

## Hardy nursery stock

# Hardy nursery stock – management of stock plants

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Well managed stock plants help meet the demand for reliable and timely supplies of high quality propagation material and enable nurserymen to exercise quality control from the start of the production process. This factsheet considers the main elements of successful stock plant management.

## Action points

### Site preparation

- Choose areas of suitable soil-type for field grown stock plants and if necessary, add organic matter, fertilisers and lime to improve the structure and nutritional status.

### Planting

- Use clonal stock plants for improved uniformity and vegetative propagation performance. Allow at least three years for them to establish in the field.
- When setting out stock plants, follow the recommended in-row and between-row spacings to ensure easy access and management.
- In field situations, plant through black polythene or permeable mulches to control weeds, particularly during the initial establishment period of stock plants.

### Maintenance

- In dry conditions, irrigate stock plants at least 24 hours before taking cuttings for best results.
- Monitor irrigation requirements and nutrition levels regularly, particularly with container grown stock plants.
- Prune stock plants routinely to maintain their juvenility and productive life. Begin renewal plantings

at least three years in advance of stock removal to ensure continuity of supply.

### Growth manipulation

- Consider using blue coloured films with alpine stock plants grown in containers under protection for compact cutting material that roots well.
- Use shading to improve the growth and cutting quality of high value subjects such as (evergreen) *Azalea*, *Camellia*, *Eucryphia*, *Magnolia*, *Pieris*, *Rhododendron* and *Skimmia*.

- Evaluate supplementary lighting to advance and improve the quality of stock plant growth under protection and for enhanced production of early cuttings.

### Harvesting

- Ideally, harvest soft and semi-ripe cuttings in the morning when conditions are cool. Store in shallow boxes/trays or white polythene bags at 4°C and 90% relative humidity. Use the material quickly and avoid long term storage.



1 Use clonal stock plants to optimise uniformity and propagation performance

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## Benefits of stock plants

The primary role of a stock plant area is to provide an adequate supply of healthy, high quality, true-to-type plant material at the optimum time for propagation. The principal benefits of well managed stock plants are:

### 1 Plant health status is known

Dedicated stock plant areas can be monitored and managed to provide clean cutting material free from pests and diseases including virus infection (particularly important when propagating fruit nursery stock).

### 2 Propagation material can be quality controlled

Uniform stock plant growth provides graded batches of even, high quality cuttings that root faster and more evenly. Clonal stock plants selected for enhanced rooting potential provide the best material for vegetative propagation. For seed propagation, stock plants also help provide a more reliable, timely and known source of high quality seed with better prospects for reliable germination.

### 3 Management is easier

Weeds, pests and diseases can be kept under close control. Nutrition and pruning can also be carefully

managed and stock plants under protection forced as necessary for early cuttings.



2 Stock plants should provide sufficient healthy, high quality, true-to-type plant material

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## Sources of stock plants and propagation material

Suitable stock can be selected from high quality growing crops on the nursery to establish clonal stock beds.

Good quality, uniform liner crops are also a valuable source of cutting material, which is juvenile and easy to root. Growing crops on the nursery are a popular source of propagation material too but such plants must be healthy, uniform and true-to-type.

Clonal material for budding and cuttings propagation can also be obtained from specialist commercial

sources on the continent. The Dutch based NAKB plant health scheme is a valuable source of virus free plant material and particularly important for the propagation of ornamental tree crops and fruit nursery stock.

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## Site selection and preparation

Stock plants can be grown in containers and the open ground, both outdoors and under protection. The use of protected structures provides opportunities for forcing early cutting material and is particularly useful for crops such as deciduous *Azalea*, *Cotinus*, *Exochorda*, *Hydrangea*, *Magnolia* and *Syringa* which root well from soft, juvenile cutting material taken early in the season.

