florist

Gerbera hydroponics system
Cultivation description

Table of contents

Especially in The Netherlands there has been a great change from cultivation of Gerberas in soil to cultivation in different substrates. These substrates can roughly been divided into cultivation in rockwool and in pots. This last way of growing draws more and more the interest of growers throughout the world. In this description the basic principles of the cultivation of Gerberas in pots are explained. This information should be interpreted in your local circumstances (e.g. weather). These circumstances can influence the result of application of this information greatly.

1 Why in pots?

The cultivation in pots has some big advantages. These are shown below. Of course cultivation in pots has disadvantages of which you have to be conscious of.

1) Working posture
Special in height changeable systems are developed for the cultivation in pots, by which a better working posture can be obtained. This working posture improvement can be divided into harvest and crop-maintenance activities. The speed of harvesting in pot systems in normally slightly higher if the height of the system is adjusted to the height of the employees. Also crop-maintenance such as leaf picking can be done easier and therefore often quicker.

2) Transmission of diseases
As the plants are situated in different pots the chance of transmission of diseases as Phytophtora is reduced to a minimum.

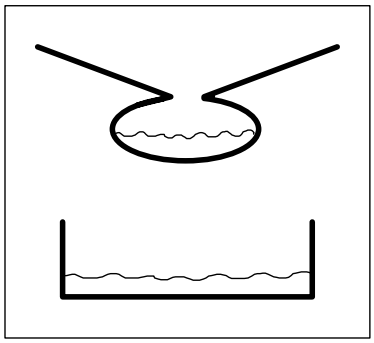
3) Soil problems
The cultivation in soil can cause a number of problems due to the structure of the soil. The first point is groundwater level. A number of growers have a strong fluctuating groundwater level. This is disastrous for the growth of the Gerberas. By growing in pots this problem is excluded. A second point is that the physic properties of the soil do not play a role, such as structure, drainage, disturbing layers and composition of the soil.

4) The production
With cultivation in pots the production is approximately 20-35% higher compared to cultivation in the soil. This percentage is related to the results in the soil, climate and the present drop-out percentage. The

increase of production is mainly caused due to the decrease of the drop-out percentage. Further, the crop will grow better in pots which also results in a higher production. This better cultivation is achieved due to the better control of the feeding and water conditions in the substrate.

5) Botrytis

When drainage water can be collected in a gutter and can be discharged, the humidity in the nursery will be lower as the drainage water can not evaporate. Due to this, diseases such as Botrytis will have less chance to develop. In the picture on the right two types of gutters are shown.



6) Irrigation

When growing in pots, the irrigation of water can be controlled more easily. This can be done by measuring the quantity of drainage water. In this way the grower can react on the weather changes (more or less water) and can react on the direct needs of the plant.

7) Crop protection

The leaves of the plants can hang more when growing in pots. Due to this the plant is more open. The (chemical) crop protection can be executed more efficient. Further, crop protection under the plant can be done more efficient. Finally, if ground plastic is placed on the soil under the pot system problems with leafminer can be reduced.

8) Soil activities

Soil profile/beds do not have to be made when growing in pots. On the other hand, the pots have to be filled with soil and expanded clay. A big advantage is that the soil does not have to be disinfected anymore.

<u>Disadvantages</u>

The cultivation in pots also has some disadvantages. Money has to be found in order to pay the investments of the system and some other necessary equipment. The investments of the different systems are between € 3,40 and € 6,80 per m^2. Further, a feeding solution computer with an EC and pH control has to be bought.

The possibilities of controlling the humidity and feeding in the pots as the buffer is smaller than in the soil can also be a disadvantage. The chance that something goes wrong when the required fertilisers and water quantities are not given, is bigger, due to the smaller buffer in the pots. Because of this smaller buffer, the

plant is much more vulnerable for changes in feeding. This way of growing asks for a more intensive dedication than the cultivation in the soil. For example a water analysis has to be made regular in order to check the water quality.

