Inexpensive IBA Root-Promoting Solutions

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INTRODUCTION

Nursery propagators regularly stimulate cuttings to root using indolebutyric acid (IBA) dispensed in powder (talc) or liquid formulations. Commercial liquid rooting preparations are readily available in a wide range of concentrations and are easier to dilute to meet the rooting requirements for cuttings of different species (Dirr, 1981; Dirr and Heuser, 1987). IBA solution may induce better rooting than powdered IBA and at high concentrations [≥1% (10,000 ppm) IBA] may also stimulate rooting of many difficult-to-root species (Chong and Daigneault, 1986).

TRADITIONAL LIQUID HORMONES

Most commercially available liquid rooting hormones are prepared by dissolving crystalline IBA in solvents—also referred to as "carriers"—such as ethyl or isopropyl alcohols. These solvents are expensive, may require a special permit to purchase, and large quantities may have to be kept locked up. For instance, pure (99%) isopropyl alcohol may be purchased in Ontario upon special order from a drug store. However, "drinkable" ethyl alcohol (ethanol) can only be purchased from liquor stores over-the-counter (40% alcohol), with a doctor's prescription (65% alcohol), or with special government permit (94% or more alcohol). "Non-drinkable", denatured laboratory grade (95%) ethanol can be purchased from a chemical supply company and does not require a permit to purchase or store. Denatured alcohol is poisonous and, if consumed mistakenly or otherwise, can result in death!

Some commercial root-promoting solutions contain solvents or hormone formulations which may cause excessive callusing or extensive basal burning (injury) to some cuttings (Barnes, 1988; Chong and Daigneault, 1986; Dirr, 1981). Under certain circumstances, the concentration of alcohol-based hormones may change during use due to evaporation of the alcohol.

GLYCOLS

Glycols are common constituents in many types of commercial antifreezes. According to Dirr (1981), polyethylene glycol is a good IBA solvent and is the least toxic of all commonly used solvents, except water. Barnes (1988) stimulated cuttings to root with IBA dissolved in glycol-based commercial antifreezes.

Chong et al. (1992) compared the rooting response of nine evergreen and five deciduous woody taxa after cuttings were treated with 0.1%, 0.3%, or 0.8% IBA in talc, or with 0%, 0.5%, 1.0%, 1.5%, or 2.0% IBA dissolved in 95% laboratory-grade ethanol or undiluted plumbing antifreeze containing 45% propylene glycol. The evergreen cuttings were taken from last season's growth and rooted during the winter under greenhouse fog regime. The deciduous cuttings were taken from current season's growth and rooted under mist during the summer. Rooting evaluation was based on the mean percent rooting of cuttings, mean root number (based on cuttings which rooted), and mean root length (based on the longest root).

There were large differences in the rooting response of taxa to carriers and/or IBA concentrations. However, as exemplified by data for one evergreen (*Taxus ×media* 'Densiformis') and one deciduous species (*Elaeagnus angustifolia*) (Fig. 1), IBA dissolved in plumbing antifreeze produced rooting in most taxa comparable to those of the ethanol-IBA combination. Root numbers of all taxa increased (linearly or curvilinearly) with increasing IBA concentrations, as did percent rooting in six of the nine evergreens and four of the five deciduous taxa. Talc formulations were similar, or were typically less effective, than IBA in solution at comparable concentrations.

NEW PRODUCTS

Encouraged by these results, Chong and Hamersma (1995) examined related commercial products that could be just as effective, such as car radiator antifreeze and windshield washer fluid. The costs and availability of these products in Ontario are compared in Table 1.

Table 1. Comparative costs of various solvents in Ontario.

Solvent	Source	Cost for 4 litres
Ethyl alcohol (ethanol)	*Liquor Control Board of Ontario*	
	65% prescription, 500 ml @ $16.95	$135.60
	40% over-the-counter, 1.14 L @ $27.50	96.49
	Chemical supply company	
	95% denatured, laboratory grade	43.00
99% isopropyl (rubbing alcohol)	Drug store	14.42
Pure methyl hydrate (methanol)	Drug store	5.53
Plumbing antifreeze (45% propylene glycol)	Hardware department	4.99
Car radiator antifreeze (95% ethylene glycol)	Auto department	6.49
Windshield washer fluid (47.5% methyl hydrate)	Auto department	1.49

Car radiator antifreeze contains 95% ethylene glycol plus small (unspecified) amounts of antioxidants and other rust inhibiting additives. Windshield washer fluid (-40°C) contains 47.5% methyl hydrate plus small (unspecified) amounts of detergents and dyes. Methyl hydrate (methyl alcohol, methanol) is an alcohol closely related to ethanol. Ethanol is a fermented alcohol. Methanol is made from natural gas or coal, and thus also referred to as wood alcohol. It was quite conceivable that these commercial products, used as IBA solvents, might be toxic to cuttings perhaps due to the additives and dyes present in these products. Before any nontraditional solvents, such as these, could be widely used by nursery propagators, their efficacy had to be fully determined.

