



Non-chemical weed control for container-grown hardy nursery stock

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This factsheet describes the principles and practices of non-chemical weed control in order to help growers develop a more integrated approach.

Action points

- Use loose-fill mulches to control weeds in crops such as alpines, heathers, herbs and pot liners, also multi-branched shrubs and herbaceous perennials.
- Ensure mulches are applied evenly and to a minimum depth of 10mm, depending on pot / plant size. Larger pots may require a 20mm deep mulch.
- Use mulches or pot-toppers (discs / mats) for larger pots such as specimens, stock plants and container grown trees.
- Apply mulches and pot-toppers promptly after potting and to a weed free growing media surface.
- Ensure pot-toppers fit snugly around the base of the plant and edges of pots to avoid gaps which can be readily colonised by weeds.
- Trial new materials and techniques first to assess their suitability and cost-effectiveness before widespread use.
- Integrate appropriate herbicides with other techniques rather than relying solely on chemical weed control.
- Focus chemical weed control on non-crop areas to reduce background weed pressures.
- Use only clean, weed free stock for potting-on, including plugs and liners.
- Ensure irrigation tanks and growing media storage areas are covered.
- Group crops with similar cultural needs together to improve irrigation efficiency and weed control.
- Irrigate crops carefully and preferably via sub-irrigation to maintain drier growing media surfaces, and so reduce weed pressure.
- Consider using growing media amendments such as wood-fibre or bark for improved moss / liverwort control.



1. Use of bark mulch on commercial crops

Background

The safe and effective use of herbicides in container-grown nursery stock is complicated by a number of factors, notably the exceptionally diverse range of plants involved. Some subjects are particularly sensitive to herbicides and the situation is further complicated by the diminishing availability of suitably approved products, particularly for use on crops under protection.

Environmental concerns and legislation also accentuate the need for growers to consider more sustainable approaches to weed control, which reduce their reliance on herbicides. Weeds such as moss and liverwort are also difficult to control effectively with chemicals alone, and are costly to remove by hand during production or at despatch.



2. Hand weeding of pots, particularly of liverwort during despatch, is time consuming and costly

Benefits of non-chemical weed control

Non-chemical weed control combines disciplined nursery hygiene and good crop husbandry with alternative, non-chemical techniques such as the use of loose-fill mulches, growing media amendments and pot-toppers. When implemented diligently, such approaches have the potential to provide high levels of safe and effective weed control with minimal environmental impact.

Loose-fill mulches or pot-toppers can be used with most container-grown nursery stock crops and in the majority of situations, including under protection. They can add value during marketing and are usually safe to plants. Such approaches also overcome any problems of weed resistance,

growth suppression and crop damage, which sometimes occur following the use of herbicides.

Pot-toppers and mulches are also user-friendly and unlike herbicides, do not require formally trained or certificated staff to use or apply them. Operator exposure and harvest intervals prior to despatch are not an issue and such techniques are popular with nursery staff, especially those involved in frequent plant handling. A further advantage is that such materials normally need to be applied only once, usually after potting, unlike herbicides, which often require sequential applications to maintain weed control.

Nursery hygiene

A disciplined approach to nursery hygiene is an inexpensive way of reducing background weed pressure and the starting point of successful weed control. Weed infestations frequently result from poor nursery hygiene, for example bittercress seeds persisting around the edges of dirty pots quickly develop into a major weed problem within newly potted container plants, as do plug raised plants and pot liners contaminated with moss and liverwort.

Principal weed sources around the nursery include non-crop areas such as headlands, pathways, bed edges and areas between tunnels / glasshouses as well as rubbish heaps, uncovered waste skips, used pots and old, unsold stock. Contaminated growing media and irrigation water can also pose problems, whilst container beds often harbour weeds such as bittercress, groundsel, willowherb and liverwort.

Routine nursery hygiene measures should include:

- Covering waste heaps
- Covering growing media storage areas
- Controlling background weeds (on paths, headlands, reservoir banks etc.)
- Using clean pots and trays
- Monitoring crops regularly and hand weeding promptly.



