

Hortus

Plant Propagation from Cuttings

A Guide to Using Plant
Rooting Hormones by
Foliar and Basal Methods

Third Edition

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Plant Propagation from Cuttings

**A Guide to Using Plant Rooting Hormones
by Foliar and Basal Methods**

Third Edition

Written by Joel Kroin
with assistance from Kees Eigenraam (Rhizopon),
Cliff Hoogland (Phytotronics), and information
from Dr. Fred Davies and Bailey Nurseries

Published by



Plant Propagation from Cuttings is the most effective way to clone plants that are identical to the stock plant

Five Successful Methods

Basal Methods

Use Dry Powder Rooting Hormones:

Dry Dip Method

Use IBA Rooting Solutions:

Basal Quick Dip Method

Long Soak Method

Foliar Methods

Use IBA Rooting Solutions:

Spray Drip Down™ Method

Total Immerse Method

The World's Finest Plant Rooting Products

Rooting Solutions

IBA Rooting Solutions:

Hortus IBA Water Soluble Salts

Rhizopon AA Water Soluble Tablets

Dry Powder

Rooting Hormones

Color Coded Powders in Three Concentrations:

Rhizopon AA #1, #2 and #3

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Articles

Propagate plants from cuttings using foliar applied aqueous (water based) IBA rooting solutions.

Tips: do's and don't's

By Joel Kroin, President, Hortus USA Corp.

Presentation made at the International Plant Propagators Society (2014)

Foliar applied rooting solutions for plant propagation from cuttings: historical background and utility.

History and methods to apply rooting solutions by basal and foliar methods.

By Joel Kroin, President, Hortus USA Corp.

Presentation made at the International Plant Propagators Society (2014)

Growth regulator effects on adventitious root formation in leaf bud cuttings of juvenile and mature *Ficus pumila*

Physiology of foliar methods and their relationship to the juvenility & maturity of cuttings.

By Frederick T. Davies and J. N Joiner

J. Am. Soc. Hort. Science (1980)

Auxin application via foliar sprays

How Bailey Nurseries implemented plant propagation using foliar applied IBA rooting solutions

By Samuel Drahm, Senior Researcher, Bailey Nurseries

Presentation made at the International Plant Propagators Society (2007)

Label

Hortus IBA Water Soluble Salts

Products Used to Make Rooting Solutions

Hortus IBA Water Soluble Salts & Rhizopon AA Water Soluble Tablets are used by ALL BASAL and FOLIAR Methods and Rates (*Quick Dip, Basal Long Soak, Spray Drip Down and Total Immerse Methods.*) They replace technical IBA and K-IBA, and pre-mix rooting products, with MORE applications.

Both products contain the water soluble active ingredient: Indole-3-butyric acid (IBA).

Hortus IBA Water Soluble Salts® (20%)



- **Measure** Hortus IBA Water Soluble Salts using a scale then mix into ordinary water.
- Hortus IBA Water Soluble Salts are water soluble to OVER 100,000 ppm IBA, remain in solution at any concentration.

Rhizopon® AA Water Soluble Tablets



- **Count** Rhizopon AA Water Soluble Tablets then mix into ordinary water.
- Rhizopon AA Water Soluble Tablets are water soluble to 1500 ppm IBA.

Products Used by the Basal Dry Dip Method

Rhizopon AA #1, #2 and #3 Dry Dip Rooting Hormones are always ready to use by the Basal Dry Dip Method.

Rhizopon® AA #1 (0.1)

- Active Ingredient 0.1% Indole-3-butyric acid (IBA)
- **Color identified Pink Color Powder.**
- Use on easy to root cuttings.

Rhizopon® AA #2 (0.3)

- Active Ingredient 0.3% Indole-3-butyric acid (IBA)
- **Color identified Green Color Powder.**
- An intermediate all purpose product.
- Use on easy to more difficult to root cuttings.

Rhizopon® AA #3 (0.8)

- Active Ingredient 0.8% Indole-3-butyric acid (IBA)
- **Color identified White Color Powder.**
- Use on more difficult to root cuttings.



Foliar Methods

Use Hortus IBA Water Soluble Salts and Rhizopon AA Water Soluble Tablets to Make Rooting Solutions



SPRAY DRIP DOWN™ METHOD

- Stick cuttings.
- Spray the Rooting Solution onto leaves until drip down.



TOTAL IMMERSE METHOD

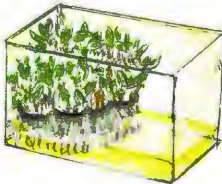
- Total immerse the cuttings a few seconds in the Rooting Solution.
- Drain.
- Stick cuttings.