2 Difference in growing in pots and in the soil

Cultivation in pots asks for a complete different approach than cultivation in the soil. The biggest difference between the two ways can be divided into:

Fertilisation
As described earlier, the feeding and water is due to the limited buffer in the pots the direct controller of the plant. Constantly, fertilisers have to be given in the water. The feeding schedule of the cultivation in pots is different from in the soil. Especially the micro-elements need more attention.

Frequency of giving water
Again due to the smaller buffer, the frequency of irrigation should be higher than in the soil.

3 The pot

The diameter of the pot should be 18-19 cm and have a volume of 3 - 3½ litre. With this volume the control of the plant is maximum. Further, the height of the pot is important. This should be 18 – 20 cm, depending on the substrate as each substrate has a different pF-curve. A good air-water level in the substrate can be achieved.

The bottom of the pot should be strong enough in order not to be deformed by the growth of the plant. The bottom of the pot should be flat. Otherwise, the growth of the roots can be obstructed by the profile on the bottom of the pot. Further, a pot should be chosen which does not have plastic rims on the inside of the bottom of the pot (which makes it easier to take one pot out of the other). These rims should be on the outside of the pots. They can obstruct the roots when they are growing along the side of the bottom of the pot.

For drainage, the pots should contain 4 holes of each approximately 1cm diameter.

4 Expanded clay

Expanded clay is made of clay which is baked at a high temperature. The clay parts expand during this process of baking. After this the expanded clay is porous and can contain water and air.

In order to get a good drainage it is necessary to put ½ litre expanded clay on the bottom of the pot. The roots grow over the bottom of the pot and along the side. If the roots are situated between the expanded clay they will not be affected if there is given too much water, as it can drain out easily. The chance on Phytium is therefore reduced strongly. The expanded clay parts should have a diameter of approximately 1 cm.

Besides expanded clay there are also other products available on the market such as small pebbles and volcanic material. The pebbles have as disadvantage that between the stones no water can be exchanged. If peat or coco decomposes, the small parts can get between the stones and in this way a tight layer can develop. Normally, volcanic material is porous and can be used if the stones are big enough.

The different materials can contain a certain level of salts. When a material has to be chosen and purchased this has to be kept in mind. There are also big differences between the different expanded clay types.

5 Substrate components

There are many different types of medium available on the market. For the Gerbera cultivation the air-water contents of the soil is very important. In this chapter the different features of the Gerbera substrate components are described.

Peat

The most used substrate is peat. With peat until now the best results have been made. Peat however is not an uniform product, the physic qualities differ strongly. This depends on the origin of the peat and the organic material where it consists of. The vast majority of the used peat substrates consists of different types of peat.

Perlite
Perlite is a volcanic material which improves the soil structure. Further, it nearly does not contain any nutrients. However, it has a slight pH increasing effect.

Rice chaff
Rice chaff (peel of the rice) is being added in order to improve the structure of the soil. It contains few nutrients and will most probably not influence the feeding in the soil. Further, the decompose process of the rice chaff passes slowly (± 2 years). There has to be paid attention that the rice chaff is being disinfected as they can contain rice grains.

6 Growing substrate

Especially for the Gerbera pot cultivation a substrate is developed in The Netherlands. This substrate contains a good balance of air and water. It contains coarse grained, middle fine and fine peat. Further, 30% of rice chaff is added or 30% of perlite. As peat normally contains few nutrients, calc (Dolokal) and nutrients (pg Mix and some Fritted Trace Elements) is mixed through the substrate. The substrate contains approximately 48% water and 45% air. Because of the high level of air in the substrate, irrigation with fertilisation can be done very frequent. In order to get a good production it is necessary that the plants react as quick as possible on the offered feeding solution. Therefore, a substrate is required with enough air in it. The pH of the soil is buffered on 5,5 and the basic fertilisation of the EC is 0,8 mS/cm

7 Alternative substrate

Besides the peat mix substrates, a number of other mediums are sold on the market. Besides peat, cocos is the second most used substrate in pots.

