# Pot Chrysanthemums Production

## "Principles & Practices – in Brief"

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# Pot Chrysanthemums

## Principles & Practices

**In response to questions regarding some of the principles and practices associated with pot chrysanthemum production the following brief outline provides some answers.**

### *1. What is the basic production schedule?*

| **Long days** (10 - 21 days) | **Short days** (7 - 9 weeks) |
|---|---|
| Vegetative growth | Bud initiation and flower development |
| Night-break lighting | Black-out cover |
| Less than 8 hrs continuous darkness | 12-16 hrs continuous darkness |

### *2. What has day length got to do with it?*

In 1920 it was discovered that flowering of chrysanthemums was governed by the length of day (the period from sunrise to sunset). This control of flowering by day length is known as photoperiod. Because chrysanthemums were found to flower when the days were decreasing in length, they were classified as 'short-day' plants. It was discovered that it was the length of night, not the length of day, that causes the switch to flowering i.e. they should really be called 'long night' plants.

The chrysanthemum in its natural habitat flowers in the autumn. The plant grows vegetatively during the long days (short nights) of summer. Bud initiation occurs when the first critical photoperiod is reached as the days become shorter (nights become longer) in the autumn. Development of the flower buds continues later in the autumn as the days continue to shorten (nights lengthen) ie. when the critical period for flower development is reached. Night lengths greater than 9.5 hours (continuous darkness) are required to initiate flower buds and night length of 10.5 hours (continuous darkness) or more are required for flower development.

[Note: All varieties of chrysanthemum will eventually produce a flower bud in long-day conditions - this is know as a long-day bud and is generally determined by the number of leaves formed on the shoot (the leaf number). Delay in taking cuttings from the stock plant may lead to unwanted buds in varieties which have low long-day leaf numbers.]

### *3. Why use night-break lighting?*

This treatment is applied to distinguish between 'Long Days' and 'Short Days'.

### *A. Long Days*

In commercial production the aim is to produce flowering pot chrysanthemums with the desired final size characteristics on a particular date. Photoperiod control is essential to achieve this objective.

The photoperiodic sequence in producing potted chrysanthemums always consists of Long Day (LD) vegetative growth followed by Short Day (SD) reproductive 'flowering' growth. The length of the LD period determines the size of the vegetative plant at the start of SD. The size of plant achieved during propagation influences the final size of the flowering plant, hence more long days are given in winter to achieve a better structure when plant growth is slower.

Long days must be provided to the plants during the desired vegetative phase either from natural long days (summer) or artificially during natural SD (autumn/winter/spring). The most effective method of preventing flower bud initiation when plants have to be kept vegetative has been found to be the use of artificial lighting during the night to produce two dark periods shorter than 9.5 hours (to be safe this is usually less than 8 hours).

Long day conditions are normally created by lighting the plants during the middle of the night (dark period). Because most year-round growers use automatic black-out systems which cover the whole glasshouse in summer, lights have to be used under the blackout where long day conditions are required (for 4-5 hours in the middle of the night).

Plants are only receptive to long day (and short day) lighting stimulus when the cuttings have developed root primordia ie. 4-5 days after sticking.

It is known that the inhibiting effect of night-break lighting continues for a short period after the lamps are switched off so it is now considered unnecessary to give continuous illumination during the lighting phase. The alternative to lighting continuously during the night interruption period is to employ what is called cyclic lighting. For installations providing not less than 100 lux illuminance (from

incandescent lamps) 10 minutes of continuous light are required in every 30 minute cycle ie. 10 minutes on: 20 minutes off.

To improve vegetative growth during the winter months supplementary lighting from high intensity discharge (sodium) lamps may be used for 24 hours per day (no additional LD light treatment is necessary when plants receive supplemental lighting during the night).

***B. Short Days***

The term response group is commonly used to describe the time in weeks from the start of flower initiation (SD) to the flowering of that variety.

Short photoperiods - SD (long nights) must be supplied naturally or artificially for proper flowering. During natural long day periods of the year artificial short days are supplied by pulling black-out covers over the plants for 12-15 hours per day (March 21 to September 21 in Northern hemisphere). Conventionally 11 hours of daylight and 13 hours of darkness are applied during the short day period. Recent research has been evaluating the influence on pot quality of reducing the night length.

[Note: Screens are used in winter to retain heat within the greenhouse (thermal cover) rather than to provide black-out.]

The application of artificial short days needs to be followed continuously from the start of SD until at least the first indication of colour on the flower buds to ensure that there is no delay in flowering.

[Note: High temperatures can also delay bud initiation and subsequent flower development. If high temperatures develop under the black-out the material can be retracted after sunset, so that the heat can escape, and reapplied prior to dawn.]

***4. Why and how is pinching carried out?***

The main growing point on a vegetative chrysanthemum shoot produces a hormone which passes down the plant and inhibits the outgrowth of the auxillary buds (potential side shoots). If the growing point is removed by 'pinching' the flow of the hormone is interrupted and the auxillary buds are free to grow out and form new shoots.