In field situations or where planting in borders under protection, a suitable soil type is essential and thorough soil preparation before planting. The land should be free from soil-borne disease pathogens such as *Phytophthora* spp. or *Verticillium dahliae* and, perennial weeds. It is also important to check the land for the presence of root-invading nematodes such as *Pratylenchus* spp and *Xiphinema* spp.



3 Stock plants grown under protection are useful for early cuttings and for meeting scheduled production requirements

## Field grown stock plants

### Soil type

Soils should be deep, well drained and moisture retentive. Soils of the texture 'sandy loam' or 'silt loam' are ideal. Lighter sandy soils can be considered but it is important to maintain good levels of irrigation and major nutrients, particularly potash, to sustain long term stock plants on such soils. Land which slopes can be accommodated providing the gradient is not excessive. Ensure the soil has adequate reserves of organic matter and apply farmyard manure or another suitable bulky organic manure if necessary.

### Weed control

Allow at least one full growing season before planting to ensure the land is weed free. Perennial weeds such as bindweed, couch grass and thistle must be eradicated before planting;

where perennial weed pressure is exceptionally high, alternative sites should be considered.

### Soil nutrient levels

Soil analyses should be undertaken to check nutrient levels and base fertiliser dressings applied accordingly – see Tables 1 and 2. Note: the figures in Tables 1 and 2 are recommended rates of nutrient **not** fertiliser; for example, 50 kg/ha of nitrogen is equivalent to 145 kg/ha of actual ammonium nitrate fertiliser (34.5% N). Slow growing conifers, ericaceous spp and liners can be sensitive to excessive amounts of soluble fertiliser; for such crops, omit soluble N fertiliser before planting and apply a top-dressing once established (50 kg/ha N maximum.)

For ericaceous and calcifuge spp, use ammonium nitrate (eg Nitram) instead of ammonium nitrate lime fertilisers (eg Nitrochalk). If the pH

of the soil needs to be reduced further, ammonium sulphate may be used.

### Drainage

Good drainage is very important; deep cultivate if necessary during the summer months. In heavy soil situations, raised beds are preferable for plants requiring good drainage.

### Soil pH

Check the pH and percentage calcium carbonate in the soil before planting; acid soils are essential for ericaceous species, conifers and certain evergreens such as *Camellia*, *Magnolia* and *Skimmia*. High pH soils (above 7.0) have potential but are not suitable for some subjects eg *Crinodendron*, *Enkianthus*, *Hamamelis* and *Hibiscus*. Soils with a neutral pH (7.0) are ideal and will accommodate the widest range of species.

**Table 1**  
Nitrogen rates for field grown nursery stock

Species	Base dressing (kg/ha N)	Top dressing (kg/ha N)
Ericaceous, calcifuge & slow growing spp.	0–50	0–50
Medium & quick growing spp.	50–150	50–150

**Table 2**  
Phosphate (P<sub>2</sub>O<sub>5</sub>), potash (K<sub>2</sub>O) and magnesium (Mg) requirements of field grown nursery stock by soil analysis

Soil P, K or Mg Index	Before planting			Top dressing		
	Phosphate	Potash	Mg*	Phosphate	Potash	Mg
	(kg/ha)			(kg/ha)		
0	100	200	75	50	100	25
1	75	150	50	25	50	Nil
2	<b>50</b>	<b>100</b>	25	<b>Nil</b>	<b>25**</b>	<b>Nil</b>
3	25	50	<b>Nil</b>	Nil	Nil	Nil
Over 3	Nil	Nil	Nil	Nil	Nil	Nil

In the absence of soil analysis data, use the figures in bold print.

If a heavy dressing of farmyard manure is applied before planting, the fertiliser can be reduced by 20 kg/ha phosphate, 40 kg/ha potash and 8 kg/ha magnesium per 10 tonnes of manure. A minimum of 50 kg/ha of phosphate and potash as fertiliser should always be applied where the soil index is 0 or 1.

\* Use magnesian limestone for calcicole areas and kieserite for ericaceous, calcifuge and conifer areas.