Basal Methods



BASAL QUICK DIP METHOD

- Immerse basal end of cuttings a few seconds in the Rooting Solution.
- Stick cuttings.



BASAL LONG SOAK METHOD

- Immerse basal end of cuttings a few hours in the Rooting Solution.
- Stick cuttings.

Use Rhizopon AA #1, #2 and #3 Dry Dip Rooting Hormones



DRY DIP METHOD

- Dip basal end of cuttings in the Rhizopon AA rooting powder.
- Stick cuttings.

Questions you want to ask when reading this book

About the Products

How much Hortus IBA Water Soluble Salts do I need?

- A Rooting Solution, for one gallon at 1000 ppm, uses 19 grams of Hortus IBA Water Soluble Salts.
- By the Basal Long Soak and Basal Quick Dip Methods one gallon of Rooting Solution can treat many thousand cuttings.
- By the Spray Drip Down Method one gallon of Rooting Solution can treat 175-225 square feet of propagation trays.
- For typical use, at 100 ppm IBA, annual cuttings use 1.9 grams of Hortus IBA Water Soluble Salts per gallon.

Can I make a concentrated stock mix?

Rooting Solutions made with Hortus IBA Water Soluble Salts can be made to over 100,000 ppm IBA using ordinary water. Growers can make up concentrated Rooting Solutions in the production office. The concentrated Rooting Solution can be added to the production tank in the work area then add water to bring the solution to full rate.

What is the keeping life of a Hortus IBA Water Soluble Salts Rooting Solution?

- An un-used Rooting Solution can be used for several days after make-up if stored at normal room temperature and light. Solutions made for the Spray Drip Down Method are un-used until sprayed. (See pages 16-17 for solution notes.)
- The Total Immerse, Basal Long Soak and Basal Quick Dip Methods use the Rooting Solution on each treated plant lot. Dispose used Rooting Solutions between production lots to avoid cross contamination.

What is the keeping life of dry Hortus IBA Water Soluble Salts, Rhizopon AA Water Soluble Tablets and un-used Rhizopon AA dry powder rooting hormones?

Un-used, DRY, in the original container, sealed, and at room temperature, the products retain potency for many years. Refrigeration is not required. Do NOT allow the powders to become damp or wet. (See pages 16-17 for notes.)

What is the cost of Hortus IBA Water Soluble Salts compared with so called 'pre-mix' rooting products? How is Hortus IBA Water Soluble Salts different from a pre-mix?

- Hortus IBA Water Soluble Salts cost about 1/3 to 1/5 the price of 'pre-mix' rooting solutions.
- Hortus IBA Water Soluble Salts can be shipped by ordinary means. 'Pre-mix' rooting solutions can incur 'hazardous shipping charges'.
- Hortus IBA Water Soluble Salts Rooting Solutions are made by the grower using ordinary water; the Rooting Solutions can never cause solvent toxicity. Alcohol based 'pre-mix' rooting solutions may cause alcohol toxicity to the cuttings especially at high concentrations.
- 'Pre-mix' contain un-needed ingredients; NAA in them has little plant need and not used by European growers.

Hortus IBA Water Soluble Salts & Rhizopon AA Water Soluble Tablets, dissolved in water, make IBA and KIBA rooting solutions for all applications.

What is the difference between Hortus IBA Water Soluble Salts or Rhizopon AA Water Soluble Tablets and technical IBA/KIBA?

Hortus IBA Water Soluble Salts & Rhizopon AA Water Soluble Tablets make IBA and KIBA rooting solutions used for all basal and foliar methods.

Hortus IBA Water Soluble Salts, Rhizopon AA Water Soluble Tablets, and **Rhizopon AA dry powers** are registered with the US EPA for use by plant growers.

Hortus IBA Water Soluble Salts make solutions to over 100,000 ppm IBA/KIBA. **Rhizopon AA Water Soluble Tablets** make solutions to over 1500 ppm IBA/KIBA.

The US EPA **does not permit** technical IBA and KIBA to be used by plant growers; **none** are labeled for any use by plant growers. IBA can only be dissolved in **dangerous solvents**. KIBA, dissolved in water, is **unstable**; both IBA and KIBA drop out of solution at nominal ppm's.

What is the WPS re-entry interval (REI) for Hortus IBA Water Soluble Salts and Rhizopon AA products?

Hortus IBA Water Soluble Salts and all Rhizopon AA products have US EPA labels with ZERO hour REI. After sticking and treating, workers and handlers can enter the growing area any time without PPE.

How do I select Hortus IBA Water Soluble Salts or Rhizopon AA Water Soluble Tablets?

Both products are used in both foliar and basal methods.

Hortus IBA Water Soluble Salts:

- **Measured using a scale;** useful where large production tanks are used.
- Useful when growers require high concentrations.

