Floricultura
ORCHIDACEAE & ARACEAE

Cultivation manual

Cymbidium pot plants

Cultivation

General

This manual is based on cultivation and climate circumstances on the Northern hemisphere and the Netherlands in particular.

Substrate

In Cymbidium pot plant production, natural substrates such as bark and/or coir mixtures are usually used. An airy substrate is vital to Cymbidium. The pot must not be placed on dense or closed 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.
  Cymbidium plants come in flasks (tissue culture flasks) straight from the laboratory. Plants can directly be deflasked into small pots or plugs. Use overhead 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 supplied in plugs with a leaf length of 10-15 cm.
  Plants with a leaf length of 10-15 cm are planted in 14-15 cm (2-litre) pots with one drip tube in every pot. The plants are placed at about 48 per net m^2 and after six months to 24 to 30 plants per net m^2. One may choose to use a 16-17 cm pot in warm and Mediterranean regions.

Second vegetative phase

If the plants have reached such a size that they can be flowered within the next year, the plants should be spaced out to 12-14 per m^2 as follows according to the varieties (with 2 drip tubes):

- Early-flowering (summer/autumn-flowering) varieties should be spaced out to their final positions during January and/or February.
- Mid-flowering (winter-flowering) varieties should be spaced out to their final positions in March/early April.
- Mid-flowering/late-flowering (spring-flowering) varieties should be spaced out to their final positions in April/May.

The schedule for moving plants to the proper section for growth/spike initiation/flowering phase according to variety is as follows:

Cultivation phase	Vegetative 20°C	Spike inititation 13°C	Vegetative 20°C	Flowering phase (°C)
		from-to	*from-to*	*from-to*
Early	to Oct	Nov-Jan	Feb-May	June-flowering (18°C)
Mid-flowering	to Oct	Nov-Feb	Mar-Aug	Sep-flowering (15°C)
Late-flowering	to Oct	Nov-Mar	Apr-Oct	Nov-flowering (13°C)

Temperatures

The target temperatures depend on the growth stage of the plants and the season. During the vegetative phase 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) at night 16-18°C and a day temperature of 18-20°C.

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Once the plants have reached the size where they can be expected to start flowering within the coming season, they should be subjected to different temperatures according to their 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).

Light

Light plays an important role in Cymbidium production. The maximum day length for Cymbidium is 16 hours. We advise against longer day lengths with supplemental lighting.

Vegetative phase

During the vegetative phase, plantlets require exposure to 20,000 to 30,000 lux (300-500 µmol/m^2/sec) at the plant for proper growth. During the winter months (and also for day length extension), providing them 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 growth lighting decrease. 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) on the plants, 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).

Bud initiation phase

Light is important for the initiation of flower buds. The target should be at least 30,000 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.

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 evaporation will be inhibited and growth may stop.

Maintaining the recommended levels 24 hours a day is not necessary. Temporarily higher 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.

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. Ensure sufficient water storage capacity. Allow for a water requirement, including drainage from the plants, of up to 4 litres of water/m^2/day on a hot day. Do make sure that there is sufficient drainage, certainly in spring and summer, that is 20 up to 30% drainage.

Particularly in winter, the water must be warm enough. The minimum temperature is 12°C. Lower irrigation water temperatures may cause various growth problems such as wilting spikes or flower spoting. Ensure a minimum evaporation of 0.3-0.4 litres/ m^2/day during the colder period. Then the plants are still active. Higher temperatures are no problem as long as they are kept below 25°C. Very much highly-useful information on plant activity can be obtained by daily measuring of the drainage figures. A hanging scales for pot weight confirmation 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 (except during the winter period), a combination of calcium nitrate, 20-20-20 (Plantprod) supplement- ed with magnesium sulphate in a ratio of 3:6:1 would be a fine combination that could be applied with a 2-tank system. For a 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 will be between 0.3 and 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 then absorb a higher EC. For a vegetative phase during the winter, the schedule for spike initiation 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 will be between 0.3 and 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 nutrient has been absorbed in the substrate that will still have an influence in November.

