hobbyist. The 6-in. pot could be grown and available to the consumer year round.

Commercial production of *Hibiscus rosa-sinesis* has a great potential as a color crop, especially when grown as a green, compact flowering plant by the use of good growing practices and by Cycocel treatments, which enables the hibiscus to be in bloom for early spring sales, and the year around.

ROOTING HORMONE FORMULATIONS: A CHANCE FOR ADVANCEMENT

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The effects of synthetic auxins indolebutyric acid (IBA) and naphthaleneacetic acid (NAA) have been known since 1935 (8). Since that time work with these chemicals and other compounds such as 2,4-dichlorophenoxyacetic acid (2,4-D) (2), and willow extracts (6) have been reported. Commercial mixtures such as Wood's Rooting Compound (7), Rootone products, and Dip'N-Grow are successfully used throughout our nursery industry.

Flowerwood Nursery practices specific use of combinations of IBA, NAA, potassium-IBA, alcohol, water, talc mixtures and solutions, as root-promoting treatments. We find species and cultivar variations by treatment demonstrated by *Raphiolepis indica*, *Rhododendron*, *Camellia sasanqua* and almost all species that we produce. Our auxin formulation program offers opportunities for great progress for plant propagators in time, quality, and quantity of rooting.

Hormone-induced rooting of cuttings is a common practice among nurseries of all sizes. Many purchase commercially-available packaged rooting compounds. Others purchase chemical-grade auxin and formulate their own solutions. Most common is the use of crystalline IBA, diluting it with alcohol and water for desired concentrations.

Flowerwood Nursery produces 80% of all its liners from stem cuttings. Typical cuttings are from 3 to 7 in. in length. These cuttings are taken from container or field stock plants. Cuttings are bundled with rubber bands and trimmed for uniformity. Most cuttings are not stripped. All cuttings are rinsed in a fungicide solution before auxin treatments. The balance of

our liner production is evenly divided between division and seed.

Auxin treatment is typically a 3-sec. basal dip. Quick dips and extended dips are occasionally used. All cuttings are directly stuck into 2¼-, 3¼- or 4-in. plastic liner cups (5). Cuttings are rooted in Cave Enterprise covered gutter-connected plastic hoop houses under intermittent sprinkler irrigation. We use Ross 24 sprinkler heads. All phases of propagation except watering, pest control, and maintenance are piecework systems.

IBA-ALCOHOL-WATER SOLUTIONS

The foundation of our auxin formulation program is IBA-alcohol-water dilutions. We purchase chemical-grade IBA from Eastman Kodak Co. of East Rochester, New York. Other chemical companies have been listed as a source in a previous publication (1).

Basic Formulations:

(1) To prepare Stock solution = (10,000 ppm IBA)

mix . 5 grams IBA
1 pint 70% isopropyl alcohol

(2) To prepare 5,000 ppm IBA

mix . . 8 parts stock
4 parts tap water
4 parts 70% isopropyl alcohol

(3) To prepare 2,500 ppm IBA

mix . 4 parts stock
6 parts tap water
6 parts 70% isopropyl alcohol

(4) To prepare 1,250 ppm IBA

mix . 3 parts stock
7 parts tap water
6 parts 70% isopropyl alcohol

(5) To prepare 1,870 ppm IBA

mix . . 2 parts stock
7 parts tap water
7 parts 70% isopropyl alcohol

Uses of IBA-water-alcohol dilutions:

10,000 ppm IBA: Use on difficult-to-root species such as *Photinia* × *fraseri*, *Eriobotrya japonica*, hardwood *Ilex* × *attenuata* 'Fosteri', and hardwood *Ilex opaca* 'Savannah'. Mr. Sidney Meadows years ago advised me to root *Photinia* by using the strongest liquid treatment. Out of ignorance I treated with stock 10,000 ppm IBA and it worked. At this time Mr. Meadows was unfamiliar with IBA-water-alcohol solutions. His advice was right on target. *Photinia* × *fraseri* cuttings, with opti-

mum type wood and proper environment, will root profusely in 15 days.

5,000 ppm IBA: This treatment is seldom used at Flowerwood Nursery. Most of our cuttings are taken in spring, summer, or fall of current year wood. this strength would be of use on winter cuttings of ligustrum, pyracantha, and other species. Species that root fairly well in the summer might be slow and difficult in the winter. With this level of IBA one should see reduced rooting time and higher percentages of takes.

2,500 ppm IBA: This treatment is widely used. Response on medium-slow or medium-difficult species is great. It is commonly used on *Ilex cornuta* and species of *Ligustrum, Pyracantha, Viburnum* and most *junipers.*

1,870 ppm IBA: 1870 ppm IBA is used on fairly easy and fast-to-root items. Examples would include *Euonymus*, certain azaleas, *Ilex vomitoria* Nana (dwarf yaupon), and *Ilex crenata* 'Compacta'.

1,250 ppm IBA: There are certain cultivars that root from fallen cuttings. They root where they touch the ground and they root in the trash can. We commonly use this weakest strength IBA on these items. Most Kurume azaleas, Satsuki azaleas, *Trachelospermum* (*Rhynschospermum*), *Cotoneaster*, and *softwood Lagerstroemia* all fall into this category. The advantages of using treatments on the easy cultivars are shortened mist time, reduced disease pressures, and reduced intensive care time of long duration rooting. Quality and quantity of roots are also enhanced.

As a general rule, the harder the cutting wood, the higher the auxin concentration should be.

