PROPYLENE GLYCOL QUICK-DIPS: PRACTICAL APPLICATIONS

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INTRODUCTION

Liquid quick-dips have steadily gained popularity as a means of treating cuttings with auxin. Traditionally, alcohols have been the primary solvents for synthetic auxins (4, 5, 6, 7, 9, 10). However, in some cases alcohols in combination with auxins have proven to be deleterious to cuttings. Alcohols have been implicated with basal necrosis, premature leaf drop, and abnormal root development (1, 3, 4, 6, 7, 8, 9, 12). Alternatives to alcohols do exist and have been used on a limited scale, (5, 6). Barnes (2) and McCrachen (9) have both done research with propylene glycol with positive results. McCrachen (9) showed that propylene glycol reduces the oxidation rate of IBA in solution and that the activity of propylene glycol-IBA solutions remains stable after one year. His work also showed that dips of IBA in propylene glycol at concentrations of 1000, 3000, and 5000 ppm were slightly superior to equal concentrations in ethyl alcohol. In some cases the positive correlation was as much as a 10% improvement. Dirr (6) lists *Berberis thunbergii* 'Crimson Pygmy' as being highly sensitive to ethanol quick-dips. McCrachen showed that with this species, root quality was superior with propylene glycol dips as compared to ethanol dips.

Research by Barnes (2) over the past two years has shown propylene glycol to be an effective auxin solvent. Several points of use and application are presented here.

LIQUID DIPS

Liquid quick-dips from auxin and propylene glycol can be made in two ways:

1. Pure auxin crystals can be dissolved in either 50 or 100% propylene glycol to make up a concentrated stock solution. Normally, these solutions are prepared with a concentration of 10,000 ppm (1%). These solutions can then be used as any other quick-dip preparation. Dirr and Heuser (6) give an excellent review of quick-dips. It is important to note that auxins (IBA and NAA) do not readily dissolve in (50%) propylene glycol unless the solvent is heated to around 160°F, although upon cooling, auxins will not precipitate out. The new auxin, phenyl-indole thiolobutyrate, will dissolve in propylene glycol (50%) to about 2000 ppm when heated.

2. Liquid quick dips can be made from auxin-talc powders. In this case a given amount of talc preparation, (commercial rooting powders) is put in a kitchen blender and blended with 50% propylene glycol to give a workable solution. The ratio of powder to the solvent can be adjusted to make any concentration up to around 5000 ppm. (Note, if the solvent is heated, greater concentrations can be achieved). It is convenient to make such solutions in a ratio of one part powder to nine parts solvent. A 4% IBA talc powder, when mixed with glycol, will result in a solution of approximately 4000 ppm IBA. Machen (11) gives an excellent paper on the making and blending of hormone formulations. By using the blender method, constituents such as boron, rooting co-factors, and fungicides can conveniently be included (2).

For the average nurseryman, auxin solutions made from talc powders are the easiest to prepare and use. A survey of Dirr and Heuser (6) indicates that the majority of plants can be rooted with an auxin concentration of 1000 to 3000 ppm. Solutions of these types can be easily prepared with a kitchen blender, a kitchen scale, measuring spoons, and some measuring cups. Any commercial rooting powder is suitable for these solutions and the 50% propylene glycol can be obtained from many recreational vehicle centers as a water system antifreeze.

While these solutions can be used like any other quick-dip, it is important to make some basic considerations. The cuttings must be wounded, and the drying time for treated cuttings is longer than what would be with an alcohol quick-dip. However, this is offset by more auxin being made available to the cutting.

We have used glycol-auxin solutions for the following types of cuttings: hardwood conifer, soft and hardened springwood cuttings, and ripened one year growth of broadleaf evergreens (Table 1).

Table 1. General production with propylene glycol quick-dips.