Fertalisation schedule

Vegetative high in N for shoot division 20-20-20 + calcium nitrate + magnesium sulphate = 6:3:1 tanks A and B + urea	0,5-0,75 EC	all year until winter
Generative low in N for bud initiation 7-11-27 + calcium nitrate = 2:1 tanks A and B without additional N	0,3-0,5 EC	1-2 months depending on colour of leaves, flowering time April- September
Elongation-flowering high in K for firmness 7-11-27 + calcium nitrate = 2:1	0,65-0,8 EC	dependent on flowering July-October
Winter low fertiliser for maintaining good roots, little N 7-11-27 + calcium nitrate = 2:1	0,25-0,5 EC	increase again from mid-February

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 too dry cultivation.
- Root rot
  Root rot is usually caused in autumn and winter by too much moisture, too much salt, too low pH, or cultivation in gutters or on flood- and-drain systems.
- Duponchelia
  Duponchelia is a moth that can feed on the centre leaves and even flower spike buds.
- Botrytis
  Botrytis may occur in autumn and winter at high RH in still air and low temperatures at the flower stems and plants.
- Sooty mould
  Sooty mould grows on the honeydew of the flower ovaries 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 dos- ages are and we recommend to carefully read the labels.

Greenhouse systems

Sections

For climate division, four different sections are recommended, while all sections must be suitable for vegetative phase, cooling and spike initiation, so they are multifunctional. More sections make flowering planning more flexible.

Benches or mobile containers

Production takes place on benches or mobile containers with an open mesh bottom. Cymbidium pot plants cannot be grown on ebb-and-flow systems or other closed benches. That will always cause losses due to Phytophthora and Pythium.

Heating

Phase	*Daily average*	*limits*
Vegatative phase	20°C	18°C night - 22°C day
Cooling	13°C	10°C night - 14°C day
Spike initiation	from 10 to 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. Flowering must be followed by a cold period of about 3-4 months with an average daily temperature of approx. 13°C. The number of degree days for that cold period should be approximately 1,450.

After the cold period approx. 4,500 degree days to flowering must be realised. At a daily average of 20°C, that is about 32-34 weeks to full flowering. Daily averages above 21°C must be prevented. These values are guidelines. Moreover, there will be differences per variety. Variety-specific information is not available.

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 neu- tralise the low pH of this water.

Counterflow system

A counterflow system or small heated indoor intermediate tank is required. The water temperature in winter should not be 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 sum- mer exceeds its energy savings during the winter. A shading percentage of 30-40% shade suffices.

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 pot Cymbidium. During the first stage of the vegetative phase (potted in a 14-15 cm pot), one drip tube per pot is required. During the final stage of the vegetative phase and during spike initiation, two drip tubes per pot are required.

Overhead watering is required if the vegetative phase begins with deflasking. Use of drip tubes can be started once the plantlets have been transplanted into 14-15 cm pots. Then overhead watering is not strictly required. If artificial lighting is available during the first vegetative phase, the substrate in which the plants are placed in the 14–15 cm pot, can be provided with slow-release, high-N fertiliser. The plants then receive only clean water from the top with the aid of an overhead watering system. In that case drip tubes are not necessary in the first stage, which saves labour. That does require the use of lighting, certainly after watering to get the plants dry in time.

The active period of the fertiliser has to be attuned to the moment the plants are spaced out. Usually that is after no more than 4 to 5 months. The fertiliser must no longer be active when the plants are spaced out and fitted with drip tube. The combination of lamps (= light), temperature and high-N fertiliser ensures good growth during the winter period.

Air humidification

High-pressure air humidification in spring may enhance growth. In many cases the RH in the greenhouse is too low during production, which has a negative influence on assimilation. In addition, air humidification makes it possible to lower the green- house 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 stay wet.

Production

Yields in a modern facility using 85% of its space (as realised by mobile containers or mobile benches) will be 6 to 7 plants/m^2 of greenhouse space/year. Factors in the yield will be variety, cultivation and loss percentage. When using fixed benches, yield drops to 4.5 to 5.5 plants/m^2/year. The average loss percentage is 3-5%. The labour requirement is around 900 hours/1000 m^2/year. Early-flowering varieties will flower fairly easily within 2 years; late varieties will take somewhat longer.