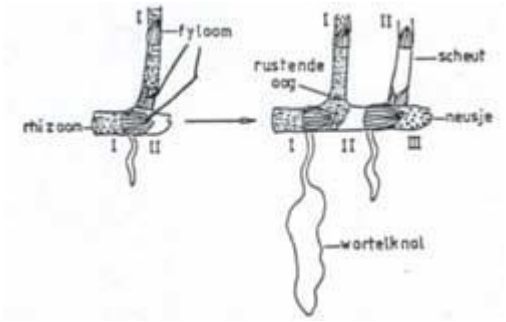
Growing Information Alstroemeria Cut Flower

Alstroemeria is still a relatively new product on the world market and interest in it is continually growing. This growth is due to the fact that this crop is fairly easy to cultivate and does not require special demands. The flowers are beautiful and have a very long vase life.

1. Morphology



Alstroemeria has an underground rhizome, which develops vertical shoots. The main rhizome can generate new lateral rhizomes that can also produce flowering shoots. Above the soil, the stems do not generate any lateral stems. Since the major part of the plant's development occurs underground, the temperature of the soil plays an important role in this development. After a period of high soil temperatures, the plant produces many shoots (and new rhizomes). However, depending on the variety, many of these shoots remain blind (i.e. they do not produce flowers).
One alstroemeria stem can produce 3 to 7 flowers, each on a lateral pedicel near the tip of the stem. There are different types of alstroemeria (orchid, butterfly, and aurantiaca) but most of today's types are hybrids. Although there is year-round production, alstroemeria still have a production peak in spring and (when soil cooling is used) also often in the autumn.

2. Culture methods and productivity

Most alstroemeria are cultivated in heated glasshouses or plastic tunnels. It is also possible to grow them in unheated glasshouses, plastic tunnels or even outside as long as the soil doesn't freeze. Note, that if temperatures are too cold (<8 °C / 46,4 °F) and too humid, they won't flower in the winter
Ten to fifteen weeks after having planted the alstroemeria, they start to flower; and this continues for 3 to 4 years. After 3 to 4 years the plants still produce enough flower stems, but the quality becomes thinner and the crop becomes much more labour-intensive. It is then more profitable to replant the same or a newer variety. Some varieties do maintain their quality for cultivation up to 5 or 6 years (e.g. Tampa and California).
The production level shows a wide range from 180 to 400 stems per m2 per year depending on variety, production method, the amount of light, and the availability of soil cooling. Normally about 60-80 % of the production can be sold as first quality (4 flowers or more per stem with a certain stem thickness). This depends on the variety and the year of production.

For a general impression of possible production levels:

planted where	planted when	first year - stems/m²	following years - stems/m²
outside	may	50-70	120-150
unheated tunnel or glasshouse	may	70-100	150-220
heated glasshouse	january	150-220	200-350
heated glasshouse	may	100-150	200-350
Heated glasshouse with HID*	january	180-250	300-450

**HID = High Intensity Disclosure lighting*

3. Planting

Young alstroemeria plants are usually propagated by tissue culture, and sometimes by manual division of the plant. The plants are delivered in 9-cm or 7-cm pots. Alstroemeria are planted in two rows running along beds measuring 1.02 to 1.19 metres wide. For beds 1.02 metres wide, we normally plant 3.1 plants/m² of glasshouse space. The distance between plants along a row is 34 to 40 cm depending on the type of alstroemeria and the width of the beds. The distance between the rows should be 40 to 50 cm, depending on how fast the rhizome grows toward the edge of the bed. Two to four layers of support material (netting) are required. The netting usually has openings of 20 x 17 cm.

Planting layout for alstroemeria:
2 rows of plants/bed.

Desired number of plants/gross m²	Distance in cm between plants along on the row	Number of plants/10 linear metres of bed (with 2 rows/bed)
3.0	41.6	48.1
3.1	40.3	49.6
3.6	34.7	57.6
4.0	31.2	64.1
4.5	27.7	72.2

4. Planting seasons

In Europe, alstroemeria are usually planted from November to June and in the southern hemisphere from September to December.

5. Irrigation/soil

Alstroemeria are being grown on practically all types of soil from peat, sandy soils to heavy clay. As long as the soil contains enough air and is properly drained, producing high yields of stems is possible. If this is not the case, then it is advisable to improve the structure of the soil by adding composted bark.
The irrigation system must be adjusted to the soil. Normally, water is provided from underneath by a sprinkler system. Drip lines can also be used, but the horizontal transport of the water through the soil must be sufficient to keep all of the soil consistently moist. In hot countries, a combination of drip lines and an

overhead sprinkler system can be very useful; this combination also maintains a better climate in the summer if the humidity gets lower than 50 %.
Alstroemeria perform best when plants receive frequent, fairly heavy watering, because most of the roots are located in the top layer of the soil (0-25 cm beneath the surface). Only when growth is very intensive in the autumn and winter, or when the leaves turn yellow is it better to give less water for a few weeks.

