Fact Sheet 10

Use and benefits of composted green material in growing media

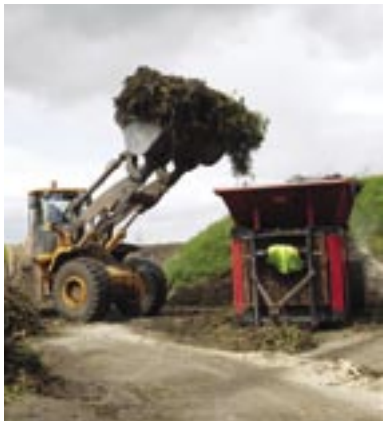
PUTTING COMPOST TO WORK!

What is composted green material?

High quality composted green material is produced by composting source segregated botanic residues generated by landscapers, hobby gardeners and other horticulturists. These plant materials are collected separately from kitchen waste and other societal wastes.

The feedstock material is, therefore, less at risk from contamination than mixed wastes.

The British Standards Institution's Publicly Available Specification for Composted Materials – BSI PAS 100 (2002) – ensures that the composting process is carefully controlled to produce a high quality product. In purchasing PAS 100 certified material, users can be assured of conformity and that the material is independently assessed and verified by a certification scheme, such as that run by The Composting Association. In growing media, composted green material (CGM) is a natural partner for sphagnum peat, bark and other complementary substrates. Refer to WRAP's 'Guidelines for the specification of composted green materials used as a growing medium component' for advice on rates of use.



Key properties

CGM differs from sphagnum peat and other substrates in a number of important respects:

- Bulk density is higher than for sphagnum peat or bark (at comparable moisture content).
- Electrical conductivity (EC) is much higher than in sphagnum peat and higher than in bark (EC values are a reflection of the level of water-soluble nutrients).
- pH is much higher than in sphagnum peat and higher than in bark. However, pH can easily be lowered to a suitable level and the relatively high pH of CGM-based mixes has not generally been shown to compromise plant growth (NB: the optimum pH for all-peat growing media is significantly lower than for other growing substrates).
- CGM contains significant levels of a full range of essential plant nutrients, including trace elements. However, available nitrogen (N) usually needs to be supplemented.
- CGM tends to be more biologically active than sphagnum peat; for example, it enhances nitrification (conversion of ammonium nitrogen to nitrate nitrogen).
- Cation exchange capacity (CEC) tends to be higher than in sphagnum peat (CEC provides 'buffering'; reduced fluctuation in pH and nutrient availability).
- In a very dry state, growing media based on CGM absorbs water more readily than all-peat growing media.
- Typical CGM (<10.0mm) tends to have a lower water holding capacity (WHC)/higher air-filled porosity (AFP) than medium grade sphagnum peat.

Why use composted green material in growing media?

CGM's special properties make it an ideal component of growing media:

- **Nutrients:** apart from water-soluble N, CGM can (depending on rate of use) provide all major and secondary base nutrients.
- **Trace elements:** CGM can provide a full range of trace elements, notably iron.
- **Slow release:** much of the nutrient content is released over an extended period.
- **Buffering:** available nutrients are buffered and leaching of nutrients, therefore, tends to be reduced.
- **Nitrification:** ammoniacal N (NH_4-N) is quickly converted to nitrate (NO_3-N) by naturally-occurring nitrifying bacteria; a safety benefit in sensitive crops.
- **Lime:** being rich in carbonates and other compounds of calcium and magnesium, CGM can (depending on rate of use) provide most, if not all of the 'lime' requirement.
- **Suppression:** in combination with composted/matured forestry residues, CGM has been shown to reduce the incidence of algae, moss, liverwort, plus some plant diseases (for example *Xanthomonas hederae*) and certain pests (for example snails).
- **Non-slumping:** in trials to date, slumping has not been observed in growing media based on mature CGM.
- **Economy:** taking its nutrient value and other benefits into account, CGM can be economical, especially where a local source can be used.
- **Peat alternative:** where required, CGM can form the basis of cost-effective peat-free, or peat-reduced, growing media. CGM is widely available from indigenous sources.
- **Quality:** quality of CGM is assured, partly by purchasing to BSI PAS 100 (2002) but more critically by WRAP's 'Guidelines for the specification of composted green materials used as a growing medium component.' CGM is the first growing media substrate to be subject to such a specification.
- **Tested:** these properties have been demonstrated in an extensive and wide-ranging independent programme of growing trials undertaken in the UK.

What subjects can be grown using composted green material?