Cocos
With cocos substrate, normally the fine cocos 'dust' is meant and not to coarse fibbred cocos. There can be grown in 100% cocos or for example in a mix of 60% cocos and 40% perlite. An important quality feature is the water and air contents. Normally, cocos contains approximately 70% water and 25% air. Consequently, it can be said that the cocos substrate holds a lot water. Therefore, also here a half a litre expanded clay should be placed on the bottom of the pot in order to have sufficient drainage. Another quality criterion is the level of Natrium (Na) and Cloor (Cl). Between several cocos

substrates big difference in levels of these two elements are found. The levels should not be too high. Further, when growing in cocos the physic qualities of the medium should be kept in mind. The cocos substrate binds Calcium (Ca) strongly and can release quite some Kalium (K). Finally, the pH in the substrate is normally lower than the found pH of the drainage water. In general it can be said that it is more difficult to achieve the optimum growing results in cocos than in peat.

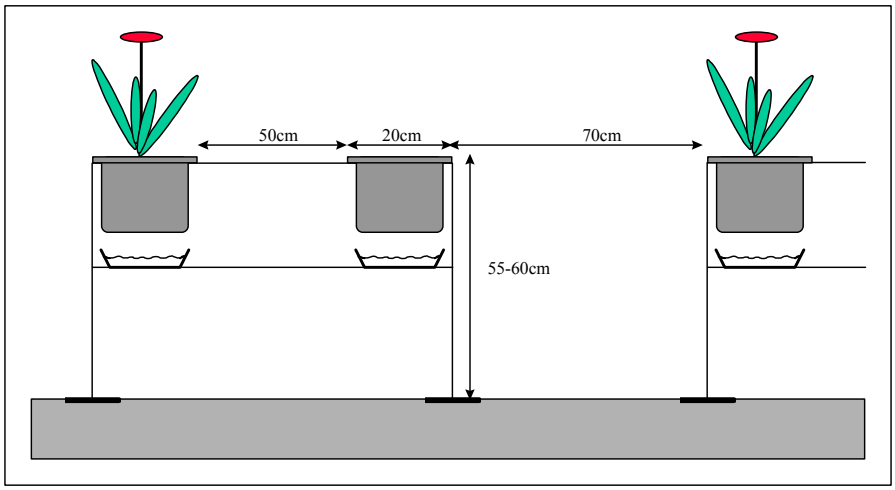
8 'Home made'

A number of growers have made a pot system themselves. With the right materials and a good design this does not have to be difficult. However, the materials and design should be very well considered and chosen. Many different types and shapes of iron can be used as material. Important is that the material has sufficient bearing-power, not only in the beginning of the cultivation but also when the plant has grown full-size.

It is not possible to give a blueprint of a potsystem. The height depends on the working position and level of the workers in your greenhouse and the width of the rows on the light intensity and size of the greenhouse. It is of course possible to give an example, which however can not be used as a blue print. This example will be given below. It is advisable to experiment with the system long time before the planting has to be done.