6. Fertilising

Before planting, make sure that the soil has the proper structure and that the amount of phosphate in the soil is sufficient (PAL> 80). The values for other nutrients must be at least in line with those listed in the table, below. Values slightly under these levels should pose no problem provided that highly soluble fertilisers are administered on a regular basis (at least once a week) via the irrigation system. Commonly provided nutrients are ammonium nitrate, calcium nitrate, potassium nitrate, magnesium nitrate, and magnesium sulphate. In the Netherlands, most growers use the A and B container system in which they provide fertilisers with almost every watering (using water with an EC of about 1 to 2).
To get plants off to a good start, the concentration of salt (the electrical conductivity or EC) should not be too high at planting time, especially in the summer (1,0 Ec). The following table provides a list of minimum and maximum nutrient levels in the soil. For reasons of quality it is better to strive for the higher levels in the autumn and winter when growth is very intensive. During periods of extreme crop evaporation (spring and summer), strive for the lower figures.

Target nutrient levels in the soil (1:2 volume extract):
mmol/l

	PH	EC	NH^{+}	K^{+}	Ca^{2+}	Mg^{2+}	NO_3^{+}	SO_4^{2-}
min	5.5	0.8	0.1	1.5	1.7	1.0	3.0	1.0
max.	6.5	1.6	0.4	4.0	2.8	2.0	6.0	3.5

	H_2PO4^{2-}	Fe^{2+}	Mn^{2+}	Zn^{2+}	B	Cu^{2+}
min	0.15	3.5	0.5	1.5	10.0	0.5
max.	0.25	15.0	4.0	4.0	30.0	2.5

For substrates like perlite or cocopeat there are other nutrient levels (not listed here).
If the pH of the soil is too high (7 or higher), iron or manganese deficiency may occur. This will be displayed by a yellowing of the leaves. A lack of iron can be treated by providing 6-8 grams of EDDHA per m² or by providing this regularly in irrigation water, but it will not always solve the problem.
Yellowing of the leaves can be a frequent problem with certain varieties. Yellowing can appear after a high production period when the plants have lost some active roots or at the end of winter, when the plant has fewer roots due to low light conditions. Cold soil (10-12°C / 50-53,6°F) and excess water prolong the problem. The butterfly types display fewer problems in this regard.

7. Air temperature

For a period of six weeks after planting, the temperature is to be kept at 13°C (55,4°F) during the night and between 14-16°C (57,2-60,8°F) during the day. A lower temperature causes a slower start in the production, but can provide higher quality and shorter stem length.
During the summer, an average of 17 to 22°C (62,6-71,6°F) is an excellent temperature for the growth of alstroemeria. Cool nights and maintaining soil temperatures between 14 to 17°C (57,2-62,6°F) are desirable for high-quality results. In warm countries, it is necessary to use whitewash on the glasshouse if the temperature regularly rises above 30°C (85,9°F).

During the late autumn and winter, the temperature is kept between 10 and 14°C (50 and 57,2°F), depending on the variety, its length, and the quality of the stem. The more natural and/or artificial light the crop receives, the higher the temperature that can be maintained. Temperatures under 9-10°C (48,2-50°F) lead to the very slow development of plants as well as very low production.
In the early spring (February/March), it is better to heat a little more (13-15°C / 55,4-59°F) or on sunny days to keep the warmth inside the glasshouse by ventilating less. This will produce an earlier, more uniform production peak in the spring and a better recovery of the foliage before the summer.

8. Soil temperature

The development of alstroemeria shoots takes place in the underground rhizomes. High soil temperatures during the summer will often lead to poor flower induction among many varieties (e.g. Fuji, Isola, Tampa). This is why the number of blind shoots increases during the autumn and winter. There are varieties less susceptible to developing blind shoots and which also flower in the autumn without soil cooling (e.g. Modena, Glacier, Stratus, Hot Pepper). But even then, most become taller and produce later and less uniformly than when soil cooling is provided. In addition, the crop is prone to be more labouring intensive. Nowadays, many growers use a soil cooling system to prevent the crop from making too many blind shoots in the autumn. For most varieties, it is advisable to keep the soil temperature at about 14°C (57,2°F) in the summer (in Europe, this is from June to October). In countries where light intensity is higher (Southern Europe and Japan), this could be a little higher (15-17°C / 59-62,6°F). In countries like Colombia where alstroemeria are grown at an altitude of about 2000 meter, it is not necessary to cool the soil.
Generally during the spring (before week 20), the soil temperature may be allowed to rise a little higher for a few weeks before one starts to cool the soil (up to 16-17°C / 60,8-62,6°F). This will encourage the plant to generate sufficient numbers of shoots before summer.
If the soil temperature becomes too low in the winter (12°C / 53,6°F) or lower in January to March for several months, it will cause a late spring production. Depending on the variety, it will also lead to a lack of vegetation and poorer stem quality in the summer. Therefore some growers apply the soil cooling system also for heating the soil to 13-14°C (55,4-57,2°F) in the winter.
When applying assimilation lighting with high-pressure sodium lamps (also called High Intensity Disclosure lighting = HID), the soil has to be between 14-16°C (57,2 -60,8°F) year round (see the section on Lighting).

