HYDROPONIC FERTILIZATION OF WOODY PLANTS IN CONTAINERS

WILLIAM L. BROWN

Louisiana State University
Southeast Horticultural Experiment Station
Hammond, Louisiana 70401

Hydroponic fertilization is the supply of all mineral nutrients to a plant in the irrigation water. It has been used for many years, both commercially and as a research tool, primarily for greenhouse flower and vegetable crops.

The possibility of its use with container-grown woody ornamentals was first considered by us several years ago as we pondered the full range of possible fertilization methods. Incorporation into the growing medium of all nutrients needed for a year's growth was envisioned as one extreme of this range and the supply of all nutrients in the irrigation water as the other extreme. There are considerable advantages to the use of one of these extremes or the other.

One of the advantages of hydroponic fertilization is that it eliminates the necessity for mixing the medium. If an economical material is available that has the physical and chemical properties needed, plants can be potted in this material without additives. In our area the obvious choice is pine bark.

In our first test of this method in 1977 a commercial hydroponic fertilizer made by Pronto Plant Food Company was used. The 8-5-15 analysis of the material was boosted to the equivalent of 10-5-15 with urea. The "A" and "B" components were applied either simultaneously or at alternate irrigations to determine if this factor had any effect on growth. These treatments were compared with one which supplied all nutrients needed from Osmocote 18-6-12, superphosphate, dolomitic limestone, and fritted trace elements. Other treatments involved some incorporated materials and some supplied in the irrigation water.

Average growth ratings with hydroponic fertilization were higher than those with Osmocote, which were, in turn, higher than all of the "combination" treatments used. There was no apparent difference between the hydroponic treatment which supplied all nutrients at each irrigation and that which used the "A" and "B" components alternately. Therefore, in all tests since that time the alternating method has been used.

In the following year's test, a homemade hydroponic fertilizer was compared with 6 slow-release treatments and 4 combinations of incorporated and liquid fertilizers. All liquid programs were calculated to supply an average of 150 ppm of N. The hydroponic program also supplied 50 ppm P_2O_5, 100 ppm K_2O, 122 ppm Ca, 40 ppm Mg, and all other essential elements.

'Hino-crimson' azalea, variegated pittosporum, 'Convexa' (Syn.: 'Bullata') Japanese holly, 'Dwarf Burford' Chinese holly, and 'Santa Cruz' pyracantha were used For all 5 species the quality rating for the hydroponic treatment was significantly higher than that of all other treatments.

In 1979 hydroponic fertilization was compared with 4 other treatments which made use of the best cultural practices that we had determined in a variety of previous experiments. One of these practices was the use of ⅛ soil (by volume) added to the pine bark medium for all treatments except the hydroponic one. Another was incorporation of Osmocote in the top quarter of the medium instead of throughout the medium. The 5 fertilization treatments were tried under 2 irrigation systems, sprinklers, and "spitters."

In overall quality and color ratings, hydroponic fertilizer applied through sprinklers rated significantly higher than all other treatments. The same treatment ranked significantly higher than all except Osmocote 18-5-11 with sprinklers in size rating. Hydroponic fertilization through spitters rated highest in compactness.

'Formosa' azalea, variegated pittosporum, and 'Wilsonii' English ivy performed especially well when given hydroponic fertilization, receiving high scores in all 3 criteria used: size, color, and compactness. 'Blue Pacific' juniper and 'Dwarf Burford' holly also rated very well with hydroponic fertilization, scoring very high in size and color. 'Compacta' Japanese holly was slightly lacking in size and compactness, tending to produce long, unbranched shoots. 'Richard's' harland box was slightly larger with Osmocote 18-5-11, but color was much better with hydroponic fertilization.

In 1979, we also compared various sources of P and Mg that might be used for hydroponic fertilization. Soluble sources of phosphorus are scarce and expensive. The usual source of magnesium, Epsom salts, is also rather expensive. The P sources tried were an 18-46-0, which was not completely soluble; phosphoric acid; urea phosphate; and urea ammonium polyphosphate (UAPP). The latter 2 are experimental materials from the Tennessee Valley Authority. The alternative source of Mg was sulfate of potash-magnesia.

No significant differences were found among plants grown with the various hydroponic solutions. In general, all were better than the Osmocote-fertilized check plants. UAPP would be unsuitable for hydroponic fertilization through an injector because a precipitate formed when it and $MgSO_4$ were used in the same concentrate. The 18-46-0 and potassium magnesium sulfate had the disadvantage of leaving an insoluble residue.