3. Non-crop areas, container beds and bed edges are a common source of problems and must be kept weed free

It is these areas where nursery hygiene measures should be targeted, and HDC Factsheet 10/07 'Guidelines on nursery hygiene for outdoor and protected ornamental crops' provides detailed guidance on how to deal with them. HDC Factsheet 15/05 'Use of chemical disinfectants in protected ornamental production' is also a useful source of reference.

Cultural control of weed problems

Cultural weed control essentially involves diligent crop husbandry, notably the management of water, crop nutrition and the crop environment.

Water management

Areas which are constantly wet frequently attract weeds. Careful water application to crops discourages weed seed germination and the development of weeds, especially moss, liverwort and pearlwort on the surface of growing media and container beds.



4. Capillary sandbeds help to keep the surface of the growing medium drier for longer, so discouraging weed problems

HDC funded project HNS 126 *'Biology, epidemiology and control of liverwort infestation of nursery plant containers'*, confirmed that liverwort can be reduced by capillary watering or drip irrigation and controlling crop irrigation. A further finding of HNS 126 was that the spread of liverwort was favoured by more frequent (overhead) irrigation cycles and that fewer, longer applications are preferable. From a nursery perspective, allowing the surface of the growing medium to dry out a little between water applications is useful but it is important to ensure that crops do not dry out excessively. Grouping crops together with similar irrigation requirements also helps to improve irrigation efficiency.

Crop nutrition

The use of controlled release fertilisers within the growing medium rather than liquid feeds applied to the surface helps to reduce weed problems (especially moss and liverwort). The placing of controlled release fertiliser into the base of the drilled hole created when machine potting rather than incorporating it throughout the mix, may also help to further reduce surface weeds, most notably the occurrence of moss and liverwort.

Crop environment

HNS 126 demonstrated that liverwort can be controlled by modifying light levels. In nursery situations, this could be achieved by the use of mulches, pot-toppers or permeable bed covering materials, each of which exclude light and reduce surface moisture, and so in turn weeds.

Mulches, pot-toppers and growing media amendments

Mulches

Loose-fill mulches are capable of providing good levels of weed control in container-grown plants. They are particularly suitable for short-term crops grown in small pots such as alpines, ferns, heathers, herbs and liners as well as longer term herbaceous perennial crops and ornamental grasses, both of which usually have quite dense, multi-branched or suckering crowns and so are less suited to pot-toppers.

The safe and effective use of residual herbicides with such crops is complicated, although commercial experience suggests that mulches are less reliable than herbicides for the sustained control of broad leaved weeds.

For commercial success, materials for use as pot mulches need to be:

- Affordable and cost effective to use
- Attractive at point-of-sale
- Non-phytotoxic or damaging to plants
- Permeable to water
- Light excluding to discourage weed growth
- Non-shrinking
- Resistant to being dislodged by wind or rain
- Resilient and long lasting

- Easy to apply, with scope for mechanisation
- Pleasant to handle and apply by hand.

A number of materials are now commercially available for use, of which granulated pine bark is the most popular, largely because it satisfies most of the necessary criteria. However, as with any mulch, crop irrigation requires particular care as making a visual assessment of plant requirements is more difficult due to the physical presence of the mulch. Other materials which can also be considered for use as mulches include coco-shell, coir fibre, perlite, grit, potato cork and almond shell.



5. Bark mulches are attractive and popular as they satisfy most of the necessary criteria for successful weed control

Whilst the properties of coco-shell, coir, perlite and grit are well known, potato cork and almond shell are perhaps less familiar. Both materials are marketed as a range of durable, permeable and bio-degradable mulch products (Biotop®), suitable for field or container-grown crops, with a 'lifespan' of up to 12 months. They can be applied mechanically and are available with varying degrees of starch ('glued', 'lightly glued' and 'extra glued') to help bind the material together and so improve its resistance to wind erosion, for example in exposed outdoor situations.

For best results, mulches need to be applied promptly after potting to a clean growing medium surface and to a minimum depth of 10mm, preferably 20mm for larger pots (3 litre pot upwards). Most pot mulches will provide effective weed control for a full growing season, sometimes longer depending on the type of material, the depth of application, the prevailing irrigation regime and level of weed pressure. A suitable storage and handling system on the nursery is also important to enable the mulch material to remain moist but not overly wet, such that it flows readily when applied. This is especially important if the mulch is applied mechanically, for example via a 'bark-topper'. Current product and supplier details can be found at Appendix I.