\*\* For top-dressing, where the K index is at the lower end of Index 2, apply 50 kg/ha.

### Site protection

Adequate frost protection and shelter are essential, particularly in very open situations. Avoid frost pockets. Prolonged exposure to strong, cold winds can reduce cutting yield and quality and, the effective lifespan of stock beds. Fencing from rabbits and deer must also be considered. See HDC factsheet 07/04 for further information on controlling rabbits.

### Container grown stock plants

These provide flexibility, allowing plants to be grown either outdoors or under protection in different environments to control growth. This is particularly useful for scheduled production systems that require regular supplies of cuttings. Space requirements and soil type suitability are further considerations when choosing between field or container grown stock plants which, ideally, should also be within easy reach of the propagation unit to ease and speed handling.



4 Container grown stock plants provide flexibility and are particularly useful where regular and timely supplies of cuttings are required

Substrates must be well drained and contain adequate nutrients to sustain quality growth; long term controlled release fertilisers are ideal although supplementary feeding will be

necessary as stock plants become established. See HDC factsheet on nutrition of container grown nursery stock for further information.

### Planting and spacing

Good access is essential and planting in soil or containers, at spacings appropriate to the vigour of the species concerned makes stock plant management easier. Table 3 sets out recommended spacings. Small growing species such as heathers can be planted on a bed system using a spacing of 450 mm x 450 mm. Label the plants accurately

and include the correct plant origin. With slow growing species such as *Camellia*, *Elaeagnus*, *Ilex* or *Rhododendron* early cutting production can be increased by planting double the number of plants that are ultimately required and subsequently removing alternate ones as growth proceeds.

#### Number of stock plants required

This will vary with species and the requirements of the nursery. At least three years will also be required to

build up cutting potential and it is important not to 'over harvest' stock plants during this phase. As a general guide, stock plants numbers should be based on 25 cuttings per plant in year 2, 50 cuttings per plant in year 3 and 100 per plant in year 4 rising to 150 per plant from year 5 onwards.

**Table 3**  
Recommended in-row and between-row spacings for slow, fast and medium, growing stock plant species

Vigour / growth rate	In-row spacing	Between-row spacing
Slow eg <i>Camellia</i>	0.6–0.9 m	0.9–1.2 m
Medium eg <i>Berberis</i>	0.9–1.2 m	1.2–1.8 m
Fast eg <i>Buddleia</i>	1.2–1.8 m	1.8m–3.0 m

## Maintaining stock beds

Stock plant areas should be managed properly if their full potential is to be achieved. Regular maintenance is essential and includes:

### Nutrition

Annual top dressings should be applied to field grown nursery stock each spring (Tables 1 and 2) with soil samples taken every three years to check nutrient levels. Container stock will also require regular supplementary nutrition once established; re-potting may become necessary to maintain quality. Rooting of cuttings depends on several factors including the ratio of carbon to nitrogen in the material itself. An excess of nitrogen will reduce rooting performance so nutrition must therefore be well balanced.

### Irrigation

Adequate irrigation during the growing season is essential. Efficient rooting requires cutting material to be turgid and this may involve irrigating stock plants at least 24 hours before removing the material. In the field, overhead watering may suffice whilst for large stock plants in containers, a drip-point system will be required. Where polythene or permeable mulches are used to maintain weed control, a good quality drip line installed underneath the mulch provides the best results. A drip line with in-line pressure compensated drippers will be less likely to clog up over time.

### Weed control

Weed competition reduces growth and weeds themselves can also be a source of pests and diseases. Where background weed pressure is high, soil sterilisation should be considered prior to planting; dazomet (Basamid) will provide good levels of weed control.

Planting through black polythene or permeable mulches to control weeds should be considered, particularly during the initial establishment period. Such covers reduce the need for herbicides, help conserve soil moisture and provide a clean surface to work from. They also reduce soil splash and the spread of pathogens such as *Rhizoctonia*. This system is ideal for heathers, alpiners and slow growing

shrub species although container systems are increasingly used with a 3–5 year renewal schedule.

