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## *Cultivating Pot Chrysanthemums*

### **Pot size**

4 standard pot sizes are used:

- 9 cm with one cutting
- 12 cm with three cuttings
- 14 cm with 5 cuttings
- 23 cm with 7 cuttings

The number of pots per m<sup>2</sup> naturally depends on the size of the pot. Generally speaking it works out as follows:

- |              |                                 |
|--------------|---------------------------------|
| • 9 cm pot   | 50-55 plants per m <sup>2</sup> |
| • 12 cm pot  | 23-25 plants per m <sup>2</sup> |
| • 14 cm pot  | 15-17 plants per m <sup>2</sup> |
| • 23 cm bowl | 9-10 plants per m <sup>2</sup>  |

### **Potting compost**

The most commonly used potting compost for pot chrysanthemums is the 40/60 'fine' mixture. This is made from 40% garden peat and 60% sphagnum moss peat. This potting compost mixture is finely sieved to remove the long fibres.

A small percentage of perlite or cocos is now used regularly. This increases air retention capabilities and accelerates rooting. Be careful that you don't have too high a percentage in the potting compost, especially when using cocos. This medium has a noticeable influence on the intake of nutrients and the bonding of certain elements.

The potting compost that is used always needs basic fertiliser. To achieve a good pH one would need 5 to 7 kg Dolomite per m<sup>3</sup>. As well as this, a basic addition of trace elements is desirable in the form of 0.5 to 1 kg PG mix.

A number of growers also use a stock fertiliser of 400 – 700 gr calcium saltpetre per m<sup>3</sup> of potting compost.

### **Cuttings and rooting**

With pot chrysanthemums the cuttings are set in their final pot immediately. The cuttings are immediately powdered with rooting hormone at the production location, which results in faster, better rooting.

The potting compost is generally wet once prior to setting. Giving water from below is preferred because this maintains the airiness of the potting compost. Depending on the season and the cultivars, one should spray with a solution of 1 to 2 gr of Alar per l of water, prior to applying the rooting plastic to the plants. Sometimes an agent that will combat Botrytis is also added now.

It is certainly necessary during the warmer seasons to cover the cuttings with rooting plastic as quickly as possible. The plastic must be big enough to seal the sides well also. This is the only way to achieve even rooting.

During the winter and early spring using transparent plastic will be sufficient but quite quickly during the course of the year this will have to be replaced with milk-white plastic and a screen will have to be pulled shut over the rooting or, if



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this is not available, one would have to whitewash the greenhouse. Direct sunlight on the rooting plastic is fatal for pot chrysanthemums.

After 7 to 12 days (depending on the cultivar and season) the root development will have to be checked and if this is established the plastic can be removed. It is best to do this as evening approaches so that the plant has the chance to acclimatise.

### **Topping**

The pot chrysanthemums can be topped approximately 13 to 18 days after setting. This depends on the season. When topping at least 5 or 6 leaves must be left on the plant. Topping should be done very evenly in order to produce the most even end result that is possible. After topping the plants can stand against each other for a maximum of one to one and a half weeks. After this they should be set out at their final distance so as not to hinder the plants development.

There are now a number of companies that top automatically by using a mowing bar. This system works well but requires a number of adjustments to the cultivation conditions.

It is recommended that trials should be carried out at your own company before going over to automatic topping.

### **Fertilising and watering**

Fertilising and watering are two processes that are dependant on factors such as plant development, season, potting compost, growth and climate.

When water is given, nitrogen is normally added and during cultivation extra fertiliser will always be needed. Depending on the plants' stage of development and growth at that moment, one should generally give water with an EC of 1.5 to 2.

Generally speaking a lot of nitrogen is given during the first weeks of cultivation to enhance the development and growth of the shoots. Potassium, magnesium, phosphate and iron are also often mixed in at the same time. During the course of cultivation the emphasis switches more to potassium and magnesium although phosphorus, nitrogen and iron mustn't be forgotten. Depending on the type of water that is used, trace elements will have to be added occasionally. It is difficult to influence the plants' growth and straightness on the basis of the EC that is used.

As the EC in the pot increases the plant will find it more difficult to straighten and generally speaking it will become darker.

Below is a table giving target values

EC	pH	NH4	K	NA	CA	Mg	NO3	Cl
1.0	5.8	0.1	3.8	<1.0	2.1	0.9	6.0	<1.0

SO4	HCO3	P	Fe	Mn	Zn	B	Cu
1.0	0.5	0.50	8.0	2.0	2.0	15	0.7

## **Growth regulators**

Spraying with growth regulators is one of the most important processes in the cultivation of chrysanthemums. This determines the form and length of the plant and in this way its quality.

Spraying with growth regulators depends on a lot of different factors which include:

- cultivar
- greenhouse climate
- season
- EC in the pot
- Pot size
- Cultivation method (wet or dry)

Alar degrades quite quickly under the influence of light and temperature. Because of this it is important not to dissolve the spray powder in hot water but to use no more than lukewarm water. Further, it is recommended to spray as evening approaches, shortly before the blacking out sheet is pulled shut so as to ensure that the light has little or no degrading influence on the Alar.

