

# Cultural instructions (spray) carnations



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## General information

The carnations belong to the genus *Dianthus* of the family Caryophyllaceae. It is one of the most popular cut flowers in the world. In temperate zones carnations are mostly planted in glasshouses, in subtropic areas in plastic- and glasshouses and also in open air and in the tropics more or less in shade houses.

## Transport

Transport of the cuttings in cool conditions is crucial. The temperature during transport has to be 2°C. till maximum 5°C. When the cuttings arrive, they must be directly placed in a coldstore of 5°C. When no coldstore is available, the cuttings must be placed in a cold place where is no direct sunlight. Local transport must also be under cool conditions.

## Preparation

The crop can grow well in good manured soil. Take care with manure from sheep and/or chicken, because these can be too salty. Before planting it is recommended to analyse the soil and irrigation water on their chemical conditions. The results of the soil analysis are necessary to adjust the level of the nutrients in the soil. The soil must be well drained and in a good condition. A good soil is as follows:

- Good loose structure (air in soil)
- Well drained and a constant groundwater level
- Enough nutrients and organic material
- EC 1,0 - 1,5 mS
- pH 5,5 -6,5
- Free off pests and diseases
- No residues of herbicide
- No residues of harmful chemicals

## Soil disinfection

Soil can be disinfected by steaming or by using chemicals. When steaming the soil must be dry. When steaming a minimum soil temperature of 90-100°C . is required. For steaming 100m<sup>2</sup> a steaming capacity of 600.000 kcal/hour is needed.

When there are serious weed problems it is better to disinfect the soil as well. Covering the soil before planting with plastic is also very effective against weed, the bottompart of this plastic must be black.

Chemicals for disinfection can be added to the soil by spraying, followed by milling into the soil. The soil has to be covered with a plastic film. After minimum 5 to 7 days the plastic can be removed.

The following chemicals can be used:

1. metam-sodium: 7 liter per 100m<sup>2</sup>
2. dichlorpropeen cis-isomeer: Nematrap, Telone-Cis. etc  
Amount: see etiquette of the bottle
3. If it is still allowed Methylbromide is still the best chemical for disinfection.

## SOIL DESINFECTION

<i>Measures:</i>	<i>Steaming</i>	<i>Methylbromide</i>	<i>Metam-natrium</i>	<i>Dichlorpropen</i>
<i>Against</i>			<i>(Injection)</i>	<i>(Injection)</i>
<i>Nematodes</i>	++	++	++	++
<i>Fusarium oxysporum</i>	++	+/-	+-	-
<i>Virusses</i>	++	-	-	-
<i>Weeds</i>	++	++	++	+
<i>Indication waiting time</i>		2-3weeks	3-6 weeks	3-6 weeks

MARK: After the use of methylbromide it is necessary to wash out the bromide.

Advisable is 200 - 400 liter / m<sup>2</sup> .

## Crop support

Crop support is essential and very important. Crop support and nettings do extremely effect the result of the crop. A firm system must be used. The maximum cropheight should not be much more than 1.80 meter in a culture-time of nearly two years. In full flush the crop can be very heavy.

The front- and endsupport must be very firm and well anchored. The distance between the intermediate posts can be 3 meters maximum (however 2-2,5 m is recommended). The intermediate posts may be less strong as the endsupports. Layers are needed to keep the nettings at the right level. The best thing is to use adjustable layers.

## Nettings

Nettings normally have 8 meshes of 12.5 by 12.5 cm. For a culture time of 18 - 24 months, five till six nettings are needed. When the growing period is shorter it is possible to use three or four nettings. It is important to stretch the nettings. Sometimes plastic nettings are used instead of iron nettings. Iron nettings are recommended. However, in case you use plastic nettings it is advisable to attach along each side of the net a iron-wire for better support. The easiest way to work is to place all nettings on top of each other on the soil or benches before planting, this way the nettings can be moved up gradually during growth of the plants and will avoid damaging the shoots of the plants.

## Planting

Per 1.000 m<sup>2</sup> gross surface approximately 21.000 cuttings are planted. The usual pathwidth is 45 cm. The normal benchwidth is from 1 till 1.10 meter. Shallow planting is essential; the top of the paperpot should still be visible (70% of the paperpot should be under the soil). Normally 32 cuttings are planted per m<sup>2</sup> nett.