Other non-chemical weed control options include the use of mechanical cultivation down alleyways and along headlands in field situations, mulching with organic materials such as bark and grassing down / mowing of alleyways between plants.

Residual herbicides can be considered once stock plants are established but should be used with care; very soluble materials may cause damage, check growth or reduce rooting ability of cuttings. During the summer months, periodic use of contact herbicides may suffice and in dry conditions, prove more effective.

It is important to check the prevailing weed species so that the most appropriate herbicide is used. Under protection, herbicide options are more restricted.

### Pest and disease control

Regular pest and disease monitoring and a preventative, programmed approach are essential for successful control and for the production of clean and healthy propagation material.

Specific disease problems include downy mildew (*Hebe*, roses), fireblight (*Cotoneaster*, *Malus*, *Prunus* spp and *Pyracantha*.), *Rhizoctonia* (heathers) and rust (*Betula*, *Fuchsia*, *Hypericum* and *Vinca*).

In field situations, soil-borne pathogens such as *Phytophthora* and *Verticillium* can also cause problems. *Phytophthora* has a wide host range which includes conifers, *Rhododendron* and Ericaceous spp whilst *Verticillium* mostly affects *Acer* varieties and Rosaceous subjects. In such cases, soil sterilisation should be considered although clean land and crop rotation are the best solutions. Under protection, *Botrytis* will need to be controlled



5 Adequate irrigation during the season ensures cutting material is in optimum condition for propagation: field irrigation equipment (left) trickle irrigation of stock plants (right)



6 Raised stock plant beds provide improved drainage for moisture sensitive subjects and permeable mulches provide weed control and conserve soil moisture



7 Treat promptly or remove stock plants with problems such as powdery mildew

during the autumn / winter period. See HDC factsheets 23/02, 24/02, 25/02, 04/04 and 14/04 for further information on disease control. Wound pathogens such as *Pestalotiopsis funerea* on Junipers and *Monochaetia karstenii* on *Camellia*

and *Pieris* can be a particular problem amongst stock plants where the regular removal of cuttings coupled with routine pruning frequently predisposes plants to disease attack. Various leaf spot and stem die-back pathogens can also pose problems

with *Garrya*, *Hedera*, *Hebe* and *Lavendula*. Routine fungicide programmes before and after the removal of cuttings may be necessary.

## Pruning

Regular pruning is necessary for both field and container grown stock plants to maintain quality cutting production. Where possible, pruning work should be mechanised to save time. Pneumatic pruning shears can be considered for vigorous woody subjects and are particularly useful when dealing with older plants during renewal pruning or when harvesting winter cuttings of fruit rootstocks and ornamental subjects such as *Cornus*, *Salix* and *Platanus*.

Annual pruning, usually in spring, is important if stock plants are to remain fully productive. Regular pruning maintains juvenility and so improves the quality, rooting ability and growth potential of cuttings. It also regulates plant shape and so makes stock plant management easier. Cutting yield is also increased.

The type of pruning undertaken will vary with species but may be broadly categorised as follows:

### Severe pruning (stooling)

Where plants are cut back hard almost to ground level annually to produce a strong flush of new growth

suitable for cutting material. Such pruning discourages the production of floral buds and maintains the juvenility and hence productivity of the stock plants. Subjects that can be pruned in this way include *Cornus*, *Hydrangea*, *Hypericum*, *Potentilla*, *Salix*, *Syringa* and *Senecio*.

### Hard pruning

Where plants are cut back by at least half each year. Typical examples include *Deutzia*, *Forsythia*, *Philadelphus* and *Weigela*.

### Moderate pruning

Plants are pruned back carefully to a bud by a half to two thirds each year. *Azalea* and *Viburnum* varieties respond well to this treatment.