Pot-toppers

Pot-toppers are discs or mats which are placed over the surface of the growing medium to control weeds. Like loose-fill mulches, they are able to control weeds in container-grown plants and offer similar benefits in terms of safe, effective weed control. They are usually applied once, after potting, and for best results, to a clean, weed-free surface. Some pot-topper products are more suitable than others for longer-term, over-wintered container plants. There may also be scope for retaining such products during despatch, for example to garden centres.

For commercial success, pot-toppers need to be non-shrinking and a good fit to avoid gaps around the edges of the pots and around the neck of the plant, which can be quickly colonised by weeds. They must also be quick and easy to fit, either at potting or shortly afterwards. It is essential too that pot-toppers are permeable to water, non-phytotoxic and resistant to dislodging by wind. Commercial experience suggests that they are usually more suitable for pot sizes of 2 litres upwards.



6. Pot-toppers can provide good weed control but need to be a good fit, easy to apply and permeable

A number of pot-topper products are now commercially available based on natural fibres, coir, wool, non-woven fabric or a polypropylene / acrylic mix. They vary in price depending on size, grade and ordered quantity. Whilst they may appear expensive (typically 12p for a 3 litre pot cover at current prices), particularly when the cost of putting them on (and where required, removal at despatch) by hand is taken into account, the resultant savings in hand weeding (and indeed the costs of using herbicides) should be considered.

Most pot-toppers will provide effective weed control for a full growing season, often longer depending on the type of material, the prevailing irrigation regime and the level of weed pressure. It may sometimes be possible to re-use pot-toppers (so making them more cost-effective), depending on weed pressure, irrigation regime, longevity of the crop and material used. They are also available to fit a range of pot sizes and for use as tray mats with young plants.



7. Tray mats are a safe way of controlling weeds in young plants

Current product and supplier details can be found at Appendix II.

Growing media amendments

Commercial experience suggests that weeds such as moss, liverwort and pearlwort are less of a problem where bark, wood-fibre or loam are used in the growing medium, possibly indicating a useful degree of biological suppression. Indeed, various oil-seed meals including *Limnanthes alba*, *Sinapis alba* and oil-seed rape (each of which contain various glucosinolates that react to form biologically active secondary products) have been shown to provide some control of liverwort when used as a mulch or growing media amendment (as examined in HDC funded projects HNS 126 'Biology, epidemiology and control of liverwort infestation of nursery plant containers' and HNS 175 'Liverwort control in HONS using novel techniques'). The effects of bark, wood-fibre and sterilised loam are also structural and linked to their more open, free draining nature, which dries the growing medium surface, thereby reducing colonisation by moss and liverwort.

HDC funded project HNS 93c 'Protected container-grown nursery stock: Chemical and non-chemical screening for moss and liverwort control in liners' considered the merits of loam (sterilised and unsterilised, each at 10% by volume), wood-fibre (30%) and the *Limnanthes* seed-meal (1-2%) as growing media amendments for moss and liverwort control. Whilst wood-fibre was reasonably effective, the sterilised loam and seed-meal were less effective and only had a short-term effect. The unsterilised loam suffered from considerable weed infestation rendering it unsuitable for commercial use.

Wood-fibre was in fact more effective when integrated with other chemical control measures and this is likely to be the best way forward in commercial situations. Replacing part of the peat content of the growing medium with wood-fibre and bark to around 50% can reduce moss and liverwort to such an extent that a standard nursery herbicide programme will give good control of these problems, particularly when linked with high standards of nursery hygiene and careful watering.

Irrigation considerations

Where mulches or pot-toppers are used, it is important to ensure that plants do not dry out or conversely, suffer from over-watering. This may require some adjustment on the part of nursery staff accustomed to a quick visual check of the surface of the growing medium when assessing watering requirements. In this respect, sub-irrigation is particularly

useful. Similar remarks apply in respect of growing media amendments such as bark and wood-fibre, especially when combined within very open potting mixes which can dry out rapidly. Mulches are usually less prone to spillage en-route to container beds and thereafter, if they are watered in immediately after application following potting.