Deciduous	IBA conc. (ppm)	Rooting (%)
Franklinia alatamaha	1000	100
Hamamelis vernalis	1000	90
Prunus serrulata 'Kwanzan'	1000	100
Viburnum 'Alleghany'	1500	85
Viburnum carlesii	1500	95
Evergreens, conifers		
Calocedrus decurrens	2000	80
Cedrus deodora	2000	85
Chamaecyparis obtusa cv.	2000	90
Cryptomeria japonica 'Sekan-sugi'	2000	100
Juniperus chinensis 'Hetzii'	1000	100
Taxus cuspidata 'Densiformis'	1000	95

Evergreens, Broadleaf		
Camellia sinensis	2000	88
Ilex glabra 'Shamrock'	1000	100
Ilex opaca 'Old Heavy Berry'	1000	100
Skimmia reevesiana	1000	100
Ericaceous		
Leucothoe axillaris	1000	90
Pieris japonica	3000	80
Rhododendron 'Delaware Valley White'	1000	100

The use of any new technology should be followed with prudence. In some cases, glycol solutions are not superior to alcohol quickdips; however, this seems to be offset by some rather startling results with difficult-to-root plants (Table 2).

Table 2. Difficult to root plants response to glycol quick-dips.

Species	IBA conc. (ppm)	Rooting (%)
Betula spp.	1500	80
Cercidiphyllum magnificum 'Pendulum'	1500	60
Calycanthus floridus	1500	80
Chionanthus virginicus[1]	4000	77
C. virginicus[2]	4000	35
Elliottia racemosa[3]	4000	50
Fraxinus chinensis[3]	2000	80
Osmanthus americanus	2000	100
Pinus roxburghii[3]	2000	80

[1] [2] One and 10 year old mother plants respectively
[3] Cutting rooting in samples of (10) or less

Table 3. Propylene glycol solutions· pros and cons.

Advantages	Disadvantages
Less basal burning	Cuttings should be wounded
Leaf drop negligible	Longer drying time[1]
Non-toxic solvent	Solvent must be heated
Less volatile solvent.	

[1] This is off-set by auxin remaining in solution longer and is more available to the cutting.

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DAN STUDEBAKER: How long do you let the cuttings dry?

BILL BARNES: About 15 min., so it is not a serious impediment.

DAN STUDEBAKER: Is it fairly stable after it is on the cutting?

BILL BARNES: Yes, it is. One thing we like about the glycol formulations is that we can add food dye to the dips. Therefore, I can tell the workers to dip the cuttings in a specific colored solution; it solves a great deal of problems.

RICK LEWANDOWSKI: What about the presence of fungicides in the solution?

BILL BARNES: We have found no effect from thiram. But Benlate has worked with *Prunus subhirtella* ''Plena Rosea''. It did help the rooting.

RICK LEWANDOWSKI: You mentioned storage for 21 days. Is that related to flocculation of the IBA out of solution?

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BILL BARNES: When we use a blender mix, we use large quantities of glycol and water, make a gallon, for example, and microbial action may occur.

RICK LEWANDOWSKI: With difficult-to-root species, is timing still critical?

BILL BARNES: On difficult-to-root species timing is very critical. In our area late May and June is the most important time. Very soft tissue is best for rooting.

MAJORIE HANCOCK: Have you used this material with lilacs and Japanese maples?

BILL BARNES: Yes, with the Japanese maples, particularly dissected types and with 'Bloodgood'. On French hybrid lilacs we have had variable results. Much clonal differences in rooting of French lilacs exist and this shows up in our rooting.

JOERG LEISS: Do you use powders to make your solutions?

BILL BARNES: We use crystals for the concentrated auxin solutions. To make large volumes of solution we use talc powders because all you need is a measuring spoon and blender, and that saves time.

VOICE: Have you used this method with herbaceous material?

BILL BARNES: Yes, it works well.

VOICE: Can you cite any examples?

BILL BARNES: *Chrysanthemum pacificum* and some phlox. We use about 1000 ppm concentration.

TOM McCLOUD: Were the solutions stored in the dark?

BILL BARNES: No, in the light in a clear glass bottle to test storage under adverse conditions.