IBA — NAA — ALCOHOL WATER SOLUTIONS

A very successful propagation program can be designed using only IBA. However, several species respond dramatically to IBA-NAA combinations. Five years ago I began to investigate IBA-NAA combinations. In 1980 my first discovery was that *Raphiolepis indica* cultivars had very specific responses to IBA-NAA levels. This held true as I worked on *Camellia japonica, Camellia sasanqua, Rhododendron*, and many other species.

Basic formulations:

(1) To prepare 10,000 ppm IBA + 3,000 ppm NAA
mix . 1.43 grams NAA
1 pint IBA stock solution

(2) To prepare 8,000 ppm IBA + 2,500 ppm NAA
mix . . . 8 parts IBA stock solution
1 part 70% isopropyl alcohol
1 part tap water
1 19 grams NAA
(3) To prepare· 2,500 ppm IBA + 2,500 ppm NAA
mix . . . 1.19 grams NAA
1 pint of 2500 ppm IBA
(4) To prepare 5,000 ppm IBA + 1,500 ppm NAA
mix . 0.71 grams NAA
1 pint of 5000 ppm IBA

My experience shows that NAA at 2,500 ppm can be toxic. I do not use NAA at levels greater than 3000 ppm.

There exist great opportunities to those who become familiar and comfortable with IBA-NAA mixtures. Commercial mixtures do not give me the latitude to design specific optimum auxin treatments to accommodate cultivar variances.

OTHER FORMULATIONS

K-IBA. K-IBA is the potassium salt of indolebutyric acid. It is highly water soluble while IBA itself is not. We selectively use K-IBA solutions as auxin treatments where alcohol sensitivity is present.

To prepare 3,000 ppm K-IBA
mix . . . 1.43 grams K-IBA
1 pint H_2O

To prepare 3,000 ppm K-IBA + 3,000 ppm NAA
mix . . . 1 pint H_2O
1 43 grams K-IBA
1.43 grams NAA

The most dramatic effect of K-IBA is for treatment of *Ilex crenata* 'Helleri', *Ilex vomitoria* 'Nana,' and *Berberis thunbergi* 'Atropurpurea Nana.' When using an alcohol-based solution, all of these species at times will have basal flaming, a result of alcohol burning, immediately after auxin application.

IBA-talc-fungicide. We formulate our own talc mixtures. We find greater response with those mixtures than to solution treatment only in a few cases (*Elaeagnus*, *Rhododendron*, and certain *Ilex* species).

To prepare: 2% IBA-talc-fungicide
mix 2 grams IBA
8 grams Benlate
90 grams talc

Any commercial baby powder talc will suffice. To change the percentage IBA one has to manipulate the IBA-talc ratios.

SOME SPECIFIC OPTIMUM AUXIN TREATMENTS

IBA

1. *Rhododendron* (satsuki group) 'Shinnyo-no-Tsuki': 1250 ppm IBA
2. *Cotoneaster salicifolius*: 1250 ppm IBA
3. *Euonymous japonica* 'Aureo-marginata': 1870 ppm IBA
4. *Gordonia lasianthus*: 2500 ppm IBA
5. *Pyracantha* 'Navajo': 2500 ppm IBA
6. *Photinia* × *fraseri*: 10,000 ppm IBA

K-IBA

7. *Berberis thunbergi* 'Atropurpurea Nana': 3000 K-IBA
8. *Ilex crenata* 'Helleri': 3000 ppm K-IBA

IBA-Talc

9. *Elaeagnus pungens* 'Fruitlandii': 2% IBA-talc

IBA-NAA

10. *Nandina domestica* 'Purpurea': 1250 ppm IBA + 1500 ppm NAA
11. *Ilex cornuta* 'Rotunda': 3750 ppm IBA + 750 ppm NAA
12. *Camellia sasanqua* 'Yuletide': 6000 ppm IBA + 2500 ppm NAA
13. *Camellia japonica* 'Warrata': 8000 ppm IBA + 2500 ppm NAA
14. *Ilex latifolia*: 10,000 ppm IBA + 1500 ppm NAA

METHODS OF EXPERIMENTATION

There remain many discoveries to be made in regard to auxin treatments and practices. New product lines at Flowerwood Nursery are initially propagated by our best reasonable guess. Difficult items are tested with a wide range of application methods, auxin levels, and auxin combinations. Currently we use 15 different treatments to do auxin experimentations. We constantly study responses and analyze our results. We feel that many factors affect rooting abilities, but a primary factor is the auxin treatment. Our research is headed in the direction of higher IBA concentrations, as well as use of aryl esters of IBA and indoleacetic acid (3).

Auxin treatment of cuttings is an integral part of Flowerwood's accelerated cropping systems. The essence of accelerated cropping is to maximize plant growth and development beginning with the cutting. We avert stress. If we cannot avert it, we try to minimize stress. Use of auxin treatment, we feel,

greatly accelerates rooting and liner development helping us in our race to the market place.

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DEVELOPMENTS IN DRACAENA PRODUCTION

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Dracaena fragrans and *Dracena fragrans* 'Massangeana' are two of the most important plants used in interiorscaping. These plants are native to tropical Africa but are known to have been under cultivation in Europe since at least the mid-1700's. Currently, these plants are available in bush, cane, tree, and stump forms. They are used extensively in interiorscapes because of their aesthetic impact and because they perform well under low light conditions with very few insect and disease problems.

This paper will focus mainly on the production of this plant in the cane form and will introduce some new techniques which could have a significant effect on how cane is produced and grown.

Until the 1960's most cane was collected in Central and South America and shipped to the United States for growing. During the past 25 years extensive acreage of cultivated cane has greatly increased both the total volume and diversity of