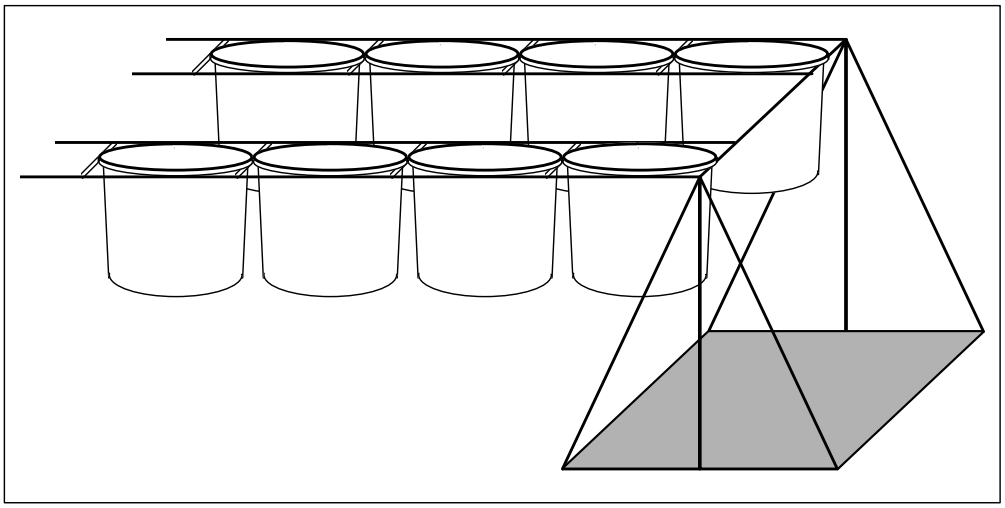
Row height and width

As earlier is said, the width and height depends on some factors, which are different in each company. In the picture below, standards measures are shown. As guide-line for the height of the system, the height of the hand can be used. The finger tops should touch the top of the system when putting your arm along the side of your body.

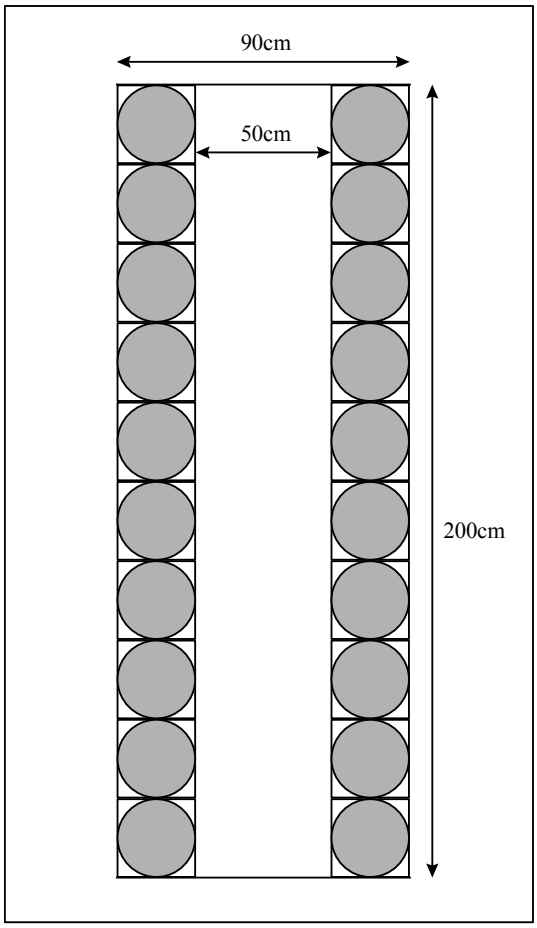


Strength and stability

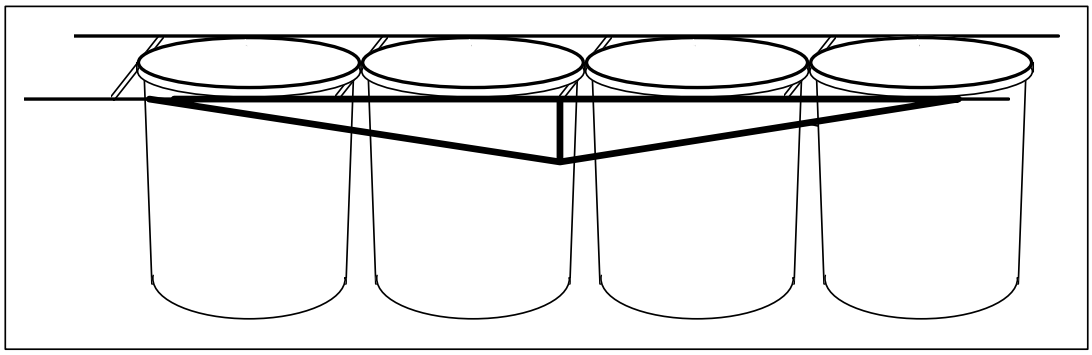
The materials which are used should be able to carry the pots and the plants. In order to have enough stability approximately every 2 meters a standard-bearer should be placed as shown on the picture shown below. The distance between two standards depends on the material which is used. Further, only two vertical standards does not give enough support. Also diagonal standards should be made.