Bedding and pot plants

Growing trials have shown that a wide range of bedding plants (summer and winter types) and pot plants can be grown. Some subjects – for example *Lobelia* and *Impatiens* – have shown a slightly more compact growth habit in CGM-based mixes than in standard (peat-based) mixes. Onset of flowering was delayed in a small minority of subjects, for example *Cyclamen*.

Propagation

Growing trials have shown that a wide range of plants can be raised from cuttings and seed, including pot herbs, herbaceous perennials, vegetable transplants, pot and bedding plants. Some subjects – for example pot herbs – have shown a slightly more compact growth habit in CGM-based mixes than in standard (peat-based) mixes.

Hardy Ornamental Nursery Stock

Growing trials have shown that a wide range of Hardy Ornamental Nursery Stock can be grown, including herbaceous perennials, alpines, roses, climbers, conifers, hardy ferns, deciduous trees and ground cover subjects. Good results have been obtained with *Skimmia*, *Magnolia* and *Primula* but experience with ericaceous species is limited at present. Some subjects have shown a slightly more compact growth habit in CGM-based mixes than in standard (peat-based) mixes.

Before making significant changes in substrate type for any subjects, it is advisable to carry out trials alongside current practice.

How should composted green material be used in a growing medium?

Manufacturers of growing media, recognising the potential for CGM, are using the renewable nutrient-rich substrate in a wide range of products.

Growers who mix their own growing media will find CGM – used at say 33% by volume of the mix – particularly competitive:

- CGM can provide all essential base nutrients apart from nitrogen.
- CGM can replace all or most of the lime normally added.
- Addition of loam may not be required (CGM buffers well and contains a 'reserve' of trace elements).
- Inclusion of bark may not be required (CGM has a high content of woody material, which can be altered through specifying a different particle size range).
- Inclusion of a wetting agent will probably be unnecessary (CGM-based growing media rewets well).
- Mixes based on CGM and bark or other forestry co-products tend to reduce the incidence of algae, moss and liverwort and, more occasionally, certain pests and plant diseases.

Basic principles

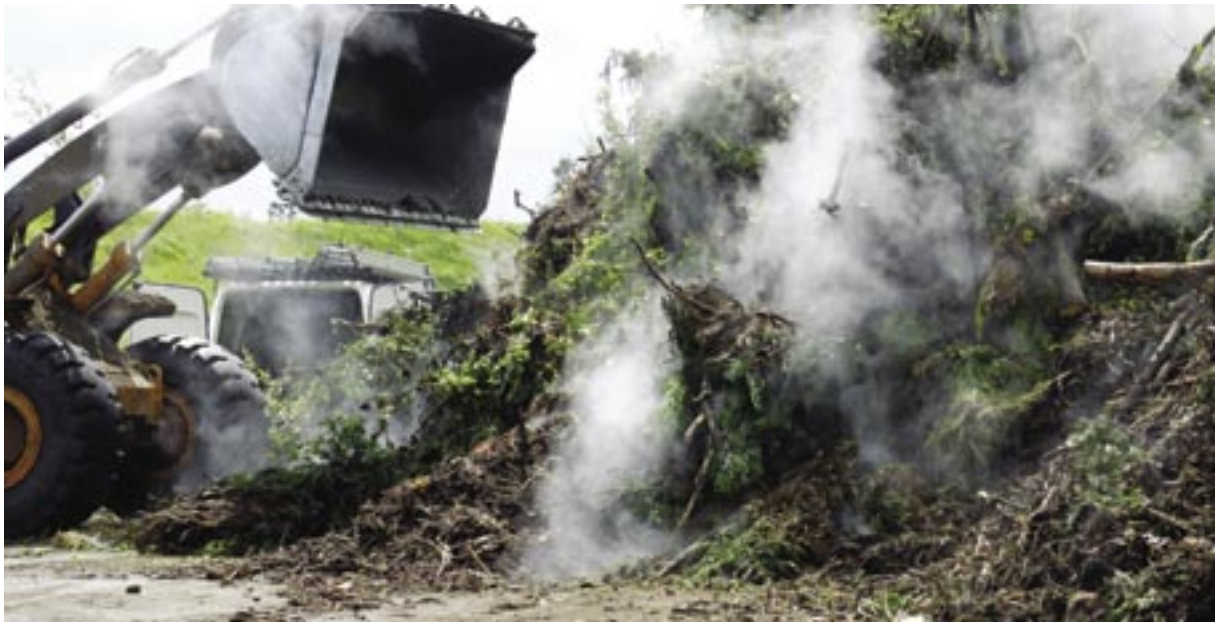
As CGM is rich in nutrients, it must be mixed with one or more low-nutrient substrates before use.

Nitrogenous fertilizer is added to provide readily-available nitrogen (N). Unless sphagnum peat is used as the diluent, additional N may be needed to prevent N lock-up.

