Use of Green Waste Composts in Media for Hardy Nursery Stock

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INTRODUCTION

For more than 10 years, the Horticultural Research Institute Bad Zwischenahn has been conducting research on the use of green-waste composts in substrates for container plants. There are a number of advantages in using green-waste compost as an additive to peat substrates. These include: buffering of nutrients and pH, improvement of ecological image by reduction of organic waste, conservation of peat and, usually, a low price.

However, there are also some potential disadvantages, including: high pH, high salt content, decreased water capacity of the substrate, high volume weight, and increased transportation costs.

Great care is needed with the use of green waste composts in container substrates. It is absolutely necessary to analyse the compost before use and to keep the quality to a defined level. In Germany this is the nationally recognised "Gütebestimmungen für Substratkompost" (quality control for substrate-compost). Otherwise, plant damage — through nitrogen deficiency caused by fixation in the compost, salt and chloride toxicity, or other factors — is possible. Even with a high quality compost, the advantages and disadvantages need to be evaluated before deciding to use the material in container-plant cultivation.

GREEN WASTE COMPOST FOR NURSERIES

The production of green waste composts is increasing each year and they are increasingly being offered to nurseries in Germany, often for a very low price. At the same time, the container-plant sector has become interested in substitutes for peat as a container medium because of the bad ecological image of peat usage.

In recent years, the Horticultural Research Institute Bad Zwischenahn, in close cooperation with substrate producers, the extension service, Horticultural Research Institute Hannover-Ahlem, and the College for Horticulture Fachhochschule Osnabrück, has conducted research in the use of different composts in substrates for hardy nursery stock. Plants used in trials with these substrates were *Buddleja* (high nutrient demand), *Ribes* (chloride sensitive), and *Hypericum* (salt sensitive). The aim of the trials was to learn about the qualities of green-waste composts and to find limits for the different chemical contents.

DIFFERENT GRADES OF COMPOST

German standards distinguish between different types of compost. "Biokompost" contains a high proportion of organic kitchen waste and so has high levels of salt, and often chloride, and is not usable for container substrates; "Grünkompost" is made exclusively of plant material from parks and gardens. In reality, however,

composts offered to growers are often mixtures — basically Biokompost with Grünkompost mixed in to improve quality. So in practice, the terms "Biokompost" and "Grünkompost" are of little help in characterizing the quality of a compost.

A group of researchers, under the leadership of Horticultural Research Institute Hannover-Ahlem, developed the alternative compost descriptions "Substratkompost Type 1" and "Substratkompost Type 2". These terms are not defined by the origin of the composted materials but by their quality and their nutrient content (Table 1.)

Table 1. Characteristics of "Gütesicherung Substratkomposte".

	Type 1	Type 2
Maximum proportion of compost in substrate	20%	40%
Salinity (as mg litre^{-1} KCl)	<5000	<2500
N (mg litre^{-1})	<600	<300
P_2O_5 (mg litre^{-1})	<2400	<1200
K_2O (mg litre^{-1})	<4000	<2000
Cl (mg litre^{-1})	<1000	<500
Na (mg litre^{-1})	<500	<250
Zn (mg kg^{-1})	<300	<300

(Other factors including absence of N fixation and growth inhibition are being tested by incubation test, with indicator plants and by other means.)

SUBSTRATE STRUCTURE

In a trial with *Buddleja*, root development was normal on plants grown in a substrate containing 40% compost, but roots were poorly developed on plants growing in a substrate of pure compost.

Waste-derived composts have a higher organic mater content than peat and their dry volume weight is much higher than peat. As a result the transportation weight of container plants with a compost/peat mix substrate is higher than those with peat only substrates, especially when the plant itself is comparatively small (e.g., groundcovers). If the composts are wet, there is little difference in weight between peat and compost because of the high water-holding capacity of peat. On the other hand, it is easier to moisten a dry compost and peat substrate than pure peat. But the water capacity is reduced, so compost and peat mixes may need more frequent watering.

SALT AND CHLORIDE

Composts, especially "Biokompost", have high salt levels. In trials with *Ribes* and *Hypericum*, symptoms of salt damage (necrosis or chlorosis at the leaf margin) occurred when the plants grew in compost mixes with salinity levels of more than 2000 mg KCl litre^{-1}. In nurseries, it is possible to observe the same damage symptoms in groundcover crops at even lower salinity levels.

Chloride levels in compost are especially important. In trials, damage to *Ribes* and *Hypericum* was found at chloride levels above 400 mg litre^{-1}. In our tests, this level

of chloride could be found in compost/peat mixtures containing 25% or more compost. When evaluating potential for chloride injury, other sources of Cl stress, including irrigation water, fertilizers, or other soil amendments (e.g., coco-material) should be considered.

Each compost has to be analysed and if its chemical parameters don't fall within the limits of the "Gütesicherung Substratkomposte", they should not be used in substrates.

NITROGEN DEFICIENCY

Another problem that repeatedly occurred in the trials was nitrogen fixation. By early summer, crops, especially those that were potted into coarse-structured green-waste compost, showed nitrogen deficiency symptoms. These symptoms were caused by microorganisms using the nitrogen applied as fertiliser to decompose organic materials in the compost. This experience shows the importance of testing the compost before use to see if it is still fixing high amounts of nitrogen. There is a test, named "Brutversuch" (incubation test), that has been developed to measure the amount of nitrogen being fixed.

There are some composts — especially "Biokompost" that are capable of releasing large amounts of nitrogen. At certain times, for example after potting, when the plant does not demand much nitrogen, such releases could leach out and cause pollution.

NECESSITY OF PHOSPHATE AND POTASSIUM FERTILISATION

Phosphate and potassium contents of composted waste are very high, so it appeared that growers might get away with only having to apply nitrogen fertiliser. In one of our trials, the growth of plants growing in a medium containing Osmocote 39-0-0 (coated urea) was compared with those fertilized with Osmocote 5-6M (balanced NPK). Osmocote 39-0-0 supplied the plants with nitrogen much more slowly than Osmocote 5-6M, so nitrogen deficiency could occur. Trials at another research station showed that plants grown in waste-derived compost without added potassium suffered retarded growth. The current recommendation, therefore, is that even in waste-derived composts potassium and phosphate have to be supplied, although the amounts can possibly be reduced compared with those applied to peat-based composts.

ALKALINITY

A waste-derived compost usually has a high pH. This has to be considered when calculating the amount of lime added to the peat in substrate mixtures. In our trials, we were able to reduce the amount of lime from 4 g to 1 g litre^{-1} in substrates containing 20% "Biokompost" (pH 7.6-8.2 in $CaCl_2$). The amount of lime needed depends not only on the pH of the compost but also on its buffering capacity.

The high pH of waste-derived composts may cause problems for some plant species. With Ericaceae, for example, mixtures containing high proportions of compost are usually not desirable. On the other hand, plant species that prefer high pH, such as *Taxus* and *Buxus*, might grow better given the buffering capacity of waste-derived composts rather than the decreasing pH that occurs frequently under liquid feeding with soft water.

CONCLUSION

Growers need a substrate which will not present a risk of damaging the crop. Waste-derived composts offer advantages and disadvantages that have to be considered. If a waste-derived compost is to be mixed into a substrate, it is absolutely necessary to test the material before use. The German "Gütesicherung Substratkomposte" (quality control for substrate compost) gives guidelines where the important qualities and nutrient contents are measured so that the risk of crop damage is reduced to a minimum if such a quality compost is used. But composts are still not used widely in German container nurseries and there are many things to learn about using composts in container substrates.