Rhizopon AA Water Soluble Tablets:

- **Measured by counting tablets;** useful where a scale is not available.
- Useful when growers require low concentrations or small liquid volumes.

About the Rooting Solution Methods

Why would I want to use ‘Foliar’ compared to ‘Basal’ Rooting Solution methods?

Foliar methods are used on leafy plants in the growing season. Basal methods are used all year. Foliar methods treat cuttings uniformly. Basal Quick Dip Method may have variable treatment. **Hortus IBA Water Soluble Salts and Rhizopon AA Water Soluble tablets are used by the Quick Dip Method and all Foliar methods, but Quick Dip uses more labor.**

When can I turn on misters after treating by the Spray Drip Down Method?

Growers usually wait 3/4 hour or until the Rooting Solution dries on the leaves.

Is special equipment needed for foliar methods?

The Spray Drip Down Method uses standard spray equipment such as backpacks, hydraulic, booms, tractor mounted sprayers, robots, hand sprayers, and custom spray carts specific to needs. The Total immerse Method uses a simple tank and strainer.

About the Dry Dip Rooting Hormones & Comparison with Rooting Solutions

How many cuttings can be treated using Rhizopon AA dry powders?

One pound of Rhizopon AA dry powder rooting hormones can treat about 30,000 cuttings.

Is there a difference in rooting between using 'Rooting Solutions' or 'dry powder rooting hormones'?

Hortus USA sells both dry powder rooting hormones and products to make water based IBA rooting Solutions, both ways are beneficial. Growers usually have long standing preferences. Use should be based upon the variety, time of the year, maturity of the cuttings and quality of the stock plants. Many US growers prefer Rooting Solutions, while some European growers prefer Dry Dip powder rooting hormones.

How are Rhizopon AA dry powder rooting hormones different from other brand dry powder rooting products?

Rhizopon AA #1, #2 and #3 are made with high loft talc resulting in uniform coverage of the treated cutting. The powders are color coded to identify the product: **Rhizopon AA#1 is pink**, **Rhizopon AA#2 is green** and **Rhizopon AA#3 is white**. Color coding helps the production workers to pick and use the proper product. All production lots are laboratory tested to assure they have uniform mix and meet the required concentration.



Fine quality roots produced by Bailey Nursery using the Spray Drip Down Method

Why do I need rooting hormones to propagate 'easy-to-root' cuttings?

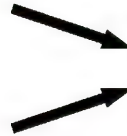
Cuttings require applied IBA rooting hormones to rapidly produce high root mass, with uniform roots and upper growth.



