



LILIUM

CULTIVATION-INSTRUCTIONS



Soil and Irrigation water.

Soil

Lilies can be forced into flower in almost any type of soil. Nevertheless, care must be taken to ensure excellent soil structure and retain moisture permeability (no impermeable layers) throughout the entire growing layer (particularly the upper layer of soil) throughout the entire cultivation period. Heavy loam and clay soils are less suitable for the cultivation of Oriental hybrids. For producing other groups of lilies, these soils can be improved by working in substrates containing humus to a depth of 40-50 cm. This improves air permeability and provides sufficient moisture permeability in the upper layer of soil so that even in these soils, sufficient oxygen can be absorbed by the moisture in the soil. Heavy soils will usually reduce the height of the crop somewhat. In addition to water and nutrients, having enough oxygen in the soil is also essential for a good healthy root system and thus for plant development.

The panning of soil susceptible to compaction should be prevented by applying a mulch after planting. The mulch can consist of with rice hulls, Styromull, rice straw, pine needles, upgraded black peat, etc. A certain amount of care should be taken when mulching due to the possible presence of the fungus *Rhizoctonia solani* in some mulching materials.

Soil Structure

The term 'soil structure' refers to both the physical and chemical properties of the soil that will affect the usability of this soil by the plant. Important factors in soil structure are organic matter and pH. It is thus important when growing lilies that the structure of the soil, whether this is the border soil of the greenhouse or field soil, is in order previous to planting. If not, there will be a high risk of root rot. And, although the primary cause of root rot is a fungus known as *Pythium*, the underlying cause in most cases is poor soil structure paired with an insufficient permeability of the soil. Flooding and a lack of oxygen are the result, followed by a weakening and even dying back of the stem roots. When this occurs, the *Pythium* fungus can easily invade these roots and worsen their condition. This is why it is essential to keep track of the structure of your soil and improve it according to schedule by applying the procedures (see table 1 & 2). You can also prevent the deterioration of soil structure by not tilling the soil when it is too wet. Also be careful not to make the soil too finely textured when tilling it. Furthermore, make sure that the soil does not become compacted as the result of intensive watering. If necessary, mulch the soil with a few centimetres of rice hulls, peat litter or similar material.

Soil structure improvement

Adding organic material, a name given to a wide variety of materials originating from plants or animals, improves the structure and at the same time the water balance, the accessibility of fertilisers, and the aeration of the soil. Fertilisers - but even more importantly, water and oxygen - are essential elements in producing a good root system that will then promote the proper growth of the plant. This makes it desirable to apply organic material to the soil, especially heavy clay soil, in plenty of time before planting.

Table 1. Standard fertilising plan

Fertilising agent	Composition		Quantity/100 m ²
Calcium ammonium nitrate	$\text{NH}_4\text{NO}_3 + \text{CaCO}_3$	27% N + 12% CaCO_3	1.4 kg
Dicalcium phosphate	CaHPO_4	35% P	1 kg
Potash magnesia sulphate	$\text{K}_2\text{SO}_4 \text{ MgSO}_4$	30% K + 10% MgO	1.8 kg
Borax	$\text{Na}_2\text{B}_4\text{O}_7$	11,3% B	0.1 kg
Kieserite	MgSO_4	25% MgO	0.5 kg



For this purpose, use can be made of:

- rice hulls: 30 kg/100 m²
- 1 year old, well-decomposed cow manure: 1 m³/100 m². Beware of the fact that manures produced by other animals such as chickens, horses and pigs can contain too much salt and lead to root burn! - upgraded black peat: 1 m³/100m²
- well-composted tree bark.

On heavier soils containing more humus, stable manure can often damage soil structure since it makes soil materials such as upgraded black peat, rice hulls and tree bark. Sand or lava sand is also used for this purpose.

Work the organic material thoroughly into the upper 50 cm soil. Beware of the fact that excessive amounts of organic material can cause damage. It is better to add this material every year until the soil has attained a good structure and then to adjust the amount provided thereafter in order to maintain the right soil structure.

pH

Maintaining the proper pH (degree of acidity) in the growing layer is essential for the root development of lily plants and for the proper absorption of nutrients. Soil with an excessively low pH can result in excessive absorption of such elements as manganese, aluminium and iron; and excessively high pH lead to an insufficient absorption of such elements as phosphorus, manganese and iron.