## Possibilities for plantingsystems

X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X

□--□12,5 cm  
□ 12,5 cm

Nett 32 pl/m  
Gross 20,8 pl/m

Or

	X		X		X		X
X		X		X		X	
	X		X		X		X
X		X		X		X	
	X		X		X		X
X		X		X		X	
	X		X		X		X
X		X		X		X	

□--□ 12,5 cm  
□ 12,5 cm

Nett 28 pl/m  
Gross 18,2 pl/m

It is important to create good conditions for the cuttings, also before planting ;

1. When the cuttings have arrived : plant as soon as possible !  
The cuttings need to acclimatise before planting. We recommend to place the boxes at roomtemperature (15 – 20 C) the last 12 hours before planting. However, keep the boxes always closed till planting.
2. Planting : make a small hole in the soil and place the cutting in that hole and slightly press the soil against the paperpot and don't cover it with soil. After planting, the upper part of the paperpot must still be visible.
3. Do not give the cuttings too much water. You must force the plant to make roots to search for water. Depending on the weather conditions, you may need to start watering within 20 minutes of planting. The best is to give many times small amounts of water by overhead-sprinklers only to reach the highest possible humidity in the air, but the plants should remain as dry as possible.
4. The first 10 days after planting are crucial ! It is recommended to start fertilising after planting.

When there is intensive sunshine, shade the plants slightly until new roots are visible (cover greenhouse with chalk or use shadecover), depending of the light intensity 30-50% shadow is recommended. To get them growing as quickly as possible, it is also advisable to use shading. Do not use the driplines in the first 10 – 14 days. However, use sprinkler / fogsystem very frequently, according to the weather, for good humidity!

### Watering system

Two or three (sometimes four) driplines are used, according to the size of the bed and dryness of the soil. For a proper water distribution the driplines must lay horizontal.  
Install a sand filter and use only good quality fertilizers.

### Pinching

When the cuttings make strong roots and are fully turgid (normally three or four weeks after planting), the cuttings should be pinched. Pinching at five or six pair of leaves is advisable. The best time for pinching is early in the

morning, because the cuttings are still fully turgid. If you want to grow crownflowers, the cuttings must not be pinched.

#### One and a half pinch:

The first pinch will produce 5 or 6 lateral shoots. With a 'one – and – half" pinch, 2 or 3 of these shoots are then again pinched at 4 – 6 leaf pairs. Each such shoot should then produce 2 or 3 further shoots which flower in due time but later than the main flush. This gives you a somewhat lesser quality but a better continuity of production.

### **Temperature and humidity**

The temperature effects the growing speed, the size of the flowers and strength of the stems and vase life of the flowers. Steady temperatures between day and night are recommendable for good quality and to avoid splitting of the flower head.

Avoid extreme temperatures ! The optimal growing temperature is 15°C till 25°C. Generally the carnation prefers lower temperatures when the weather is dark/cloudy and higher temperatures when the weather is sunny.

Very high humidity must be avoided, therefore take care for good ventilation. Always ventilate freely in order to avoid too high humidity. The optimal humidity is between 60 – 85 %

### **Watering**

Always use clean water. Irrigation water may never be in contact with drain water. Otherwise diseases can be spread easily (viruses and Fusarium). Reuse of drainwater is only possible when it is properly disinfected.

In the first 2-3 weeks after planting overhead sprinklers are to be used. After this period when the cuttings are well-rooted start watering through the driplines step by step and stop using the overhead sprinklers. Driplines do not moisten the leaves or stems of the plants, therefore they reduce fungus diseases.

It is recommendable to check the drip points twice a year because of the driplines can be blocked.

### **Feeding**

Good quality and production depends on good feeding. Incorrect nutrient levels can cause serious problems. The most important elements are:

