 0.4-1.25 kPa.

Water

Water is one of the most important factors in production. Only rainwater or reverse osmosis water is suitable. Any other kind of water will inevitably result in cultivation problems. Provide enough water storage capacity. Allow for a water requirement, including drainage from the plant, of up to 4 litres of water/m^2/day on a hot day. It is important to check for sufficient drainage. It is recommended certainly in spring and summer to observe 20% up to 30% drainage.
Particularly in winter, the water must be warm enough. The minimum desirable temperature is 12°C. Lower irrigation water temperatures may cause various growth problems such as wilting infloresences or flower spotting. Ensure a minimum evaporation of 0.3-0.4 litres/m^2/day during the colder period. Then the plants will still be active. Higher temperatures are no problem as long as the water is kept below 25°C. Much highly useful information on the plant activity can be obtained by daily measuring the drain figures. A suspended weighing scale is another excellent tool.

Fertilisation

The composition of fertilisers depends on the season and the growth stage of the plants. For Cymbidium production, it is very important to provide a complete fertilisation programme that includes all the necessary elements throughout production and to monitor EC, pH and drainage percentages every week. Simple, compound and liquid fertilisers can be used.
For the vegetative phase (with the exception of the winter period) a combination of calcium nitrate, 20-20-20, supplemented with magnesium sulphate in the ratio 3:6:1 is recommended. This is an excellent mix that can be applied with a 2-tank system. For the 2-tank system this means: 30 kg calcium nitrate in tank A and 60 kg 20-20-20 + 10 kg magnesium sulphate in tank B. The EC values are 0.3-0.8. The EC application depends on the growth phase and the temperature. A higher EC is recommended for vegetative growth. The temperatures are higher as well during the vegetative phase. If the temperature is lowered, the EC must also be lower because the plant cannot absorb a higher EC. For a vegetative phase during the winter, the

schedule for flowering can be followed. For the flowering phase, the combination is: Calcium nitrate, 7-11-27 and magnesium sulphate in a ratio of 3:6:1. The EC values are 0.3-0.8. During the period mid-late September the EC must be lowered to ensure that it is not too high in October and, in addition, that not too much nutrients have been absorbed in the substrate that will still have an influence in November. When using compound fertiliser, it is recommended to include 7-11-27 + calcium nitrate in a ratio 2:1. To stimulate growth, temporarily half the 7-11-27 can be replaced by 20-20-20.

Flowering schedule

The table below shows for each desired flowering period the temperature and time periods to be observed. The lower the temperature during the various phases, the longer the period in question will be!

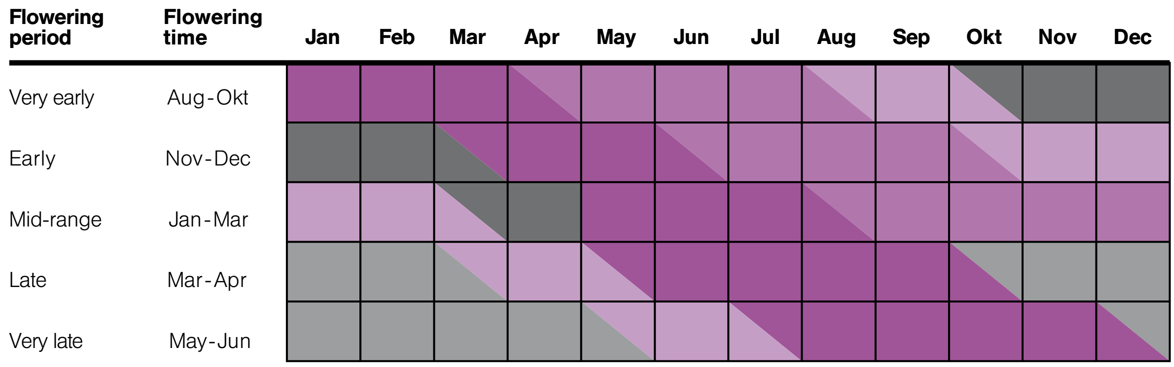
Temperature and time periods per phase and flowering time

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

* the lower the temperature during the various phases, the longer the period in question will be.

The table below shows in what period of the year the required temperature is necessary and when flowering is possible as a result.

Growth and flowering times per month



Diseases and pests

With sound cultivation and sufficient control of the most significant attackers, use of chemical control agents will rather be exception than rule. The main diseases and pests are the following.

- Red spider mite.
  Red spider mite occurs particularly in spring and summer and can be difficult to control.
- Thrips.
  Mainly Californian Thrips may occur.
- Snails/slugs.
  Snails and slugs feed on root tips and flowers in autumn and winter.
- Aphids.
  Aphids may be found very rarely and depend on variety.
- Coccoidae.
  If Coccoidae are found in a single plant, chemical control is required.