CGM is rich in calcium (Ca) and magnesium (Mg) and lime rate should therefore be reduced.

Standard grades of CGM (passing a 10mm or 8mm screen) are usually suitable but special grades may occasionally be required for:

- plant raising in cell trays: the CGM should be 5mm grade.
- capillary irrigation: the CGM should have a high fines content (at least 50% m/m less than 1.0 mm).



Formulations

CGM can be used in reduced-peat or peat-free growing media as below. These formulations are a guide. As always, expert advice should be sought and trials undertaken before switching full-scale production to a new growing medium.

Table 1. Formulations based on CGM

		Ammonium nitrate[1] g/m³		Ground magnesium limestone kg/m³	
	Rate CGM[2] % v/v	Sphagnum peat	Forestry residues[3]	Sphagnum peat	Forestry residues[3]
Summer bedding	33-40	600	900-865	0.5–0.3	Nil
Autumn/winter bedding	25-33	600	940-900	1.0–0.5	Nil
Pot plants	33-40[4]	600	900-865	0.5–0.3[4]	Nil
Propagation (seed or cuttings*):					
Medium/sensitive	15	300-450	725-875	1.0	Nil
Vigorous	25	300-450	675-825	1.0	Nil
Pot herbs (from seed or plugs)	33	600	900	1.0	Nil
Liners:					
Medium/sensitive	25	Nil	333	Nil–0.5	Nil
Vigorous	33	Nil	375	Nil–0.5	Nil
Potting on:					
Medium/sensitive	33	Nil	223[5]	Nil–0.5	Nil
Vigorous	40	Nil	200	Nil–0.5	Nil

*In cell trays or conventional containers. Recommendations for use of CGM in blocking media are not yet available.

Peat or an alternative?

Reduced-peat growing media based on a combination of CGM and sphagnum peat offers:

- lowest cost
- lowest bulk density
- most nutrient dilution[6]
- most pH reduction[6]
- most storage stability
- most availability

Some retailers and landscape architects are seeking 'peat-free plants'. Furthermore, major retailers have set peat reduction targets in their environmental policies. Use of CGM can play a major role in meeting these targets.

Trials have shown that growing media based on CGM plus bark and/or other forestry co-products can reduce the incidence of moss, liverwort and certain plant diseases more than other mixes.

However, crop development does not always match that of other mixes – including those based on CGM plus sphagnum peat.

Like CGM, all diluents must be of an appropriate size grade, especially where the medium is to be used in cell trays.

Where an automatic tray-filling machine is used, a pilot trial should be undertaken before a new medium is adopted for full-scale production.

Management

Bulk Density

Growing media based on CGM are denser than all-peat media at point of use. Handling trials are, therefore, recommended.

Trials overseen by Peatering Out Ltd have shown that, when watered for dispatch, differences in pack weight are modest.

Storage

As with all growing media, if Controlled-Release Fertilisers (CRFs) are pre-incorporated, the batch should be used within three weeks of mixing.

In the absence of CRFs, peat-reduced mixes should be used within three months and peat-free mixes within one month.

Growing media should always be stored under cool, dry conditions, protected from wind-blown weed seeds and other contaminants.

Watering

CGM-based growing media have been used successfully with a range of irrigation methods, including ebb and flow, capillary and overhead systems.

As with all growing media, water-in well but avoid over-watering, especially in the early stages of plant development.

When allowed to dry back, root balls in CGM-based crops tend to be particularly robust and experience suggests they will not fall apart. Dried-back plants are relatively easy to rewet.

The surface of CGM-based growing medium is darker and often drier than peat-based mixes. Irrigation requirements should be assessed not only by appearance – of the surface and the plant – but also by inspection, until experience has been gained.

Feeding

CRFs and liquid feeding can be used as normal.

In peat-free mixes, extra N may be needed if the bark – or other diluent – has not been thoroughly composted.

Growth habit

Top growth is sometimes more compact than usual (i.e. from all-peat media), apparently due to reduction in internode length – as though a low dose of plant growth regulant has been applied.

Rooting of cuttings is sometimes slightly slower than in a peat-based medium. In herb and vegetable subjects, germination appears to be unaffected. However, in the case of very fine or expensive seed, pilot tests are recommended before a new growing medium is used on a large scale.

Roots are often stained brown by tannins in the CGM and bark, an effect seen in some sphagnum peats.

Growth regulators should be trialled before a new growing medium is adopted on a large scale.

Establishment

Plants raised in CGM-based growing media establish normally after planting out or potting on.

Shelf-life

Where a shelf-life or transit time is specified, tolerance to transport and neglect should be assessed in comparison with the current growing medium.