For growing Asiatic, LA and Longiflorum hybrids, maintaining a pH of 6 to 7 is recommended; for the Oriental, OA, LO and OT hybrids, a pH of 5.0 to 6.5 should be maintained.

To reduce the pH, pH-reducing materials such as peat products should be worked into the upper layer of the soil. When using artificial fertilisers, pH-reducing fertilisers such as the ones containing ammonium and urea are preferable. To increase the pH, liming materials or liming materials containing magnesium can be worked into the soil previous to planting.

The addition of 1 kg of CaCO₃/m² of soil will increase the pH value of a factor of 0.3. After having increased the pH value of a soil that has been measured as having a very low pH, planting will have to wait for at least one week. During cultivation, the application of pH-increasing materials such as the ones containing nitrates (N) is preferable.

Table 2. Target values for the EC, pH and elements needed in various types of soil for lily flower cultivation.

Element	Sand	Loam/Clay	Peat
EC	0.9	0.9	0.9
pH	5 to 7	6-7.5	>5
NH ₄ ⁺	0.1	0.1	0.1
K ⁺	1.3	1.0	1.3
Na ⁺	-	-	-
Ca ⁺⁺	1.8	1.5	1.8
Mg ⁺⁺	1.0	0.8	1.0
Si ⁺⁺	-	-	-
NO ₃ ⁻	3.0	3.0	3.0
SO ₄	1.5	1.3	1.3
P	0.15	0.15	0.15

Water balance.

Because the stem roots of certain lily cultivars grown downward, these cultivars require a layer of 40-50 cm (the exact thickness depending on the existing soil structure) of well-drained soil. This is even more important when you consider that it is often necessary to leach the soil between cultivation periods to prevent excessively high concentrations of salts.



Salt sensitivity.

Lilies are sensitive to salt. High salt contents will produce roots that are hard, brittle and yellow to brown in colour. A high salt content will also reduce the roots' capacity to absorb water, and this will lead to a reduction in the height of the crop. Excessive salt contents can even result in root damage!

The salt content in the soil is determined by three factors:

- the salt content of the manure and/or artificial fertiliser applied
- the salt content of the water used for irrigation
- the nutrients in the soil and how much of them were absorbed during the previous cultivation period.

Conduct soil sampling at least 6 weeks prior to planting the bulbs in order to obtain a good picture of the pH, the total salt content and the chlorine content, and the presence of nutrients in your soil. The EC of the soil must not exceed 1.0 and the chlorine content must not exceed 1.5 mmol/l. If the EC or chlorine content exceeds these levels, the soil should be leached prior to planting with water having an EC less than 0.5. This will then make it possible to apply fertilisers to produce a good crop of lilies without the danger of increasing the salt content in the soil that would harm them. Always leach in plenty of time prior to tilling in order to prevent damaging the soil structure. Leaching sandy soil will require 30-40 litres/m²; loam and clay soils will require 50-60 litres of water with an EC not exceeding 0.5 (preferably lower) per m². Should you notice during cultivation that the soil contains too much salt (evidence: areas within the crop with shorter plants), provide more water than usual. You should thus be careful with the application of organic fertilisers containing too much salt or the application of too much artificial fertiliser.

Table 3. Indication of planting density according to group, type and bulb size per net square metre of bed surface of box area.

Group/Bulb Size	10/12	12/14	14/16	16/18	18/20	20/22
Asiatic hybrids	60-70	55-65	50-60	40-50	35-45	
LA, OA hybrids		45-55	40-50	35-45	30-40	
Oriental hybrids such as 'Stargazer' that do not produce large leaves		55-65	45-55	40-50	35-45	
Oriental hybrids such as 'Siberia' that produce large leaves			40-50	35-45	30-40	25-35
OT hybrids		55-65	45-55	40-50	35-45	
Longiflorum hybrids	55-65	45-55	40-50	35-45	30-40	

Information printed in this catalogue (like buds per bulb, height and growing period), is based on observations made under Dutch climate and growing conditions. The number of buds per bulb are also based on circumstances previously indicated. The number can be different depending on circumstances, like planting period, light, temperature and cultivation practices. We are not responsible for any unsatisfactory results.