### Light pruning

This involves tipping back of shoots or, in some cases, for example with many conifer varieties and species of *Ilex*, the removal of cuttings suffices without the need for further formative pruning.

### Renewal pruning

The principal aim here is to remove a proportion of older wood to induce

the production of new, upright shoots so maintaining vigour and juvenility lower down in the stock plant. Heavy, less productive older wood is thinned out to encourage the production of new shoots. *Ilex aquifolium* varieties respond well to this form of pruning.

Subjects such as *Camellia* and *Viburnum x bodnantense* do not produce suitable cutting material in the season after pruning. However, if they are left unattended, they produce fewer and less suitable cuttings on taller plants. For such plants, a three year pruning schedule needs to be devised. Three year wood of *Viburnum* should be removed as necessary and similar wood of *Camellia* cut back hard in spring to promote new flushes of strong growth, which should be left and cut back by half in the second year. This approach produces good flushes of suitable cuttings in the third year.

### Double pruning

This involves pruning twice each year and is suitable for many subjects propagated from soft summer cuttings or later semi-ripe cuttings. Good examples include *Berberis* and *Potentilla*. An initial spring pruning is followed by a second stop during June. However, whilst increasing cutting production overall, the quality of cuttings from the second flush can sometimes suffer and so reduce rooting ability.

### Table top systems

For soft and semi-ripe cutting material such as *Ceanothus*, a 'table top' hedgerow can be created to ease and speed the collection of cuttings. Older, taller stock can be rejuvenated by heading back the plants periodically and allowing an extra growing season before harvesting summer cuttings from July onwards.



8 Mechanical pruning saves time and is useful for rapid harvesting of juvenile, easy to root cutting material from liners

## Hedges

Subjects such as *Berberis*, *Chaenomeles*, *Cotoneaster*, *Euonymus*, *Lavendula*, *Potentilla*, *Pyracantha*, *Spirea* and many conifers can be grown in hedgerows and pruned annually using mechanical hedge trimmers to produce numerous, evenly sized shoots which can be quickly harvested for use as cuttings. Vigorous varieties can be cut back by at least half each year. Less vigorous subjects such as *Buxus*, *Eleagnus* and *Cornus* need only a lighter trim.



9 Conifer hedges are suitable for mechanical trimming to produce numerous cuttings

## Growth control options for cutting production

### Short term protective covers

Low tunnels clad with clear, opaque or white polythene can be used to accelerate cutting production and improve quality. They have been used successfully in the spring for crops such as *Hydrangea* but due to high labour inputs, have now been largely superseded by walk-in structures. These are increasingly used for a range of subjects including varieties of *Acer palmatum*, *Azalea* (deciduous), and *Magnolia*.

### Walk-in polythene tunnels and glass

These are favoured for high value crops, mainly grown in containers which allows them to be moved outside for a 'resting period' once material has been removed. It is important, that the reserves of such plants are not exhausted by continual forcing.

Spectral filters have potential for improving the growth of stock plants grown under protection. HDC project HNS 108, '*Growth of a range of nursery stock subjects under different coloured and spectral filtered films*' showed that Sterillite / Luminance polythene films filter light and retain more heat at night so speeding up root and shoot establishment.

Container stock plants potted early in spring were found to produce more cuttings as the root systems establish much faster. Blue coloured film produced good results with alpine stock plants in containers, yielding

compact cutting material which rooted well. Green films were shown to accelerate growth rates in long days, producing more material suitable for subjects which root readily from inter-nodal cuttings for example, climbing varieties of *Lonicera* spp.

### Shade structures

Houses or tunnels clad with shade materials are ideal for improving the growth and cutting quality of higher value subjects requiring shelter from sustained periods of direct, bright sunlight. Typically, these include *Azalea* (evergreen), *Camellia*, *Eucryphia*, *Magnolia*, *Pieris*, *Rhododendron* and *Skimmia*. In cooler areas, fuller protection may be needed during the winter months at least.