Automation

One of the more costly aspects of using mulches and pot-toppers is the time involved with their application, often this is done by hand and can be slow and laborious work. Careful supervision is also required to ensure mulches are applied evenly and pot-toppers are fitted properly by nursery staff.

Considerable progress has been made automating the application of pot mulches and several machines are now commercially available. They share similar working principles and typically comprise a storage hopper and variable speed elevator which transfers the mulch to the pots via an adjustable delivery chute. The depth and spread of the mulch is usually governed by an adjustable sliding plate, rotating the pots at a pre-set speed or varying the speed of the elevator or conveyor. Excess mulch (which is subsequently collected for re-use) is removed from the pots by a scraper tool or by being gently shaken off. The machines are usually moveable via swivel wheels, so their working position can be changed as required.

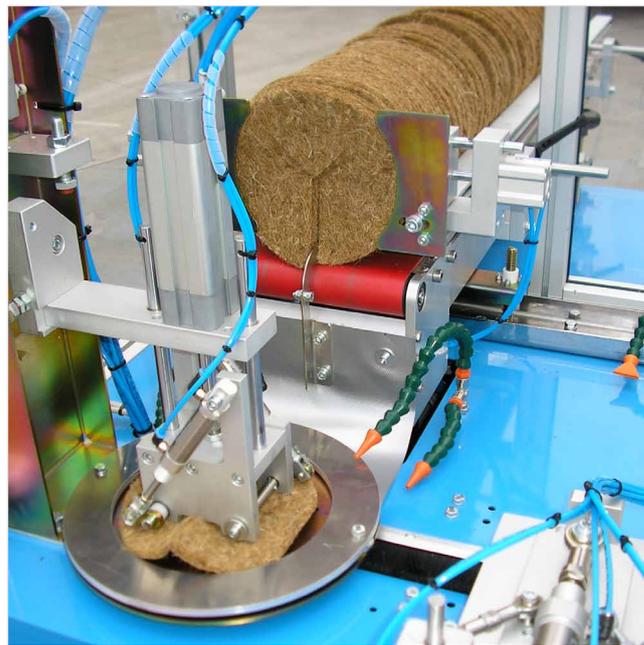
The machines usually accommodate a range of pot sizes (round or square in shape) and substrates (including bark, growing media, potato cork and almond shell), can operate at variable speeds, readily integrate with existing potting machines and are able to deliver the mulch to the required depth. Outputs vary from 1,000 to 8,000 pots per hour, depending on the machine, pot size, plant type and depth of the mulch.

There is also interest in automating the application of pot-toppers and a machine which can be integrated with automated potting systems is being developed in The Netherlands. The 'AW-Disk Dispenser' (from Engrow B.V., patent pending), has an output of around 1,400 pots per hour and is able to accommodate a range of pot sizes (2 litre to 7.5 litre). It will become available to UK growers during 2012 if commercial testing is successful.

Product and supplier details can be found at Appendix III.



8. Mechanisation is now available to ease and speed up the application of mulches



9. A commercial pot-topper dispenser

Investment costs

The cost of mulches and pot-toppers varies with the material or product and the order quantity, so it is advisable to contact suppliers for up to date prices and quotations. Based on current prices, pot mulches cost around 4p-5p per pot (3 litre pot) when applied to a depth of around 20mm and pot-toppers 12p per pot (3 litre pot).

Application costs also vary with situation but for costing purposes work on 0.5p per pot for mulches (applied by machine) and 2p per pot for pot-toppers (applied and removed by hand).

Machines for applying loose-fill mulches such as bark (sometimes referred to as 'bark-toppers' or 'top-coaters') typically cost £15,000-£18,000, depending on the exact specification.

Current indications from The Netherlands are that the 'AW-Disk Dispenser' for applying pot-toppers is likely to cost in the region of €20,000. If successful, this could make the use of pot-toppers more attractive and commercially feasible, so broadening their appeal. For a nursery producing around 200,000 pots annually, the pay-back period is likely to be less than 3 years, similar to that of a 'bark-topper' machine, based on present guide prices.