Hortus IBA Water Soluble Salts

Water Soluble to Over
100,000 ppm IBA

ROOTING
SOLUTIONS
MADE USING
ORDINARY
WATER



Rhizoapon AA Water Soluble Tablets

Pre-measured - Count and Mix

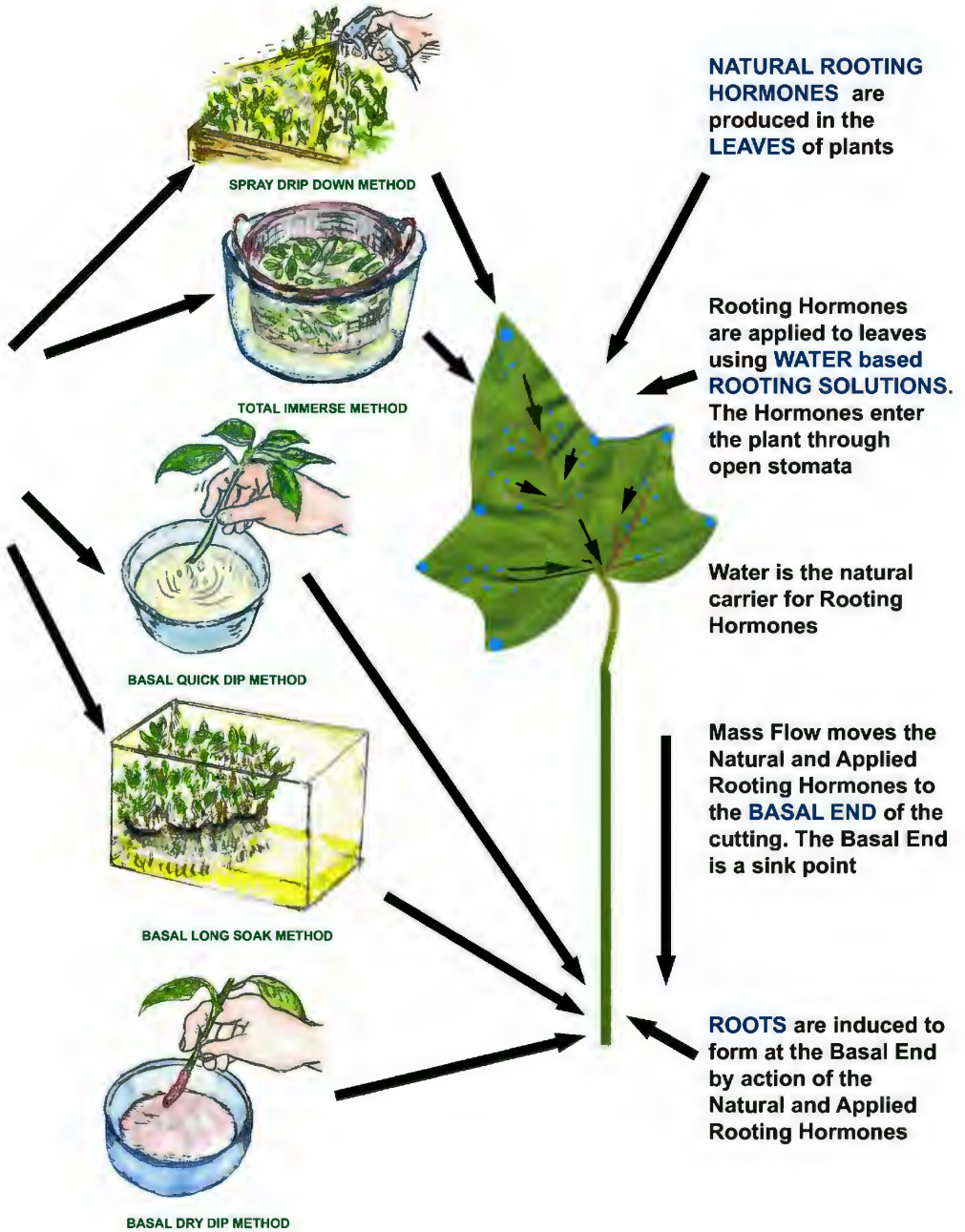


Rhizoapon AA Dry Powder Rooting Hormones

READY
TO USE
DRY
POWDER
ROOTING
HORMONES



The Most Popular Concentrations



Methods to Propagate Plants from Cuttings

Cutting Types and Methods

USE ON TYPE OF CUTTINGS	Dry Dip	Basal Quick Dip	Basal Long Soak	Spray Drip Down	Total Immerse
LEAFY CUTTINGS <ul style="list-style-type: none"> • Ornamental plants • Herbaceous plants <i>In the Growing Season</i>	✓	✓	✓	✓	✓
LEAFLESS CUTTINGS <ul style="list-style-type: none"> • Ornamental plants • Herbaceous plants <i>All Year Including Winter Cuttings</i>	✓	✓	✓	no (leafless)	no (leafless)
<ul style="list-style-type: none"> • EASY-TO-ROOT • HARD-TO-ROOT <i>Dormant in the Winter</i>	✓	✓	✓	no (dormant)	no (dormant)

Basal and Foliar Methods

METHOD		PRODUCT TYPE	PRODUCT
BASAL METHODS	DRY DIP METHOD	<p>Dry Dip Powder</p> <p>Dip basal end in rooting powder then stick. <i>Powders stay on cuttings a long time.</i></p>	<p>RHIZOPON AA #1, #2 & #3</p> <p>Dry Powder Rooting Hormones <i>Use dry > not used to make rooting solutions</i></p>
	BASAL QUICK DIP METHOD	<p>Rooting Solution</p> <p>Dip basal end in rooting solution then stick.</p>	<p>HORTUS IBA WATER SOLUBLE SALTS</p> <p>or</p> <p>RHIZOPON AA WATER SOLUBLE TABLETS</p> <p><i>Use to make rooting solutions</i></p>
	BASAL LONG SOAK METHOD	<p>Rooting Solution</p> <p>Dip basal end of cuttings in rooting solution about 12 to 48 hours (nominal) then stick.</p>	
FOLIAR METHODS	SPRAY DRIP DOWN METHOD	<p>Rooting Solution</p> <p>Stick then spray leaves of cuttings with rooting solution until the solution drips down.</p>	
	TOTAL IMMERSE METHOD	<p>Rooting Solution</p> <p>Totally immerse cuttings in rooting solution then stick.</p>	

Using Rooting Solutions made with Hortus IBA Water Soluble Salts

PREPARING A ROOTING SOLUTION

- **Weigh** the required amount of Hortus IBA Water Soluble Salts. **Measure by weight not volume: do not scoop.**
- **Use tap water** from 60F to about ~110F (water temperature used for hand washing). At higher temperature Salts dissolve fastest. (See pages 16-17 for handling). **Do not dissolve Hortus IBA Water Soluble Salts in liquids other than water.**
- **Mix:** dissolve Hortus IBA Water Soluble Salts in water.
- **Add water** to the mixing container to bring the Rooting Solution to the final volume.
- **Apply the solution** by the selected method.
- **After use,** dispose of the solution as described in the 'Storage and Disposal' statements on the product label.