Given the importance of spraying with Alar and the precision that has to be used, Royal Van Zanten has measuring sticks available for putting next to the pot chrysanthemums as an extra aid in regulating growth.

## **Climate**

One should maintain a daytime temperature of approximately 19.5 to 20.5 °C and a night-time temperature that is 0.5 to 1.5 °C higher than this.

Depending on the season and the conditions outside, temperature variations, draught gaps, minimum tube temperatures etc. will have to be taken into consideration. It is worthwhile dosing with CO for a large part of the year. One tries to achieve values of between 800 and 1200 ppm.

## **Labour**

The amount of labour that is needed for pot chrysanthemums depends very much on the cultivation system that is used. The figures given below are averages from a number of growers as they were registered a number of years ago.

The labour required is given per 1,000 12 cm pots with three cuttings per pot.

Potting	2 hours + 21 minutes
topping	51 minutes
setting out	1 hour + 9 minutes
sales/transport	3 hours + 42 minutes
	<hr/>
Total	8 hours + 3 minutes

## **Lighting**

In order to prevent pot chrysanthemums from forming buds it is necessary to provide lighting during certain periods of the year. Lighting is necessary in the period from 1<sup>st</sup> August to 1<sup>st</sup> May. In the period after May the days are long enough for the natural light to prevent buds from forming. One should though, take into account that lighting may still be necessary during this period if the blackout sheet has been closed in other departments. Lighting should only be used at the beginning of cultivation during the rooting phase. In doing this the



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plant will be stimulated into further growth before starting to form buds. The result is a fuller, better developed plant. A cyclical lighting system is enough to suppress the buds. Lighting should be used from 22.00 until around 04.00. A cycle of 7.5 minutes every half hour is normal.

The number of days that lighting is used depends on the pot size and time of year. In the summer period it is even possible to set directly in the short day. Between 5 and 7 days lighting are generally used in the summer and this is increased to 14 days in the autumn.

When using cyclical lighting it is usual to have strong lighting in each 3.20 m section with the lights set at 3 m intervals. The lamps used are 150-watt Super Argenta models.

### **Blacking out**

The system will have to be blacked out for a large part of the year in order to bring the pot chrysanthemums into flower. The chrysanthemum is mainly a short-day plant; which means that it only forms buds when the length of the night exceeds 13 hours. The system will have to be blacked out during the period from 1<sup>st</sup> March to 20<sup>th</sup> September because the days are naturally too long. In any case the system should be blacked out for 13 hours. Het doek dient in deze periode in ieder geval 13 uur gesloten te zijn, buiten de looptijd van het doek om.

It is advisable to extend the blacking out period a little when the temperature outside is extremely high in order to compensate for the slowing down in bud formation caused by the high temperature.

### **Diseases and pests**

It is important to spray to prevent a number of infestations, in the winter spraying every 3 to 4 weeks is generally sufficient whereas in the summer this is necessary every week.

### **Insect parasites**

#### **Leaf miners**

Chrysanthemums are susceptible to attack by two types of leaf miners; the American Serpentine leaf miner (*Lyriomyza trifolii*) and the Pea Leaf miner (*Lyriomyza huidobrensis*).

The flies make feeding spots on the leaf in which they can lay eggs. Here the larvae can develop and make mines or tunnels in the leaf. The flies can be recognised by the yellow wing case.

Control:

- Trigard; dosage 100 cc/100 l water. Active against the larvae.
- Vertimec; dosage 50 cc/100 l water. Active against the eggs.
- Methomex; dosage 100-125 cc/100 l Active against the flies.

#### **Thrips**

The most dreaded of these is the Western flower thrips (*Frankliniella occidentalis*), which causes malformation in the top of the plant and coarsening of the leaves. One of the dangers with thrips is that they can also introduce tomato spotted wilt virus.

Control:

- Mesuro; dosage 200 cc/100 l water.
- Methomex; dosage 100-125 cc/100 l water.
- Curater; dosage 150 cc/100 l water.

### **Aphids**

There are many different sorts and sizes of aphids, they can be yellow, green, black or red. When there is an infestation one often finds empty skin casings in the foliage.

Control:

- Talstar; dosage 40 cc/100 l water.
- Methomex; dosage 100-125 cc/100 l water.
- Admire; dosage 10 g/100 l water.
- Aztec; dosage 100 cc/100 l water.

### **White fly**

Generally speaking these aren't a big problem when cultivating chrysanthemums.

Control:

- Decis; dosage 50 cc/100 l water.
- Methomex; dosage 100-125 cc/100 l water.
- Admire; dosage 10 g/100 l water.
- Applaud; dosage 30 cc/100 l water.
- Ambush; dosage 30 cc/100 l water.