A 1980 test still being evaluated is based on the fact that, while hydroponic fertilization can be economical if waste can be eliminated, the cost of applying it through sprinklers to normally-spaced plants would be very high. Therefore, plants that were planted in crowded 6 inch square pots in April were hydroponically fertilized until they were spread August 1. At this time they were given various top dressings to determine which ones carried them through the remainder of the season most effectively. These treatments are being compared with an Osmocote check and a full-season hydroponic check.

A disadvantage to purely liquid fertilization in a non-retentive medium is that if the fertilization program were discontinued in the fall and the plants were held until spring before sale, the medium would be almost completely without nitrogen and possibly other nutrients by that time. Top dressing, as in our current test, would eliminate this problem.

To give some idea of the cost involved, the hydroponic fertilizer for a 6″ diameter container, without waste, for a growing season was calculated to range from 1½ to 3¢, depending on the particular materials used. This calculation was based on 100 applications of 1 pint each. For comparison, Osmocote fertilizer at 16 lb per cubic yd would cost about 3¢ per 6 inch container.

The following formulas are offered to give a starting point for experimentation with hydroponic fertilization. The least expensive combination we know would require:

"A" solution — 168.5 g. $CaNO_3$ per 100 liters.

"B" solution — 21.7 g. 18-46-0, 90.8 g. potassium magnesium sulfate, 2.23 g. STEM and 1.11 g. Fe 330 iron chelate per 100 liters.

A more expensive, but more nearly residue-free combination would be:

"A" solution — 153.6 g. $CaNO_3$ per 100 liters.

"B" solution — 9.2 ml. of 62.5% phosphoric acid, 44.9 g. potassium nitrate, 83.3 g. magnesium sulfate, 2.23 g. STEM and 1.11 g. Fe 330 iron chelate per 100 liters.

Both of these formulas are calculated to supply 150 ppm N, 50 ppm P_2O_5 and 100 ppm K_2O.

It is our conclusion that hydroponic fertilization is a very effective method of growing woody plants in containers and that it can be an economical method if waste can be minimized by such means as crowding, individual emitters, or early season use in conjunction with top dressing. It also has potential uses during the propagation and liner production phases of woody plant production.

MY METHOD OF GROUND COVER PROPAGATION

BOB GRIMES

Warrior Nursery
Rt. 3, Box 782
Warrior, Alabama 35180

In propagating ground covers we are speaking of large quantities. In order to propagate these plants in quantity, plenty of "wood" is needed. Since all of our plants are either from vegetative propagation or division, we must have stock plant facilities.

Our stock plants are grown in 1-gal plastic containers, on approximately 1 A of treated ground covered with 1 to 2 inches of slag gravel, ⅛ to ¼ inch in size. We use #25 impulse-type sprinklers on 30-ft centers with 160 lb city water pressure. This area is treated twice a year with Ronstar (oxadiazone, Rhone-Poulenc) at the recommended rate.

Our spraying program consists of Spectracide (diazinon, Ciba-Geigy) and Docide 101 (copper hydroxide, Kennecot Copper), alternating with Daconil 2787 (chlorothalonil, Diamond-Shamrock) and Orthene 75% WP (acephate, Chevron). We spray about every 30 days, using a 100 gal Mighty Mac trailer-type sprayer with 40 to 50 lb pressure.

In order to maintain weed-free plants we utilize Ronstar at manufacturer's recommended rates. Right after the containers are planted. Ronstar is broadcast over the entire container and plant pad. Application is repeated in late summer and early spring. Roundup (glyphosate, Monsanto) is used throughout the growing season when needed on areas adjacent to the growing pad but not on the container material. It is not necessary to spend any money for hand weeding when we follow this herbicide program.

During the growing season, usually from March through November, we fertilize with a dry top dress of 12-6-6 fertilizer that has been liquid coated with 1% Di-Syston (disulfoton, Mobay Chem.). We apply 1 teaspoon by hand to each container approximately every 60 days or more often during seasons of heavy rainfall, immediately after taking cuttings. Labor is paid for fertilizing on a piece-work basis.

We propagate 12 months out of the year; however, from June to September is our heaviest workload. We take cuttings approxi-