AVOID CROSS CONTAMINATION OF SOLUTIONS

- For the Total Immerse, Basal Quick Dip and Basal Long Soak Methods dispose of Rooting Solutions between plant lots to avoid cross contamination.
- Using the Spray Drip Down Method the Rooting Solution is used one time and there is no cross-contamination. Solutions can be used completely. (See pages 16-17 for handling).

STOCK SOLUTIONS

Hortus IBA Water Soluble Salts mixed in water to make stock Rooting Solutions can be made in any concentration up to 100,000 ppm IBA!

USE METRIC SYSTEM

Use the metric system when calculating the ppm IBA for Hortus IBA Water Soluble Salts Rooting Solutions. The system allows for easy calculation of liquid volume to concentration.

NO WETTING AGENTS

Rooting Solutions made with Hortus IBA Water Soluble Salts are specially formulated to have a low surface tension needed for foliar methods. Additional wetting agents are not recommended.

Rooting Solution Rate Chart: Hortus IBA Water Soluble Salts

To make 100 ppm IBA dissolve 0.5 grams in 1 liter water

Parts per million IBA (ppm IBA)	Hortus IBA Water Soluble Salts	
	gms/liter water	gms/gallon water (1 gal = 3.8 liter)
50 ppm IBA	0.25 grams	.95 grams
100	0.5	1.9
200	1.0	3.8
250	1.25	4.7
300	1.5	5.7
400	2.0	7.6
500	2.5	9.5
600	3.0	11.3
700	3.5	13.2
750	3.75	14.2
800	4.0	15
900	4.5	17
1000	5.0	19
1500	7.5	28.5
2000	10.0	38
2500	12.5	47
5000	25.0	95
10,000	50.0	190
MAKE ANY RATE		
100,000	500	1900

Using Rooting Solutions made with Rhizopon AA Water Soluble Tablets

- Count the required amount of Rhizopon AA Water Soluble Tablets as shown in the chart below.
- Use tap water from 60F to about ~110F (water temperature used for hand washing). At higher temperature the Tablets dissolve fastest. (See pages 16-17 for handling.) **Do not dissolve Rhizopon AA Water Soluble Tablets in liquids other than water.**
- Mix: dissolve Rhizopon AA Water Soluble Tablets in the water. A small amount of undissolved particles in the solution is normal and does not affect results. If precipitation occurs with tap water then dissolve in distilled, demineralized, or filtered water. Add water to the mixing container to bring the solution to the final volume.
- Apply the solution by the selected method.
- After use: See pages 16-17 for handling and disposal.
- Avoid cross contamination of solutions. For the Total Immerse Method and basal methods, dispose of solutions between plant lots to avoid cross contamination. Using the Spray Drip Down Method the solution is used one time and there is no cross-contamination.

Rooting Solution Rate Conversion Chart:

Parts per million IBA (ppm IBA)	Rhizopon AA Water Soluble Tablets per liter water	Hortus IBA Water Soluble Salts	
		gms/liter water	gms/gallon water (1 gal = 3.8 liter)
50 ppm	1 tablet	0.25 grams	0.95 grams
100	2	0.5	1.9
200	4	1.0	3.8
300	6	1.5	5.7
400	8	2.0	7.6
500	10	2.5	9.5
600	12	3.0	11.3
700	14	3.5	13.2
800	16	4.0	15
900	18	4.5	17
1,000	20	5.0	19

Handling Dry Products & Rooting Solutions

STORAGE OF DRY PRODUCTS

- Rhizopon AA #1, #2 & #3 Dry Dip Rooting Hormones, Hortus IBA Water Soluble Salts and Rhizopon AA Water Soluble Tablets are provided dry. Store dry products at room temperature. They do not require refrigeration. The dry products will be fully active for many years.
- Hortus IBA Water Soluble Salts and Rhizopon AA Water Soluble Tablets are sensitive to humidity. Store them dry to avoid caking and difficulty to dissolve.
- ***Store the dry products in their original sealable labeled containers.***

ROOTING SOLUTION WATER QUALITY

- Ordinary tap water is usually used to make Rooting Solutions.
- If the Rooting Solution is clear, having a small amount of particles, then the active ingredient is in solution and ready to use.
- Hard, well or pond water may reduce solubility; in those cases use another source such as filtered or demineralized water.