### **Bugs**

This insect is very active and both the larvae and eggs are difficult to find in the plants. They are often only recognised when damage is found. Young leaves develop in a malformed way and as the growing point develops further the bud is often crooked on the stalk.

Control:

- Methomex; dosage 100-125 cc/100 l water.

### **Beet armyworm / Small mottled willow**

The caterpillars of the beet armyworm (*Spodoptera exigua*) can cause enormous damage to the plants. The moth is grey-brown and has two small, yellowish, kidney-shaped spots on its wings. The moths can be caught using UV lamps.

The caterpillars are recognisable by their clear green colour and a yellow stripe that runs the length of the body. They also have legs the entire length of their body

In the early stages catching and removing the caterpillars is often the best means off control.

Control:

- Nomolt; dosage 100 cc/100 l water.
- Dimilin; dosage 50 g/25 cc/100 l water.
- Andalin; dosage 20 cc/100 l water. Active against beet armyworm caterpillars
- Spod-X; dosage 30 cc/100 l water. Active against beet armyworm caterpillars

### **Red spider mite**

There were almost no instances of red spider mites in chrysanthemums after the introduction of Vertimec. However, that time has past and red spider mites are now regularly a big problem.

Using a variety of different agents has become absolutely necessary. Use a high pressure spray because the turbulence will ensure that the undersides of the leaves are coated as well.



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Control:

- Talstar; dosage 40 cc/100 l water.
- Vertimec; dosage 50 cc/100 l water.
- Nissorun; dosage 20 cc/100 l water.
- Masai; dosage 12,5 g/100 l water.
- Andalin; dosage 20 cc/100 l water.

## **Moulds**

### **Phytium/Phythium?**

The roots become brown and die off and growth slows down considerably. Leaves turn yellow and can display symptoms of shortage. Phythium is always present everywhere. It is a weakening parasite that only attacks plants that aren't completely healthy. The mould is strongly linked to high humidity so cultivating in drier conditions is often a good method of control.

Control;

- Fongarid; dosage 1-2 g/m<sup>2</sup>.
- Previcur; dosage 1 ml/m<sup>2</sup>.

### **White rust**

Green to light yellow sunken spots appear on the upper surface of the leaves while yellow/white pustules containing spores develop on the underside of the leaves. These later turn dirty brown.

Control:

- Eupareen; dosage 30 g/100 l water. Be careful during the vegetative stage.
- Kenbyo; dosage 100 cc/100 l water. Do not mix. Be careful during the vegetative stage.

### **Rhizoctonia**

The stalk becomes constricted where it emerges from the ground into the air. In the early stages the plant will wilt during the day and recover at night. A muggy climate favours this mould's development. Small amounts of water on relatively warm potting compost will increase the damage. This mould often appears in combination with phythium.

Control:

- Rhizolex; dosage 100 g/100 l water.

### **Botrytis**

Grey/brown spots appear on the leaves and stems. If it is damp grey, fluffy mycelia will form. Small brown spots (pepper) will be visible on the petals and these will rot later.

Control:

- Ronilan; dosage 50 cc/100 l water.
- Rovral; dosage 100 cc/100 l water.

### **Sclerotinia**

The plants hang limply and thick white mycelia form on the borders between healthy and infected plant material. In a later stage the scleroses or 'rat droppings' will be visible. Infected plants must be removed carefully since scleroses that fall off may cause reinfection. If the plants remain wet for a long time the chance of sclerotinia developing increases.



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Control:

- Rovral; dosage 100 cc/100 l water.

#### **Mildew**

This mould causes white spots on the leaves and shows a definite preference for certain cultivars. Susceptibility is dependant on the species to a large extent.

In contrast with a lot of other moulds, mildew needs low rather than high humidity, so the first damage will often be seen on drier spots such as by the concrete path.

Control:

- Kenbyo; dosage 100 cc/100 l water. Do not mix. Be careful during the vegetative stage.

#### **Agrobacterium**

This bacterium causes tumour-like growths on the roots, stalks, leaves or leaf stems and it can infect the plant via wounds. After infection the bacterium is transferred throughout the entire plant (systematic distribution). The best solution is to remove the infected plant. There are no suitable chemicals available and the best control method is to keep the plants as dry as possible.

#### **Tomato spotted wilt virus**

Bronze coloured spots and rings appear on the leaves and brown stripes appear running in the length of the stem. The virus is generally introduced by thrips, which makes good thrips control necessary.

#### **Please note**

Due to the considerable changes concerning what is, and what is not, permissible as far as plant protection agents are concerned, the possibility exists that the agents mentioned above now are no longer permitted. If you have no experience with a specific agent you are advised to test spray to check the cultivar's susceptibility to the agent.

#### **Conclusion**

Royal Van Zanten wishes you every success with the cultivation of pot chrysanthemums.

This cultivation methods described are intended for information only. Royal Van Zanten cannot be held liable for any errors arising from said advice.

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LD /HP 01-11-04