- Mice.
  Mice may cause damage during flowering. They feed on anther caps. Biological control using cats.
- Shoot rot
  Shoot rot occurs after watering with fertiliser from the top and excessively dry cultivation.
- Root rot.
  Root rot is usually caused in autumn and winter by too much moisture, too much salt, too low a pH, or cultivation in gutters or on ebb-and-flow systems.
- Duponchelia.
  Duponchelia is a moth that can feed on the in the leaves and even flower buds.
- Botrytis.
  Botrytis may occur in autumn and winter at high RH in still air and low temperatures around the flower stems and plants.
- Sooty mould.
  Sooty mould grows on the honeydew of the flower stems under humid conditions. Prevent fungal growth by ensuring that the flower temperature remains lower than the greenhouse temperature.

It would be best to consult an expert with regard to which chemical control agents to use and what the application dosages are and we recommend to carefully read the labels.

Greenhouse systems

Sections
For climate division in a modern nursery with year-round flowering, at least six separate sections are required. All sections must be suitable for vegetative phase, cooling and spike initiation, so they must be multifunctional.

Benches
Production takes place in beds where the plants are placed in or on open-bottomed racks. That may also be gutters, but then the pots must be placed on racks on the gutters to prevent contact with drainage water. Cymbidium pot plants cannot be grown on ebb-and-flow systems or other watertight benching. That will always cause losses due to Fusarium, Phytophthora and Pythium. In addition, viruses may also spread easily through the water.

Heating

Phase	Daily average	Limits
During the vegetative phase	20°C	18°C Night-22°C Day
In cooling	13°C	10°C Night-14°C Day
In spike initiation	10-19°C	

It must be possible to achieve these minimum temperatures both day and night, regardless of outdoor temperatures. A correct schedule requires that degree days are computed, while the weekly average values are important. For savings and better control, height-adjustable heating with 1 thin pipe per bed may be useful because the heat will directly reach the plants and the spikes. This is also an excellent way to prevent sooty mould or Botrytis on (especially white) flowers.

Water storage
Provide enough water storage capacity. Only rainwater or reverse osmosis water is suitable. Reverse osmosis water must in all cases be aerated thoroughly because of the methane in the groundwater. In addition, a marble filter may be required to neutralise the low pH of this water. On an annual basis, dependent on temperature and light, a maximum of 450 l/m² may be required.

Counterflow system
A counterflow system or small heated indoor intermediate tank is required. The water temperature in winter must not become lower than 12°C and during the rest of the year not lower than 15°C.

Shading system
A shading system provides more control over light intensity during the summer period. Its effect on production during the summer exceeds its energy savings during the winter; 50% shade is sufficient.

CO_2 system
A CO_2 system provides growth advantages throughout production. Maximum daytime values are between 600 and 1,000 ppm.

Application must also be continued when the vents are open. When hoses or tubes underneath the plants are used to supply the CO_2, it will always flow along the plants. For Cymbidium, application during the day is required.

Drip irrigation system

A drip irrigation system is required for production of cut Cymbidium. During the first stage of the vegetative phase (potted in a 14-15 cm pot), one drip tube per pot is required. In the course of time plants grow bigger and they are spaced out. Then more drip tubes can and must be placed in the pots. In the maximum end position of 1 plant per m^2 (after 5 to 6 years) there may be as many as 6 drip tubes in every pot.
Overhead watering is useful to occasionally water from the top during the season.

Air humidification

High-pressure air humidification in spring may enhance growth. During production, in spring and summer, the RH is often too low during the day. At too low RH, particularly insufficient light, there is a negative influence on assimilation. In addition, air humidification makes it possible to lower the greenhouse temperature which will limit problems such as bud drop and black anther caps. When using air humidification, it is necessary to keep the vapour pressure deficit higher than 0.4 kPa. The plants must not get wet.
Roof sprayers outside the greenhouse also influence the climate in the greenhouse. However, it is easier to influence the climate inside the greenhouse with a misting system inside.
An outdoor screen also has a positive effect on temperature and RH in the greenhouse and accentuates the cooling possible with a misting system.

Growth lighting

Growth lighting is mostly only necessary during the vegetative phase with plantlets from flasks or plugs during the winter months; 3,500 to 4,000 lux suffices.

Production

A modern cut flower nursery for Cymbidium has several sections. For year-round flowering, 7 sections would suffice of which one for the vegetative phase and 6 sections each for flowering 2 months a year.
That means in every section temperature and light must be controlled separately, dependent on the phase.
We think that in the long run, further refinement of the flowering schedule should make it possible to reduce flowering to 6 weeks per section. In that case still more sections would be required.
In such a system, production would take place throughout the year and, consequently, the workload would remain roughly the same throughout the year. Each section would follow its own cultivation schedule and only a few labour peaks would remain.
At such a nursery the average production per m^2 per year for large-flowered Cymbidium would be 10-11 spikes and for small-flowered Cymbidium 20-24 spikes/m^2/year.
The labour requirement is approx. 800-900 hour per 1,000 m^2 (approx. 4-5 people per ha/year).

(The above cultivation description for Cymbidium as cut flower is mainly based on circumstances and experience in The Netherlands/Northern Hemisphere).