A Guide to Propagation Composts©

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INTRODUCTION

Propagation by cuttings is not a natural process. Propagators manipulate plant material under controlled environmental conditions to multiply clones of desirable plants. The medium the cuttings are stuck in is an important part of this artificial environment so it is important for propagators to understand what cuttings need from a rooting medium

PHYSICAL REQUIREMENTS OF A ROOTING MEDIUM

Oxygen. The base of the cutting should be the site of rapid cell division, dividing cells have a high respiration rate. Oxygen is a crucial part of the process and must be freely available at the base of the cutting. The air around the roots must have an oxygen concentration of at least 12% for root initiation to occur — by comparison the average concentration in the atmosphere at ground level is 21%. Good air movement in the medium will also allow the removal of carbon dioxide — a by-product of respiration which is potentially damaging to the cutting when present in excess.

Water. Humidity should be sufficient to keep the cutting turgid and photosynthesising. The cut end of the plant should never be allowed to become dry as this may inhibit rooting or encourage the formation of callus tissue instead of roots. A significant amount of water can be taken up by the base of a cutting so good contact with water held by surface tension in the compost is important.

Support. The cutting needs to be held in a position which will lead to the production of a plant suitable for potting-on. The medium used should hold air and water in the correct balance for the duration of the crop, so it should be stable and not break down physically or chemically for the duration of the propagation cycle.

ROOTING MEDIA INGREDIENTS

All ingredients should be as clean as possible and free from pest and disease. Any weed problem at the beginning of the production cycle will cause problems and add cost throughout the life of a crop. Wherever possible ingredients should be graded and without fines. Very small particles (dust) will reduce the air spaces in any compost and should be avoided.

Organic Materials.

Peat. In the U.K. and Ireland this is still the most widely used ingredient in any compost being clean, relatively cheap, and readily available. Quality and grade can vary considerably. For propagation an open sphagnum-type peat is probably the best to use, most young sphagnum peats are acidic pH 4.5 to 5.5 with an air-filled-porosity (AFP, a measure of the proportion of the material which is air space) of anything from 8% to 20% or more. Older, darker peats are usually denser and more decomposed, with lower AFP and higher pH.

Composted Pine Bark. This is another very widely used ingredient. The best barks are well graded (without fines), have a pH similar to peat, and an AFP of around 40%. Pine bark can also lock up free nutrients in a compost, a useful buffer to mop up excess release if controlled-release fertilisers are incorporated.

Coir. This has rapidly made an impact on the propagation scene, it is uniform, consistent, and readily available. It has a very open structure, a pH of 5.5 to 6.8, an AFP of 10% to 20%.

Composted Wood Fibre. A relatively new product with a pH of 5 to 5.5 and an AFP of 20% to 22%, readily available and locally produced.

Inorganic Materials. These can be loosely separated into natural or manufactured products. Natural products include:

Grit or Sand. Traditionally mixed with peat to make a propagation compost. Usually clean, potentially a source of lime depending on the source of the stone. A reliable source of a good grit is difficult to find. Transport costs can be high if the quarry is at a distance from the nursery.

Vermiculite. A heat-treated mica like substance. It has the ability to hold water (two or three times its own weight) in its structure, behaving similarly to organic materials like peat, bark, and coir. It is not an inert material and can absorb and hold available some plant nutrients for plants. It can have a pH from around 6 to 9 depending on the source — African vermiculite generally has a higher pH than North American.

Perlite. Another heat-treated mineral. Unlike vermiculite it is inert, it cannot hold water or nutrients in its structure. Its use in composts is limited to increasing or maintaining pore spaces. AFP varies according to the grade used. It has a pH of around 6 to 8.

Manufactured Products.

Rockwool. Another heat-treated mineral but unlike perlite or vermiculite it is processed to produce a suitable medium. It is inert and will not hold nutrients or absorb water into its structure. It has a huge total pore volume of about 97% and a correspondingly high AFP of 40% to 50%.

Synthetic Foam. Plastics with neutral pH and a high water-holding capacity. Sold as preformed blocks they usually come in ready to use trays rather than as a compost additive as they are friable and easily broken down.

ROOTING MEDIUM RECIPES

It is possible to use any of the above ingredients on their own (rockwool and synthetic foams have options made ready for use). Pure peat and coir composts are less stable and might not maintain their structure, coir can also cause nutritional problems for some crops, particularly ericaceous plants. Perlite and bark are potentially stable and have high AFPs but it can be difficult to maintain moisture content as they are so free draining; sticking and holding cuttings in them can be difficult. Pure grit or sand is very heavy and far from ideal for large numbers of cuttings.

A blend of at least two of the above ingredients is likely to produce the best compromise between the desired characteristics. Selection can be a matter of trial and error, every nursery is different, if not unique, so a blueprint is hard to achieve. The range of crops grown will have an effect on choice. Ideally an individual nursery should have as few different recipes as possible, a compromise between the ideal for each species or cultivar grown and the practicality of storage and nursery organisation. The optimum is probably a standard mix with the opportunity to alter the pH or nutritional content without changing the structure of the medium.

Combining ingredients can affect the AFP of a compost quite dramatically, if particle sizes are not compatible AFP can be drastically reduced. This is not a predictable effect; any change to an existing mix needs careful appraisal before making a permanent alteration to a recipe.