An example costing which compares mulches and pot-toppers with a standard herbicide programme and hand weeding can be found at Appendix IV.

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Further information

HDC Factsheet 06/08. 'A guide to best practice in handling bought-in plants'.

HDC Factsheet 10/07. 'Guidelines on nursery hygiene for outdoor and protected ornamental crops'.

HDC Factsheet 15/05. 'Use of chemical disinfectants in protected ornamental production'.

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Appendix I – Mulches

Material	Supplier
Potting or propagation pine bark	Melcourt Industries Ltd, Boldridge Brake, Long Newnton, Tetbury, Gloucestershire GL8 8RT Tel: 01666 502711 Fax: 01666 504398 E-mail: mail@melcourt.co.uk www.melcourt.co.uk
TrefEGO pine bark	TrefEGO substrates, c/o Fargro, Toddington Lane, Littlehampton, West Sussex BN17 7PP Tel: 01903 721591 Fax: 01903 730737 E-mail: info@fargro.co.uk www.fargro.co.uk
Bark, coco-shell, grit, perlite and vermiculite	William Sinclair Horticulture Ltd, Firth Road, Lincoln LN6 7AH Tel: 01522 537561 Fax: 01522 780281 E-mail: info@william-sinclair.co.uk www.william-sinclair.co.uk
Bio-Top®	Crustell B.V., Kortsteekterweg 57a, 2407 AJ Alphen aan den Rijn, The Netherlands Tel: 0031 (0)172 460644 Fax: 0031 (0)172 460653 E-mail: info@crustell.com www.crustell.com

Appendix II – Pot-toppers

Product	Supplier
Tex-R® Geodiscs (non-woven fabric treated with Spin Out, a copper containing latex paint)	Fargro, Toddington Lane, Littlehampton, West Sussex BN17 7PP Tel: 01903 721591 Fax: 01903 730737 E-mail: info@fargro.co.uk www.fargro.co.uk
AW-Disk® (biodegradable material made from natural fibres and natural latex). Patented tray covering mats made from natural fibres also available for use with young plants	Engrow B.V., P.O. Box 6246, 4000 He Tiel, The Netherlands Tel: 0031 (0)344 682528 Fax: 0031 (0)344 682427 E-mail: info@engrow.nl www.engrow.nl
Wecult® (polypropylene fibre / acrylic mix with unique fish-bone slits for more secure fitting)	PG Horticulture Ltd, 5 Brunel Close, Drayton Fields Industrial Estate, Daventry, Northamptonshire NN11 8RB Tel: 01327 828373 Fax: 01327 300139 E-mail: info@pghorticulture.co.uk www.pghorticulture.co.uk www.meyer-shop.com/eng
Coir pot-topper (natural coir fibre, biodegradable)	
Wool based pot-toppers (available provisionally from June 2012)	Plant Care, Unit 2, Hill Top Farm, Nottingham Road, Melton Mowbray LE13 0NX Tel: 01664 501146 Fax: 01664 501068 E-mail: sales@plantcarelimited.co.uk www.plantcarelimited.co.uk

Appendix III – Application equipment

Product	Manufacturer or distributor
Scatter Robot® (for the application of Bio-Top® mulch products)	Crustell B.V., Kortsteekterweg 57a, 2407 AJ Alphen aan den Rijn, The Netherlands Tel: 0031 (0)172 460644 Fax: 0031 (0)172 460653 E-mail: info@crustell.com www.crustell.com
Javo Easy Topper® (for the application of loose-fill mulches)	Hortec, Orchard Farm Nursery, Lower Tysoe, Warwickshire CV35 0BU Tel: 01295 688422 E-mail: enquiries@hortec.co.uk www.hortec.co.uk www.javo.eu
GAL Topping Machine (for the application of loose-fill mulches)	GAL Systems Ltd, 9 Mower Place, Cranleigh, Surrey GU6 7DE Tel/fax: 01483 272958 E-mail: sales@galsystems.co.uk www.galsystems.co.uk
Willburg Pot Top-Coater (for the application of loose-fill mulches)	Mechanical Botanical Ltd, Pear Tree House, Ridgley Road, Chiddingfold, Surrey GU8 4QW Tel: 01428 683505 Fax: 01428 682308 E-mail: info@mechanical-botanical.com www.mechanical-botanical.com
The AW-Disk Dispenser (for the application of AW-Disk® pot toppers) new for 2012	Engrow B.V., P.O. Box 6246, 4000 He Tiel, The Netherlands Tel: 0031 (0)344 682528 Fax: 0031 (0)344 682427 E-mail: info@engrow.nl www.engrow.nl