9. Humidity

The ideal humidity is between 70-80%. Although alstroemeria is not very susceptible to Botrytis, it is better to keep the humidity below 90% during the winter. High humidity produces taller stems as well as larger and weaker leaves. During the early spring, on the first warm days of the year, quite a few varieties are susceptible to leaf scorch. The leaves (and especially the stems that are just starting to produce leaves) have not yet adjusted to the evaporation process. To prepare the plants for such circumstances, it is better to ventilate and/or heat a bit more on the days and nights when humidity levels are higher than 85-87%. The use of fans in the glasshouse can also improve the situation. Nevertheless, it is very difficult to prevent this problem on the first sunny day following a cloudy period. On the other hand, on very sunny days during the spring, when the relative humidity drops below 70%, it would be best to use a sprinkler system or a screen.

10. CO^2

Providing extra CO^2 in glasshouses will result in a increase in quality and a 10-20% increase in production. Maintain a CO^2 level of up to 350-400 p.p.m. in the summer and check that the windows are not more than 20% open. With closed windows in winter, the best CO^2 level is between 600-800 p.p.m. With a CO^2 level higher than 1000 p.p.m., the plants are neither damaged nor benefited.

11. Lighting

Assimilation lighting with HID-lamps causes a better quality and more flowering stems in winter.
Lighting with 3000-3500 lux/m2 can start towards the end of September or at least by early October with a 14-hour day length and terminating in February with a 12-hour day length. Day length is the hours of natural daylight plus the hours of assimilation lighting. Due to the restrained shoot formation caused by long days; especially in combination with low soil temperatures (14°C / 57,2°F and lower), lighting should be restricted to 12 hours from December to February. Maintaining a longer day length in combination with a low soil temperature will result in insufficient numbers of new shoots in December and January - resulting in decreased vegetation and quality in February/March. Also, the peak in production in spring will arrive later and provide smaller yields. It is recommended to count, on a weekly basis, the number of young shoots (up to 10 cm in length) of a set sample of plants. This is a simple control measure, to see if the plants are continuing to make new shoots.
With more lighting capacity (4000+ Lux/m²) and higher soil temperatures, it is possible to maintain a day length of 15-18 hours from September to April, as well as glasshouse temperatures between 14-15°C (57,2-59°F). In climates comparable to Northern Europe, this can result in a production of about 50-100 more stems/m2 per year - stems that are of better quality in the winter. With 8000 lux/m² production becomes even higher and more regular. However, profitability depends on the investment needed and the costs of electricity. This has to be calculated in each situation.
With HID lighting, it is necessary to keep the soil temperature in the winter between 14-15,5 °C (57,2-59,9°F) in order to ensure sufficient vegetation and quality from January to March. If it is not possible to keep this soil temperature, then it is better to restrict the day length to a maximum of 14 hours. Also, it is important to prevent soil temperatures from rising too high in the winter, which can easily happen to plants kept underneath a screen and when outside temperatures are moderate. Temperatures higher than 15,5°C (59,9°F) for weeks on end in December and January, can cause numerous blind and thinner stems the rest of the year.

12. Diseases and other problems

While alstroemeria are not particularly susceptible to diseases: aphids, thrips, spider mites, slugs, caterpillars, white flies and nematodes (Pratylenchus) can at times cause problems. Only when the soil becomes too wet do Pythium and less often Phythophthora present a problem. Rhizoctonia sometimes develops under warm humid conditions. Few varieties are susceptible to viruses such as TSWV and INSV, which could then present serious problems. Weeds can be a problem in the summer, when the plants have not yet produced much foliage. The following nutrient deficiencies can develop:
• Iron deficiency manifested in the yellowing of the youngest leaves, while all the veins remain green. This

most frequently occurs with high pH levels.
• Manganese deficiency manifested in the yellowing of leaves, in which only the larger veins remain green.
• Magnesium deficiency manifested in the yellowing of older leaves as well as signs of green-yellow stripes on the leaves.

13. Harvesting and other required work

Harvesting takes place by pulling the stems out of the soil. This requires less work then cutting. Cutting is done only with certain varieties in which the rhizome would be too heavily damaged were pulling to be done (especially in the case of young plants). The stems are harvested twice a week during the winter, and 3-4 times a week during the summer. After harvesting and grading, the flowers are placed in a solution containing gibberellin, a plant hormone that prevents the yellowing of the leaves.

Other required work includes stem guidance and thinning. Except during the first six months, new shoots must be hand guided so that they remain vertical and in between the layers of netting, which is the support system for the plant crop. This is done on a weekly basis.
Also, blind shoots, as well as old and damaged stems are thinned out regularly throughout the year. This keeps the vegetation sufficiently open and aired. Without soil cooling and during the autumn and winter this activity is ever more necessary.