Analysis

For growing media based on CGM and/or forestry residues and/or loam, the use of 'CAT'[7] extraction is recommended for all nutrients apart from ammonium nitrogen (NH_4-N), nitrate nitrogen (NO_3-N) and, where required, sulphur (S) and calcium (Ca).

For the latter nutrients, plus pH and electrical conductivity (EC), a standard 1:5 water-extraction should be used. EC levels are often higher in CGM-based media than in equivalent all-peat media.

CAT-extraction provides a more realistic picture of plant-available phosphorus, potassium, magnesium, iron and many other nutrients than water-extraction (which was developed purely for products made from sphagnum peat and highly soluble fertilisers).

However, until the grower is familiar with CAT-derived analytical data, it would be prudent to initially commission analysis based on both CAT-extraction and water extraction.

Effect of CAT-extraction on nutrient analysis

Nutrient solubility is affected, not only by extractant, but also by pH, overall salts concentration, time and temperature of storage and type of substrate(s).

The conversion factors in table 2 may be helpful. However, they are based on limited data and are, therefore, only provisional.

Table 2. Factors for converting water-derived data into CAT-derived data

	Based on composted green material[8]		
	Peat-free[9]	Peat-reduced[10]	All-peat
pH Electrical conductivity Ammonium N (NH_4-N) Nitrate N (NO_3-N) Calcium (Ca) Sulphur (S) Chloride (Cl)	Not applicable (Continue to use water-extraction for these determinations)		
Phosphorus (P)	3	1.3	1.3
Potassium (K)	2	1.5	1.3
Magnesium (Mg)	>8	>8	2.5
Iron (Fe)	>4	>6	>100
Copper (Cu)	>3	>5	>100
Zinc (Zn)	>4	>4	3
Manganese (Mn)	>50	>50	12
Boron (B)	1	1	1.5
Molybdenum (Mo)	1	1	3

For example, a value of 20 mg water-extractable phosphorus per litre growing medium would be likely to show a value of approximately 60 mg/l (peat-free), 26 mg/l (peat-reduced) and 26 mg/l (all-peat) by CAT analysis, where the peat-free and peat-reduced media were based on 33% CGM.

[1] If controlled-release fertiliser is to be pre-incorporated, reduce AN rate by 300 g/m^3. If AN is not available, calcium ammonium nitrate (CAN; 27%N) can be used (CAN rate = 1.3 x AN rate).
[2] Use lower rate for pricking out seedlings. The higher rate should only be used for plugs and other transplants.
[3] Forestry residues should be thoroughly composted and screened to an appropriate grade. 'Brash' = branches and tops ('lop and top') from forestry (usually conifer plantations and, in the case of Sylvafibre®, pine).
[4] For lime-hating subjects reduce magnesium limestone to nil. For very salt-sensitive subjects, reduce CGM rate to 20% v/v.
[5] Assumes 15%-25% v/v of the mix is coarse bark. If coarse bark is absent, increase AN rate to 333 g/m^3.
[6] These properties are especially beneficial for lime-hating (ericaceous) subjects.
[7] Aqueous solution of calcium chloride plus DTPA: a British and European standard method.
[8] 33% v/v
[9] CGM diluted with Sylvafibre®
[10] CGM diluted with Shamrock® medium grade sphagnum peat

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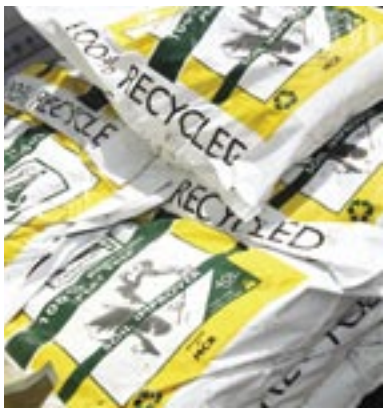

Composted materials certified compliant with BSI PAS 100 by The Composting Association have been monitored by this independent body. This provides further assurance of high product quality and an easy way to identify such products. Product properties are declared, and information included to enable product traceability – look for the certification mark. There are a number of composting companies that can supply quality assured composted material manufactured to PAS 100 For a list of certified suppliers, visit the WRAP website on www.wrap.org.uk/publications/CertifiedCompostSuppliers.pdf or call the WRAP Freephone Helpline on 0808 100 2040. Alternatively, contact The Composting Association on 01933 227 777.

COMPOSTING ASSOCIATION CERTIFIED

WRAP (the Waste & Resources Action Programme) is a national Government programme established to promote sustainable waste management by tackling the barriers to waste minimisation and increased recycling.

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