The main reason for pinching is to increase the number of flowers per plant so it is important that the pinch is made where it will result in the maximum number of breaks (since each break bears flowers). This occurs with a 'soft pinch' ie. pinching out 1-2 cms of new growth rather than pinching in hard wood lower down the stem.

The plants must be at the correct stage of maturity to get the best result from the pinch. They need to have made sufficient development to allow 7-9 cms of plant to be left after the pinch (5-6 cms on 10cm pots) with 7-9 leaves remaining on the plant (5-6 leaves on 10cm pots).

A pinch made lower on the stem than suggested will result in fewer breaks because the pinch is made into harder tissue. Fewer auxillary buds are left behind on the stem after a 'low pinch' and this also reduces the potential number of breaks.

Pinching at, or close to, the short day date will give longer, leafier breaks, which, if well controlled, can enhance quality. If pinching is left too late after the short day date, i.e. much over 14 days, then shorter breaks with less leaf development can occur as the flower bud development is more advanced. If pinching is carried out too early this can also cause problems as it will also result in fewer breaks and, since it is difficult to determine the optimum number of leaves to be left, can create more unevenness.

(See YT Workshop - " Pinching of Year Round Pot Chrysanthemums" for further detail.)

***5. How do growth regulators work and how much is required?***

Pot chrysanthemums are usually treated with a chemical growth retardant to ensure strong compact growth, by preventing them from growing to their full height, and in order to meet market specifications.

The growth retardant commonly used on potted chrysanthemums is commonly known as B9/alar (active ingredient - daminozide) and was developed as a plant growth retardant in the early 1960s. It is currently available as "Dazide" (Fine Agrochemicals Ltd) or B-Nine (Uni-Royal Chemical, distributed by Fargro Ltd.).

The growth retardant blocks or interferes with plant hormones (gibberellins) controlling cell division and possibly elongation at the shoot tips (and possibly in young leaves). The internode length (stem portion between successive leaves) is decreased without affecting the number of leaves and plants therefore become more compact. Improved leaf colour results either from the development of thicker leaves or from closer packing of an increased number of cells within the leaf. Flowering may be slightly delayed, flowers may be slightly smaller, and the intensity of flower colour may be reduced, especially if applied late in the production period (seen in bronze, pink, red and purple cultivars).

The amount and timing of B-9 applications is dependent on the cultivar, temperatures and light intensity (seasonal influences). Different chrysanthemum cultivars vary in their vigour and are generally classified as short, medium or tall.

Understanding this vigour helps in planning lighting treatments and B-9 applications. Generally B-9 is applied during propagation- ideally 24 hours after sticking when cuttings have regained turgor and again 8-10 days later - relative to variety and time of year. The second application is given after pinching when breaks are approximately 2 cm long. Uptake and transport of B-9 by the young leaves on the breaks is most effective at this stage since plant growth is rapid and there is sufficient young leaf tissue to absorb the chemical. Follow-up applications are made 7-10 days later relative to varietal vigour / growth rate / time of year. Further applications are given according to vigour.

For example:

| Vigour group | No. of post-pinch B-9 applications |
|---|---|
| Short | 0-1 |
| Medium | 1-2 |
| Tall | 2-3 |

The B-9 rates range from: 0.5g/litre - 1.5g/litre during propagation to 1.5g/litre - 4.5g/litre after pinching again depending on the variety and time of year. Short varieties receive nil or minimal B-9 treatment whereas higher rates are used for tall growing varieties and during the warmest, brightest growing seasons.

***6. What causes plant disorders such as blind growth and scorching?***

Year round precision control of potted chrysanthemum flowering is possible with daylength manipulation so failure to flower should seldom occur. Failure to provide proper conditions can cause the development of crown buds. (This may have occurred on the stock plantings so the cuttings were already triggered to develop buds - old shoots or incorrect/inadequate lighting regime). Very cold or very warm conditions can delay development and failure to provide short days prevents bud initiation. Old or torn black-out material which does not prevent light penetration can also result in failure to flower. Ethylene pollution from $CO_2$ burners can also cause failure of plants to initiate flower buds. Plants will remain vegetative if exposed to ethylene.

Plant shoots can lose their growing points due to a wide range of influences, for example, excess heat causing tip scorch, bacterial rot, pesticide damage, insect attack. The shoot may thus fail to develop and/or resultant growth will be severely restricted.

Scorching of plant tissue is generally associated with high temperature and high light, particularly when the plant tissue is most vulnerable (eg. young cuttings with no roots, young plants being weaned or older plants under irrigation stress). It is minimized by providing suitable shading to reduce temperature build-up from direct sunlight, misting to provide evaporative cooling and avoiding irrigation stresses (too dry or too wet).