There are no maximum path dimensions. However, when the paths are longer than 80 meter, labour technical problems will occur.



In order to avoid bending of the rows, extra support can be made on the side of the rows as shown below.



Installing of the system

Before the system can be installed, the soil has to be leveled. Further, a gutter has to be installed under the pots in order to collect the drainage water. In this way the ground under the system stays dry and the chance on Botrytis is therefore reduced to a minimum.

9 Irrigation system

Irrigation lines
In the past some cases have occurred where the irrigation lines caused significant reduce of growth of the plants. This happened because the lines gave off for the plants toxic gasses. Therefore, a reliable brand of lines should be chosen.

Drippers
There are many different types of drippers. Important is that each dripper gives an equal amount of water. An as small difference as possible between the first and last dripper is preferred. The capacity of a dripper should be between 1 and 2 litre per hour. A capacity of 2 litre is preferred as the chance of congestion is smaller.

10 Other investments

Besides the potsystem, also other investments have to be made.

Osmosis machine
An osmosis machine is required if the composition of the water is so bad that it is not possible to calculate a good feeding schedule, or if the Na and Cl level is so high that it is not suitable of potsystem.

Feedingunit
A feeding unit is needed to give the exact quantity of nutrients to the plants. The EC and the pH are measured and directly corrected. The set points of the pH and EC put in the computer are given to the plants.

pH-EC measure equipment
In order to measure the pH and EC in the drainage water a manual pH/EC measure machine has to be bought.

11 Cultivation

Below only the basic principles are explained as the situation and facilities in each company are different.

Irrigation

Per dripper a minimum of 50cc and maximum of 100cc should be give per irrigation turn. When the plants are older per irrigation turn a minimum of 80cc should be given depending on the season. In the winter larger quantities are preferred in order to get sufficient flushing. Normally, an overdrain of 30-40% is needed, except for the first 3 months when this should be less to stimulate the root development. The first irrigation turn should be given at sunrise. The last turn should be planned at such a time that the plant does not go in the night with wet soil.

Water and nutrients

With the pot cultivation the plant has a limited substrate volume (± 3 litre). This has to be kept in mind when irrigating the plants. A good water quality is essential in order to be able to give the optimum feeding solution. Further, it should be avoided that unwanted congestion of certain element occur which may influence the growth of the crop negatively.

In order to get enough fresh water in and flushing through the substrate, a minimum of 30% drainage should be achieved. The number of irrigation turns and the quantity of water which has to be given per turn in order to get an optimum growth is depending on the temperature, speed of wind and radiation of light. Of course the time of the year also has a big influence. The pH of the irrigation water should be between the 5.4 and 5.8 and the EC between 1.5 and 2.0 depending on the quality of the starting water, climate and the season.

In the Netherlands the following scheme is being followed. This scheme for potsystems is based on rainwater.

NO_3	11.25 mmol/l
H_2PO_4	1.25 mmol/l
SO_4	1.25 mmol/l

NH_4	1.5 mmol/l
K	5.5 mmol/l
Ca	3.0 mmol/l
Mg	1.0 mmol/l

Fe	35.00 µmol/l
Mn	5.00 µmol/l
Zn	4.00 µmol/l
B	30.00 µmol/l
Cu	0.75 µmol/l
Mo	0.50 µmol/l

12 Closing word

Hopefully, the information given in this description for potsystems will help you during your cultivation.

At the risk of labouring the obvious, we would like to say that the cultivation in pots not automatically has to result in better financial results. The extra productivity should be sufficient higher in order to cover the investments which are made. Especially if the water quality is not good enough and the stated investments can not be made. The cultivation in pots offers good possibilities and can be a significant improvement compared to the cultivation in the soil. These better results can be achieved if the prior conditions (water quality and investments) can be made.