Nitrogen	It encourages growth. Extra nitrogen may be needed for young plants and after a flush. Too much nitrogen will cause thin and soft stems, stems become floppy. Nitrogen is very soluble and is quickly leached out of the substrate by overwatering.
Potassium	When potassium is lacking, stems become thin and weak. Lower foliage burns or ripens prematurely, and necrotic spots appear in the middle-age leaves.
Calcium	One of the main functions of calcium is to give strength to the cell walls. Therefore plants well supplied with calcium have strong stems, leaves and flowers. Low calcium gives floppy stems and sometimes even dead leaf tips.
Phosphorus	Improves the roots and is needed to get more intensive colour of the flowers
Magnesium	Magnesium is needed for in the structure of leaf-green. A shortage leads to less assimilation and so less growth. The leaves become yellow, sometimes even white. Too much potassium may cause a shortage of magnesium.
Trace elements	Iron, Manganese, Zinc, Copper, Molybdate and Boron are also very important for the growth of the crop. Special attention must be paid to Boron.
Boron	Carnations need boron in relatively high quantities, compared to most other crops. Symptoms of a shortage are: <ul style="list-style-type: none"><li>· Brittle stems. Cracking off near a leafpoint when nearing maturity, or cracking after cutting</li><li>· Excessive calyx splitting</li><li>· Failure of flower buds to develop</li></ul>

The following list shows the optimal nutrient values for carnations in soil. The figures are pressed out in millimol per litre (mmol/L) 1:2 volume-extract; this means 1 volume part of soil and 2 parts of water.

#### ELEMENTS IN THE GROWTH MEDIUM AND THEIR OPTIMUM VALUES

Element		Optimal nutrient values in mmol/L	
Nitrogen	NH <sub>4</sub> <sup>+</sup> and NO <sub>3</sub> <sup>-</sup>		4.0
Phosphorus	P		0.2
Potassium	K <sup>+</sup>		1.5
Magnesium	Mg <sup>2+</sup>		1.2
Calcium	Ca <sup>2+</sup>		2.5
Sulphate	SO <sub>4</sub> <sup>-</sup>		1.5
Bicarbonate	HCO <sub>3</sub> <sup>-</sup>	less than	0.5
pH (Water)			6.2
Chloride	Cl <sup>-</sup>	less than	3.0
Sodium	Na <sup>+</sup>	less than	3.0
Conductivity (E.C.) in milli-Siemens 1,5 per cm at 25°C (1 mS= 1mmho)			

The exact values for trace elements cannot be given, while they depend on the type of soil or growing medium. In general there are sufficient trace elements in natural soil. The optimal value for Boron is 20-25 micromol per liter.

#### Crop-handling

The nets must be raised in the right time. When they are raised too early it makes picking more difficult. When they are raised too late, it allows the crop to fall to one side. Once this happens stems bend and crop losses are inevitable. Watch the crop carefully and frequently, and raise the nets little by little. When shoots grow into the path, they have to be pushed back into the nets.

The removal of unwanted flowerbuds and vegetative shoots is called disbudding:

- Spray carnations: Only the mainbud has to be removed or pinched when it is big enough to handle.
- Standard carnations: The sidebuds are removed and only the mainbud is left.

#### Artificial light

The production can be advanced by the use of artificial light. When the shoots have at least seven pairs of leaves they are susceptible for artificial light. Normally a minimum of 8 Watt/m<sup>2</sup> is used. The lamps must be installed 1.50 meter above the tops of the shoots. During 14 days the lights must be on from sundown till sunrise. Shoots that are illuminated, flower 7-10 days earlier. The quality might decrease a little bit.

By using artificial light on an old crop it is possible to increase the final flush. For this the lighting should start about 100 days before the termination of the crop. Instead of giving light during 14 days also cyclic lighting of '7,5 minute per each ½ hour' can also be used. It is necessary to light then 4-6 weeks. Less degrees of quality is obtained by using cyclic lighting.

#### CO<sub>2</sub>

CO<sub>2</sub> is necessary for growth together with daylight and water. All this together makes sugars in a chemical reaction in the plant. Those sugars are needed for the growth of the plant. So CO<sub>2</sub> is important to achieve a higher production and quality level. Every level higher than 300 PPM (parts per million) is effective (when there is light!). Optimum level is +/- 700 - 1.000 PPM.

#### Picking and handling

The vase life can be decreased very easily when wrong treated. Cutflowers should not be exposed to high temperatures. Therefore it is better not to pick flowers during the heat of the day. During picking it is recommended to collect the flowers periodically, put them on water and place them in a coldstore. However, it is even better to put them in water that contains STS. (silverthiosulphate) This increases the vase life. The temperature in the coldstore must be between 4°C and 6°C. Lower temperatures can cause quality losses. The picking-stage for standard carnations is optimal when the outer petals are starting to spread. Spray carnations are picked at an earlier stage of development. Three buds should be well coloured, but before the petals turn outwards.