Appendix IV – Cost comparison

Hand weeding/ha	Standard herbicide programme/ha	Loose-fill mulch/ha	Pot-toppers disc or mat/ha
£43,125 (23p/pot)	£6,563 (3.5p/pot)	£11,250 (6p/pot)	£28,125 (15p/pot)

Calculation assumptions

Figures are based on average costs and are for guidance and illustration purposes only. They include an allowance for hand weeding and topping up with fresh growing media where required during despatch. Figures will vary depending on situation, labour costs and prevailing weed pressures. They are rounded up to the nearest penny or pound.

Hand weeding costs are ADAS figures based on three hand weedings per year with no herbicide programme, mulches or pot-toppers. Assumes 4,650 hours required in total (three weedings of 1 ha). Labour costed at £8/hour (gross). An additional 3p/pot is included to cover hand weeding and topping up with fresh growing media during despatch.

Standard herbicide programme costs are based on two applications of Ronstar 2G @ 200 kg/ha and two applications of Flexidor 125 @ 1 litre/ha in 1,000 litres water/ha, including cost of application. Assumes product costs of £1,182/ha/treatment (Ronstar 2G) and £55/ha/treatment (Flexidor 125).

Total labour input of 20 hours for application based on 2 hours/treatment/ha for Flexidor 125 and 8 hours/treatment/ha for Ronstar 2G at two applications of each product. Includes preparation and post-spraying irrigation for rinsing off (Flexidor 125) and removal of granules from crop foliage following treatment (Ronstar 2G). Labour costed at £12/hour (gross).

Total cost (3.5p/pot) comprises 1.5p/pot for the herbicide programme element and 1p/pot to cover occasional spot weeding by hand (light weed pressure) and 1p/pot for hand weeding and topping up with fresh growing media during despatch. Where background weed pressures are high (or a herbicide application is missed), allow 2.5p/pot for the nursery hand weeding element and 2p/pot for weeding during despatch.

Loose-fill mulch cost based on one application of bark to a depth of 20mm per 3 litre pot (3p). Assumes a cost of 1p/pot for application (by machine, including labour to use the machine and running costs but excluding depreciation and

annual charges), 1p/pot to cover waste / spillage, occasional spot weeding by hand and one supplementary application of Flexidor 125 where background weed pressures may be high and 1p/pot for hand weeding during despatch (assumes little or no topping up with fresh growing media required with a mulch). For smaller quantities applied by hand, costs may be slightly higher.

Savings in peat or fresh growing media used to top-up pots following hand weeding at despatch may accrue where mulches are used and so offset hand weeding costs. Bark prices will vary with supplier and order quantity.

Pot-topper cost based on 12p for product (prices will vary with product and order quantity) plus 2p/pot to fit by hand plus 1p/pot for removal and disposal by hand during despatch and topping up with fresh growing media (assumes little or no weed removal required).

Assumes single use of pot-topper discs / mats (re-use may be possible and would reduce product costs).

All costs are based on 187,500 pots (3 litre pot size)/ha at 1.25 spacing (25 pots/m²), allowing 25% non-cropped area for roads and general access.

Herbicide programmes, mulches and pot-toppers may provide acceptable weed control beyond a 12 month period, depending on materials, seasonal conditions and weed pressure.

Despatch costs (weed removal, topping up with fresh growing media) may rise if nursery weed pressure is high, a herbicide application is missed or weed control using mulches or pot-toppers breaks down due, for example, to poor mulch application or inadequate fitting of the pot-topper.

This example excludes annual charges for machinery, maintenance and staff training as these vary considerably between nurseries, but should also be considered if making a full economic comparison.

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