### Plant growth regulators (PGRs)

Use of chemical growth regulators linked to appropriate pruning regimes

to control the growth of stock plants can also be considered as a management tool, particularly with vigorous subjects grown under protection in containers.

HDC trials\* showed that well timed sprays of paclobutrazol (Bonzi) were effective at regulating the growth of a range of nursery stock shrubs and climbers including *Abelia*, *Ceratostigma*, *Clematis* (some vars.), *Cytisus*, *Fuchsia*, *Hebe*, *Hypericum*, *Lonicera*, *Passiflora*, *Photinia*, *Santolina*, *Solanum* and *Weigela*. However, varietal responses do differ, most notably with *Clematis* and should be taken account of.

\* HNS 39 & 39a '*Container Grown Nursery Stock – Growth Regulation*' and, HNS 39b '*An examination of the use of plant growth regulators as a management tool for the production of liners of container grown nursery stock*'.



10 Shade structures are ideal for improving the growth and cutting quality of many evergreen subjects

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### Supplementary lighting

The use of high intensity lighting over stock plants under protection can be used to improve cutting yield and quality. Such techniques help to advance and improve the quality of growth so providing opportunities for enhanced production of early cuttings. Use of supplementary lighting to extend the hours of daylight is especially useful during the short day period of November to March when natural light levels are usually limited. Extending day-lengths to 16 or 22 hours between November and March using a minimum light level of 4.8 Wm<sup>2</sup> has proved successful for a range of nursery stock subjects.

HDC projects HNS 42 & 42a 'Supplementary lighting for alpines, herbaceous and hardy nursery stock species' showed heather cultivars to be particularly responsive in terms of controlling stock plant growth to provide early batches of cuttings. Also, the growth of early flushing cultivars of *Clematis* stock plants was advanced allowing cuttings to be taken a month earlier than usual. Several herbaceous and alpine species were also shown to be responsive to lighting, for example *Primula auricula*, *Phlox* and *Helianthemum*.



11 Supplementary lighting can be used to improve cutting yield and quality

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## Collection of propagation material

Well timed pruning of stock plants will produce even flushes of growth that enables the relatively easy selection and collection of uniform, graded propagation material. Grading at this stage is fundamental to achieving uniform propagation performance and enhanced quality later on.

Soft and semi-ripe summer cutting material should be collected early in the morning whilst plant material is turgid and kept cool, away from direct sun. Ideally, cutting material should be kept in shallow boxes or trays rather than wet polythene bags but if using bags, choose white polythene bags lightly damped down on the inside.

Cold storage is ideal for removing field heat and maintaining cutting quality until propagation material is

used; 4°C and a relative humidity of 90% are ideal. Wherever possible, collect and use fresh material rather than 'bank' cutting material for long spells in cold stores. Bud-wood and scion material should be similarly handled.

All propagation material should be labelled accurately with dates, batch numbers and sources of stock.

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## Longevity of stock beds

To ensure a regular and reliable supply of high quality propagation material, stock plants will, periodically, need to be replaced. The frequency with which this needs to be done will vary

with the species concerned and depend on how well or otherwise they have been managed. Routine pruning will help to maintain juvenility and the productive life of stock plants. As a general guide, the average productive lifespan of a stock bed is between 10 and 15 years with regular pruning. Renewal plantings (usually one third

of the total) should begin at least three years in advance of stock removal to ensure continuity of supply.

Container grown stock plants are mostly kept for one or two seasons and then top-dressed before being grown on into saleable specimen plants.

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## Further information

The following HDC project reports also contain useful information that can be applied to stock plant

management; HNS 27 'Stock plant and cutting processes influencing subsequent plant quality', HNS 55 'Strategies for liner production designed to achieve high quality container plants'

and HDC Handbook; *Practical Weed Control for Nursery Stock*.