AVOID CONTAMINATION OF SOLUTIONS

- The **Spray Drip Down Method** uses the Rooting Solution one time. Since no plant material is introduced to the solution, they will not be contaminated by dragging-in of organic materials. (See page 17.)
- The **Basal Quick Dip, Total Immerse, and Basal Long Soak Methods** use the Rooting Solution by having the plant material dipped into them. To avoid cross-contamination, use fresh Rooting Solutions between production lots. Preferably, solutions used by dipping should be disposed after four hours of use. Do not store used solutions. (See page 17.)

STORAGE OF UN-USED ROOTING SOLUTIONS:

- Stock and production Solutions made with Hortus IBA Water Soluble Salts and Rhizopon AA Water Soluble Tablets maintain full potency for several days when kept in a closed container, at room temperature and normal light. (See page 17 for disposal.)

DIP SOLUTION DISPOSAL

The following on 'disposal' may be applied to any solution where plant material is dipped and further used. After initial dipping the solution, drag-in of contaminants from the plants can be detrimental to further lots. (Spray Drip Down Method solutions do not become contaminated, they are not used by dipping.)

Solutions used to dip plant material can cross contaminate production lots by pathogens and other toxicities including chemical pre-treatments before use of the rooting solution. Before rooting hormone treatment and sticking, plant cuttings should be washed. Cutting from plantations have been pre-cleaned but need inspection. Rooting solutions for dipping are used by the basal Quick Dip, Basal Long Soak and Total Immerse Methods.

It is important to identifying plant cuttings that can cause phytotoxicity cross-contamination. Cuttings arriving from carefully inspected plant plantations may have low possibility for phytotoxicity problems. Cuttings taken from general field stocks have high possibility for phytotoxicity problems. Homogenous cuttings, taken from the same stock area, should be considered to have assumed some cross-contamination. Dip solutions used for these cuttings should be disposed after the production lot is completed. Solutions that show visible particulates should be disposed and replaced before treating the next plant lot.

Solutions made with Hortus IBA Water Soluble Salts and Rhizopon AA Water Soluble Tablets remain active during the short term treatment process. Dip solutions should be disposed after treating large homogenous lots. For well inspected cuttings with low possibilities of contamination, dispose solutions should be within four hours after the start of dip treatments.

Simple Tip to PRE-MEASURE SALTS:

RE-USE EMPTY CONTAINERS

To batch measure DRY Hortus IBA Water Soluble Salts and save for later, save empty Hortus IBA Water Soluble Salts containers with original covers and labels. If a particular powder weight is used for production tank loads, measure that amount. Put the weighed powder into the re-used empty containers. Cover securely. Mark the containers with the weight and save to make solutions later.

Overview of Foliar Methods

- **The Foliar Spray Drip Down and Total Immerse Methods are used on cuttings that are leafy in the growing season.**
- Foliar methods *are not* used on dormant or leafless cuttings.
- Rooting Solutions are applied to the leaves of cuttings.
- Foliar methods use Rooting Solutions that are made using water only, applied by spray onto foliage or totally immerse.
- **For foliar methods only use Rooting Solutions made with water and Hortus IBA Water Soluble Salts or Rhizopon AA Water Soluble Tablets.** Never use other 'Rooting Solutions' made with active solvents since they will dehydrate and kill plant cells.

ROOTING SOLUTIONS PRODUCTS

- **Hortus IBA Water Soluble Salts (weigh/mix)**
- **Rhizopon AA Water Soluble Tablets (count/mix)**

MODE OF ACTION

Water-based Rooting Solutions are applied to leaves of cuttings. The Rooting Solutions enter the plant through stomata, the minute openings in the leaf. The stomata allow entry into the plant of gases and liquids such as the Rooting Solution. After entry into the vascular system of the plant, the rooting hormones in the Rooting Solution move by mass flow to the basal end of the cuttings. Plants store rooting hormones at the basal end where they are slow released to induce roots.

METHODS	PRODUCTS TO USE
TOTAL IMMERSE METHOD	Use Rooting Solutions made with Hortus IBA Water Soluble Salts <i>or</i> Rhizopon AA Water Soluble Tablets
SPRAY DIP DOWN METHOD	
Selection of either the Spray Drip Down or Total Immerse Method, usually depends upon the type of cuttings and facility needs. Where large homogenous plant lots are propagated, usually the Spray Drip Down is used. For large leaf cuttings, Total Immerse may be better.	

USE SECONDARY & SEQUENTIAL FOLIAR TREATMENTS

- Overcome slow root development
- Improve transplanting of rooted cuttings.
- Level the production crop.
- Improve roots of cuttings which were already treated by any method, either rooted or un-rooted.