## STS

This is a very effective means of reducing ethylene damage and it greatly extends the flower vase life. Treated flowers are usually described as "long-life" or "silver-treated" carnations and are recognized as such by salesmen and buyers.

STS treatment: Minimum time: 4 - 6 hours in packing house or 24 hours in cool store (longer periods are not harmful)

Use only plastic containers and clean fresh water: Rainwater is most suitable, but it should always be fresh and clean. If the solution in the buckets will drop, refill when necessary but once a week filter the remaining residue and use the 'clean' leftover solution for re-use.

## Sleeves

A range of polythene, polypropylene and paper sleeves is available. A good quality sleeve should protect the bunch from damage and enhance the appearance. For sprays, clear polypropylene perforated sleeves are generally used. Remember to cool flowers before sleeving, or you will get condensation problems.

## Boxing

Do use a good quality box. Boxes are not handled very carefully and if they get damaged, so do your flowers. Cheap boxes are a false economy. Pack firmly. Fill the box completely but keep the heads away from the end of the box. Allow an inch or so to absorb any movement.

## CARNATIONS AND LABOUR (THESE FIGURES ARE BASED ON DUTCH CIRCUMSTANCES)

<i>Needed labour in hours per 1.000 m2 per section per year</i>	<i>Hours</i>
<i>Preparation before planting incl. sterilisation</i>	80
<i>Planting</i>	45
<i>Harvesting</i>	480
<i>Bundle flowers</i>	260
<i>Disbudding</i>	250
<i>Provision plants / spraying, dusting</i>	90
<i>Preparing flowers for shipment</i>	60
<i>Repair / maintenance</i>	50
<i>Other activities</i>	115
<i>Total hours under Dutch circumstances</i>	1430

## Pests and diseases

Prevention is always better than having to cure a crop. Do not simply rely on chemicals; they can do no miracles for you. If conditions are favourable to a disease you may find that it may be impossible to control the disease chemically. Cleanliness, hygiene and the environment are just as important as the preventive weekly spraying program which you need. It is important to realize that diseases start in a very small way. Spores build up and spread if conditions become favourable. Most favourable conditions for Fungi are moisture and high humidity. And moisture on foliage, stems of flowers will allow fungal spores to develop.

## Routine spray programme

Good pest and disease control can only be obtained by main training a routine preventative spraying program. Use a range of wide spectrum fungicides alternating them to prevent build-up of resistant species.

**Note:** The chemicals we mention are generally most widely used.

There are many equally suitable substitutes.

Check label before use.

Regular use of these materials i.e every 7-10 days should prevent problems.

Where diseases are well established other specific fungicides may be needed.

## Spray before problems are visible

Spray under relative slow drying conditions; late afternoon or early evening are best. To spray chemicals, try to pick dry days with no direct sun. (cloudy and dry weather is most suitable)

NEVER SPRAY PLANTS THAT ARE WEAKENED BY INTENSE HEAT/SUNSHINE.

PLANTS MUST AT ALL TIME BE SUFFICIENT TURGID (maximum water capacity of plant cells)

Below will be mentioned the most important diseases and insects and the treatments (most important chemicals)

- Botrytis: Ronilan, Rovral, Daconil
- Fusarium stemrot: Carbendazim, Topsim M, Aliette, Previcur
- Rhizoctonia stemrot: Rizolex, Maneb, Mancozeb, Ridomil
- Rust: Kembyo, Baycor soluble, Daconil
- Mildew: Baycor, Sulphur, Eupareen
- Alternaria: Baycor, Rovral, Daconil
- Heterosporium (Black spot): Kembyo, Daconil, Baycor
- Aphids: Pirimor, Admire, Permethrin
- Trips: Mesurol, Decis, Vertimec, Violin, Conserve, Dichloorvos
- Caterpillars: Nomolt,
- Slugs: Mesurol, Nomolt
- Red Spider: Vertimec, Pentac, Floramite, Apollo
- Leafminer: Vydate, Vertimec

More detailed chemicals including active ingredients can be provided on request.

**Pests and diseases**

**1: Rust      2: Botrytis      3: Spots      4: Red Spider      5 & 6: Trips      7: vascular diseases**  
**8: Footrot**