Physical mixing can have a dramatic effect on the compost. Too violent a procedure can destroy structure and seriously reduce the AFP of the medium, too gentle and the ingredients will not be combined properly. Paddle-type mixers can mix very efficiently and quickly but may have a greater potential for damaging structure; overmixing may even physically damage some ingredients such as perlite. It is possible to compensate for these potential problems by using coarser materials and adding ingredients in stages to produce an acceptable final product, but the procedure needs to be monitored closely to get it right consistently. Drum mixers are very gentle on the structure of composts but they may take longer to achieve an even mix, especially with those media including ingredients with different densities. For propagation of large numbers of cuttings this means either mixing large quantities and storing a reserve of compost, or buying in compost mixed to the desired recipe.

TESTING ACIDITY AND POROSITY

In theory each batch should be tested for AFP and pH after mixing as any of the ingredients may vary. In practice it should be done as regularly as possible and balancing the time taken against the risk of problems is an individual decision. In a perfect world each delivery of ingredients should be tested separately so that adjustments can be made if necessary during compost preparation.

Acidity. This is an area of compromise, as each plant will have a different optimum pH. As a rule, a pH of around 6 to 6.5 will suit most plants but some ericaceous species will require a pH lower than this. To alter the acidity of a peat-based mix by 1 point on the pH scale, between 0.9 and 1.1 kg of ground lime per cubic metre of compost needs to be added.

TO CALCULATE THE POROSITY OF A COMPOST:

- Seal the base of an empty container and record the volume of water required to fill it = "*A*".
- Empty the container and re-fill it with the compost you want to test, it is important to firm it as much as you would in the propagation tray as compaction has a significant effect on the pore spaces.
- Wet the compost gradually until it is saturated and any excess water runs off. This needs to be done carefully as dry compost has a tendency to float. Record the volume of water used = "*B*".
- Drain the compost into a container, until water stops dripping out of the compost. Don't leave it too long or drying will occur which alters the result. Measure how much water has drained out = "*C*".

- You can now calculate:
  Total porosity (TP) = $B \div A$
  Air porosity (AP) = $C \div A$
  Water-holding porosity = TP ÷ AP.

Ideally this should be repeated to give an average, as the medium may slump a little after its initial wetting.

It has been suggested that the optimum air-filled porosity for a propagation compost should be as high as 30%, which is much higher than that usually recommended for other growing media (around 10% to 15%). Realistically 15% to 20% is more achievable but the principle of aiming high is a good one. Solid components of a compost can make up between 30% to 50% of the total volume, depending on the particle size of the ingredients.

EFFECT OF CONTAINERS

The size of tray or cell also needs some thought when considering a propagation medium, a very small volume container will be difficult to fill evenly if the mix is very coarse. A finer mix may suit the container, but does it significantly affect the AFP? Containers that are wide in proportion to their depth drain less thoroughly than deeper, more narrow cells.

How a tray is filled can affect the AFP of composts while over firming or inconsistent handling can reduce air pore space significantly with serious effects on rooting. Tray-filling machines need to be set up very precisely to get an even and consistent result. Consistency is the key, if the performance of the medium is not predictable then problems occurring later in propagation may be harder to correct.

PRE-PREPARED PROPAGATION MEDIA

There is now a new generation of pre-prepared propagation media, based on a range of different principles. Their aims are basically the same — to provide a consistent reliable propagation system.

The earliest system uses a plastic mesh to stabilise a peat-based compost. An alternative system wraps a conventional compost in a nonwoven membrane. A newer system uses a foam gel which binds the compost ingredients together to create an open structure within a cell tray. A major advantage of those incorporating individual modules is the ability to handle cuttings as soon as roots appear. In trays filled with loose compost, a full network of roots has to develop to bind the compost together before the plants can be handled.

CONCLUSION

There is no such thing as the perfect propagation compost to suit every nursery. The important point is to use a consistent medium, which produces good results over the range of plants grown, reliably each season. There are a lot of variables that affect rooting that are out of the propagator's control, but the rooting medium should not be one of them.

SUGGESTED READING

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Experiences With Simple Propagation on a New Nursery©

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INTRODUCTION

Choice Plants was set up from scratch 5 years ago with a third-hand polythene tunnel and very old Portakabin. The aim of the nursery is to provide good quality shrubs, with some grasses, to local garden centres and landscapers. Capital for expansion projects has been raised entirely through the nursery's profits and is therefore always tight. In addition the nursery has to rely mainly on unskilled labour. This has meant that although I have a love of propagating and would always want to see some happening on the nursery, I have had to carefully evaluate why, what, and how we propagate. The purpose of this paper is to show that plant propagation is possible and viable with the most basic equipment and limited resources.

EVALUATING THE NEED TO PROPAGATE

With the cost of liners and plugs being quite competitive and availability of taxa getting better all the time, there has to be some evaluation about why to propagate on the nursery. I also have found that my cost is not just a matter of successful rooting — it's also the work involved in looking after the plants once they have rooted and moving them on to the next stage. I also have to evaluate whether it is really worthwhile propagating a subject that we only sell in small numbers.

For example, it is worthwhile for us to propagate *Senecio,* because it is easy to root, we have plenty of stock material, and we sell a lot of them. But although some of the less popular *Cistus* are also easy to root, we do not have very much stock material and we sell only about 50 plants in a year. As a general rule I consider that numbers of less than 150 are not worth propagating, aiming for a success rate at the final potting stage of at least 100.

Here are some reasons that I still continue to propagate:

Interest. Learning about propagation helps the staff to understand more about plants and provides some variety in their work.

Use of Labour at Quiet Times. In the autumn and winter we have some lulls and it is useful to try and use labour to propagate.

To Enable Us to Grow Hard-to-Source Plants. We lack facilities to propagate some of the more difficult-to-root subjects but we can propagate plants such as *Fucshia magellanica* 'Alba' and 'Versicolour' and some grasses, especially the larger cultivars, such as *Miscanthus,* which we find difficult to obtain.