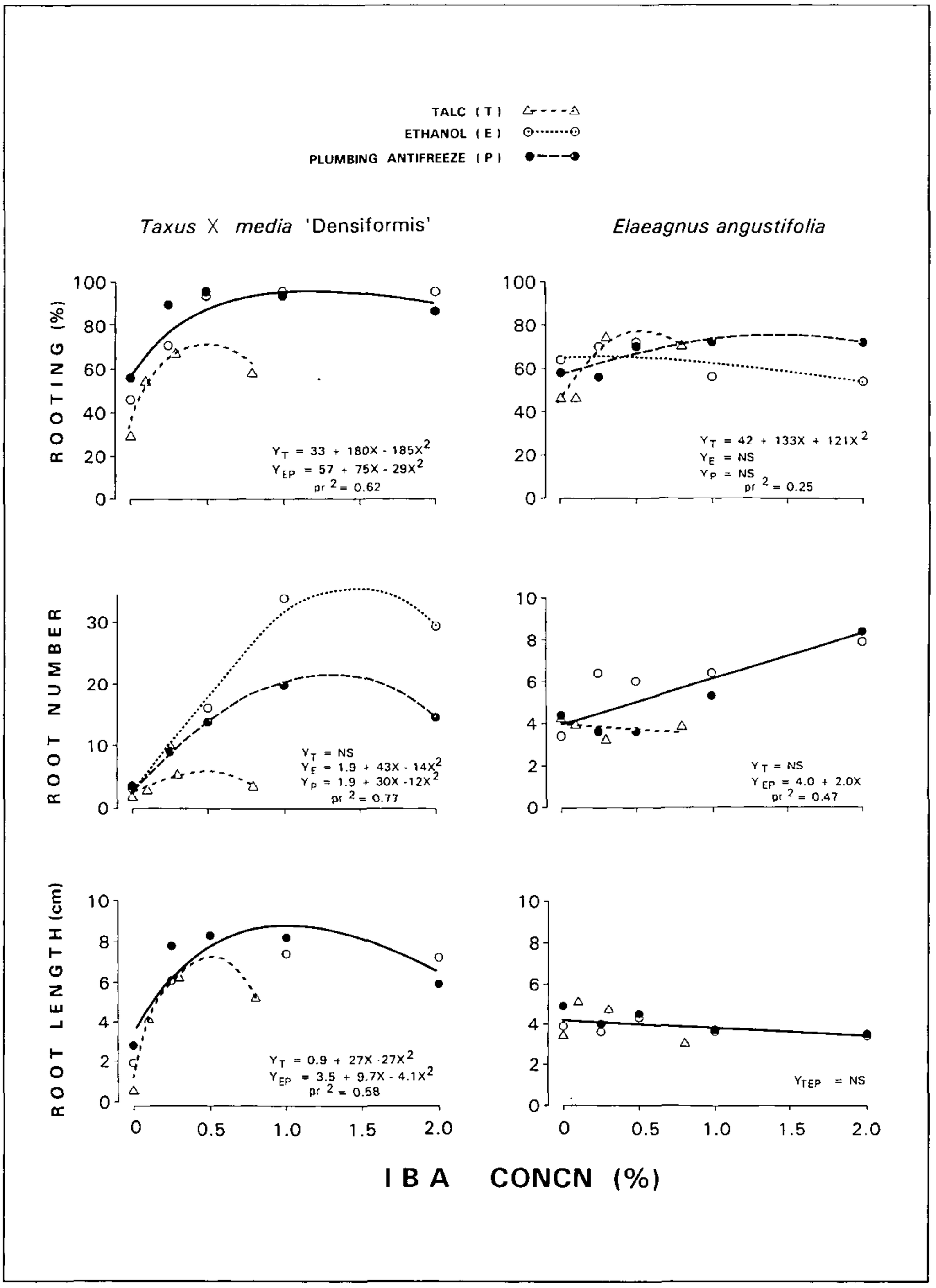

Figure 1. Rooting response of two nursery species to solvents and IBA concentrations. The regression for each carrier is represented by Y_T (talc), Y_E (ethanol), and Y_P (plumbing antifreeze). Y_{EP} and Y_{TEP} indicate nonsignificance among regressions ($P<0.05$) for the two or more solvents represented in the subscripts, and are shown graphically as solid lines. NS indicates that the slope, curvature, or both were nonsignificant ($P<0.05$). pr^2 represents the coefficient of determination after removing replication effects.