1 All goods are sold in Euros and delivered ex warehouse Holland and are dispatched from there at buyer's sole risk and expense.

2. Unless the buyer gives contrary instructions in writing before dispatch the seller will affect insurance upon the goods against transit risks at the buyer's expense.

3. The costs of cases and other packing together with all freight, forwarding, insurance and phytopathological examination charges are payable to the seller by the buyer immediately upon delivery of the goods.

4. All accounts are due two months after date of invoice: 2% discount will be allowed for payment within ten days after date of invoice. On overdue accounts 12% interest per annum will be charged, together with the collection expenses. Ownership of goods is reserved until all obligations have been fulfilled.

5. If any complaint be made touching the description of quality or condition of any goods delivered by the seller under this contract the seller undertakes either to replace within a reasonable time, so much of the goods delivered as may be proved to have been defective as regards description, quality or condition when delivered or at his option to make a fair allowance off the price of so much of the goods delivered provided always that the buyer shall have made his complaint to the seller in writing with full particulars within 10 days of receipt at the buyer's premises of the goods complained of and that if any damage to the goods be alleged he shall have forwarded with his complaint a written statement containing full particulars to be supported by statutory declaration if required, provided further that if any complaint be made within 7 days after the beginning of flowering (supported by statutory declaration if required) that the goods delivered were not bulbs of the variety of respective varieties overleaf of indicated on the invoice (payment having been made within 2 months after date of invoice) then the buyer shall be entitled to recover from the seller such damage as he shall be able to establish that he has in fact suffered by reason of such wrongful delivery.

6. The undertaking set forth in the last preceding clause hereof is given by the seller and is hereby accepted by the buyer in lieu and the exclusion of every condition, warranty of guarantee as to the description, quality or condition of any goods delivered under this contract which might otherwise be implied under the provisions of any Statute or from any facts of circumstances whatsoever. The due fulfilment of such undertaking is to constitute the sole Ramey of the buyer and the sole liability of the seller arising out or in connection with any defects as regards description, quality of condition in any goods delivered under this contract.

7. If at the time for dispatching the goods any account payable by the buyer to any member of the Dutch Bulb Exporter's Association be certified by that Association as being unreasonably overdue or if the Association certifies that the financial standing of the buyer is unsatisfactory, the seller shall be at liberty to cancel this contract as regards the whole or part of the goods at their discretion without incurring any liability whatever to the buyer, other than a liability to refund the price of the goods not dispatched if already paid.

8. If any delivery to be made under this contract be cancelled wholly or in part at the instance of the buyer or if the buyer rejects the goods or any part thereof delivered to him by the seller under this contract the seller shall be entitled to recover from the buyer either as and for liquidated damages a sum equal to 20% of the contract price of the goods left undelivered at the buyer's instance or rejected by the buyer (which sum is hereby agreed as the estimated damage likely to result to the seller from such cancellation or rejection by the buyer) or that the seller's option such damage as he may then be able establish that he has, in fact, suffered by reason of such cancellation or rejection.

9. If any delivery to be made under this contract be cancelled in whole or in part at the seller otherwise than from some causes specified in clause 7 herein, or if the seller fails to deliver the goods under this contract, or any part of them, the buyer should be entitled to recover from the seller reasonable compensation as the buyer may then be able to establish that he has, in fact, suffered by reason of the seller's default.

10. The parties hereby agree to exclude any right or application of appeal to their National Court in connection with any question of law arising in the course of the arbitration or with respect to any award made.

11. The ownership of the goods supplied under this contract will remain with the supplier and the supplier reserves the right to dispose of the goods until the sums due under the contract have been paid in full.





Deleeuw Flowerbulb Group B.V.

P.O. Box 46, 2170 AA Sassenheim - Holland
Tel.: +31-252-360260; Fax: +31-252-360270
E-mail: deleeuw@bulbs.nl
www.bulbs.nl