To level crops, **secondary weekly** Spray Drip Down Method foliar applications are used on leafy cuttings in the active growing state, at rates similar to the first initial rate. First application may be any method.

- **Increase production of root mass**

For **sequential day** application, see the article "Propagate Plants from Cuttings Using Foliar Applied Aqueous IBA Rooting Solutions. Tips: Do's and Don'ts", topic "Sequential Treatment". (Article after the numbered pages.)

STOCK PLANT PREPARATION FOR FOLIAR METHODS

The stock plants must be adequately fertilized and kept in light during the days before the cuttings are taken. These factors allow the plant to store carbohydrates necessary for root formation.

ADJUSTING THE FOLIAR RATE

- Use as low a rate as possible to achieve rooting.
- When root formation is **slow** in formation trial at a higher rate.
- When foliar methods produce leaf spotting, leaf curl, or leaf drop it may be caused by inadequate stock plant preparation or too high a rate.

Scientific Groundwork on Foliar Applied Aqueous IBA Rooting Hormones

Dr. Fred T. Davies (co-author of 'Plant Propagation Principles and Practices') did successful plant rooting trials using foliar applied aqueous IBA solutions as related to juvenile and mature cuttings.

Included in this book: Dr. Davies' landmark study details solution rates as related to the rooting of the cuttings physiology. (Article after the numbered pages.)

The Spray Drip Down™ Method

Using the Spray Drip Down Method, stick the cuttings into trays or any other way into media. Spray the Rooting Solution onto the leaves of the cuttings until there is a drip down. Wait about 3/4 hour or until the solution dries on the leaves, then turn on misters



The Spray Drip Down Method can be used on any lot size. The solution is used one time. There can be no cross contamination of the Rooting Solution between plant lots.

The Spray Drip Down Method has low labor cost. Workers who do sticking do not apply rooting products and do not need PPE. Spraying, performed by a trained operator, assures that the plant cuttings receive a uniform application of the Rooting Solutions. The time for spraying is only a few minutes.



Typical backpack sprayer suitable for application

EQUIPMENT

Use spray equipment appropriate for the growing facility, for example, backpack, power sprayers, or even robots. Other equipment is shown elsewhere in this book. Proportional solution mixers may not give uniform solution quality.

ROOTING PRODUCTS USED

- Hortus IBA Water Soluble Salts.
- Rhizopon AA Water Soluble Tablets

HOW TO USE THE SPRAY DRIP DOWN METHOD

STICKING & SEPARATION OF LOTS BY RATE

- Stick the un-treated cuttings in the media.
- Keep the cuttings hydrated by keeping misters on.
- It is useful to separate the plants into rooting solution rate groups. Plants with the same solution rate can be treated at the same time.

ROOTING SOLUTION

- For foliar methods, only use Rooting Solutions made with Hortus IBA Water Soluble Salts or Rhizopon AA Water Soluble Tablets. The aqueous solutions are specially formulated to allow entry into the plant's vascular system.

TREATMENT

- Spraying should be done the same day of sticking or soon after.
- Spraying should be done when the stomata in the leaves are open. If the propagation area is hot, do spraying at cool times, such as early mornings.
- Turn off the misters.
- **Spray the Rooting Solution onto leaves until the liquid drips down. If the leaves are wet from misters at the time of spraying, use an excess of Rooting Solution to overcome dilution of the solution.**
- To assure adequate treatment, apply enough solution to both the top and bottom of the leaves.

SPRAY RATE

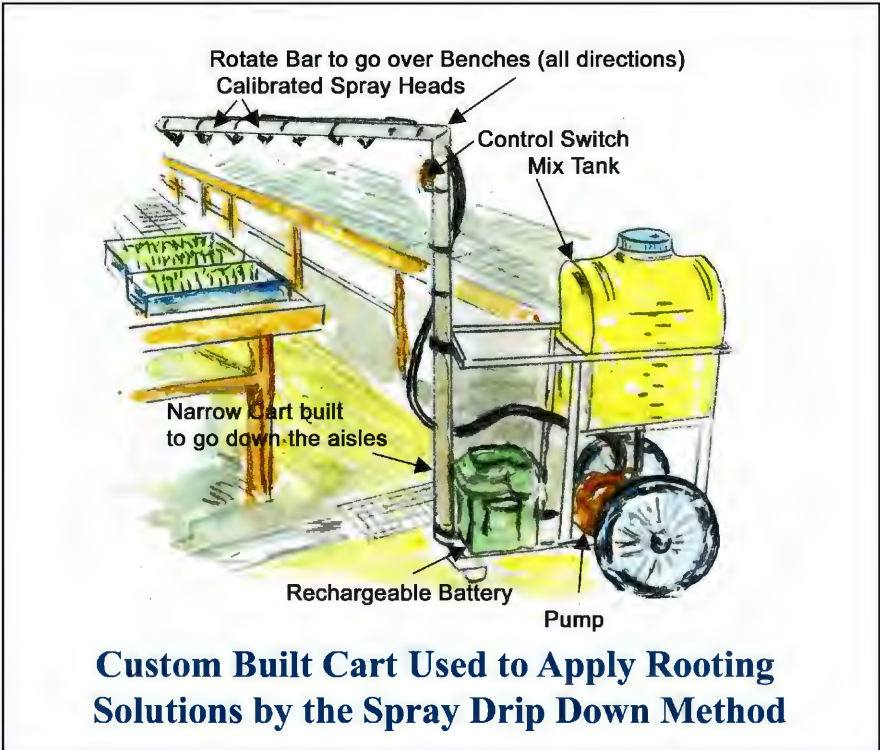
- Use about one gallon of rooting solution per 175 to 225 square foot of cuttings.