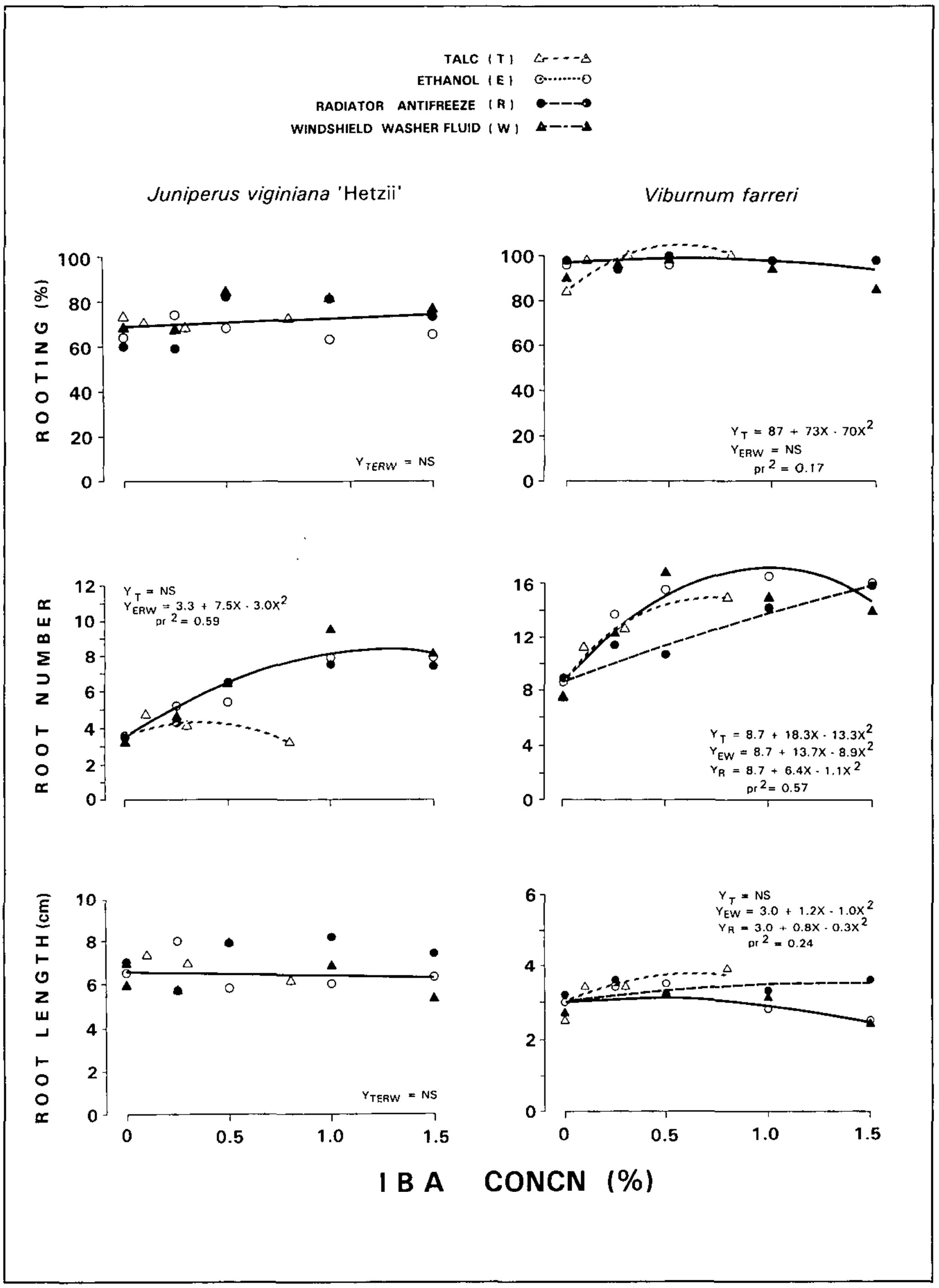

Figure 2. Rooting response of two nursery species to solvents and IBA concentrations. The regression for each carrier is represented by Y_T (talc), Y_E (ethanol), Y_R (radiator antifreeze), and Y_W (windshield washer fluid). Y_{EW}, Y_{ERW}, and Y_{TERW} indicate nonsignificance among regressions ($P<0.05$) for the two or more solvents represented in the subscripts, and are shown graphically as solid lines. NS indicates that the slope, curvature, or both were nonsignificant ($P<0.05$). pr^2 represents the coefficient of determination after removing replication effects.

In these investigations, four evergreens and four deciduous taxa were treated as described above with talc IBA, or with 0, 0.25, 0.5, 1.0, or 1.5% IBA in ethanol, car radiator antifreeze, or windshield washer fluid.

As exemplified by data for one evergreen (*Juniperus virginiana* 'Hetz') and one deciduous species (*Viburnum farreri*) (Fig. 2), the results indicated "near-similar" root-promoting effects of ethanol, car radiator antifreeze, and windshield washer fluid and confirmed results with plumbing antifreeze (Fig. 1).

CONCLUSION

Within each of many taxa tested, rooting differences, if any, due to solvents were generally small and/or commercially insignificant. Consequently, propagators can use ethanol, plumbing antifreeze, car radiator antifreeze, and windshield washer fluid and expect comparable results. These non-traditional solvents are inexpensive and are readily available.

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