MISTERS

- **After application of the Rooting Solution wait at until the solution dries, about 3/4 hour, before turning misters on.**

UN-USED ROOTING SOLUTIONS

- **See pages 16-17 for notes**



Sprayer used by Bailey Nurseries.
Photo: Bailey Nurseries

The Total Immerse Method



Using the **Total Immerse Method**, total immerse dip the cuttings in the Rooting Solution for a few second then drain. Stick at any time.

The Total Immerse Method can be used for large homogeneous lots of plants or small lots. There can be drag in of biologicals from the cuttings into the solution. The Rooting Solution should be

changed frequently to avoid lot cross contamination. Total Immerse is useful for large leaf cuttings and cuttings whose leaves have stomata on the bottom of the leaf where spray drip down is difficult to use.

The Total Immerse Method uses simple equipment for treatment, a tank and a basket. Uniform treatment is done on large batches of cuttings is done in a few seconds. Since all cuttings are submerged in the Rooting Solution every cutting is treated. After treatment the cuttings can be stored in a plastic bag and stuck later.



Hedera (Ivy) Holland. Total immerse tank for ivy.
Dip basket not shown. Photo: Rhizopon

EQUIPMENT

Use a solution tank. A dipping basket is useful.

ROOTING PRODUCTS USED

To make Rooting Solutions:

- **Hortus IBA Water Soluble Salts.**
- **Rhizopon AA Water Soluble Tablets**

HOW TO USE THE TOTAL IMMERSE METHOD

- Total Immerse the cuttings, using a basket, into the Rooting Solution for a few seconds. Drain.
- Stick the treated cuttings in the media, or put in plastic bags and store until sticking or planting out..
- Turn on misters as required.
- After treatment discard used Rooting Solution.

Overview of Basal Methods

- The Basal Quick Dip, Basal Long Soak and Basal Dry Dip Methods are used on
 - leafy cuttings in the growing season or dormant
 - leafless cuttings
 - dormant cuttings
- Basal methods can be used all year.
- Rooting Solutions or rooting hormone powders are applied to the basal end of cuttings.

ROOTING PRODUCTS USED

Dry Dip Rooting Hormones

- Rhizopon AA #1, #2 and #3.

To make Rooting Solutions:

- Hortus IBA Water Soluble Salts.
- Rhizopon AA Water Soluble Tablets.

MODE OF ACTION

Rooting Solutions or dry powder rooting hormones are applied to the basal end of the cuttings. The rooting hormones absorbed into the plant's vascular system where they are stored; they are slow released by the plant to induce root formation.

METHODS	PRODUCTS TO USE
BASAL QUICK DIP METHOD	Use Rooting Solutions made with Hortus IBA Water Soluble Salts <i>or</i> Rhizopon AA Water Soluble Tablets
BASAL LONG SOAK METHOD	
DRY DIP METHOD	Use Rhizopon AA #1, #2, or #3 Dry Dip Rooting Hormones
The selection of a method, either Dry Dip or by Rooting Solution, usually depends upon the plant variety. Many plants have successful rooting with Dry Dip methods and/or Rooting Solution methods.	

The Quick Dip Method



Using the **Basal Quick Dip Method**, propagate plants from cuttings from easy to difficult to root. Dip the basal end of the cuttings into the Rooting Solution for about five seconds then stick.

USE ON MANY TYPES OF PLANT CUTTINGS

In the Growing Season	Leafy cuttings: Tropical plants. Annual and perennial plants. Woody ornamental plants. Forestry plants.
All Year	Leafy and leafless cuttings: Tropical plants. Annual and perennial plants. Woody ornamental plants. Forestry plants.
Winter Dormant Cuttings	Leafless cuttings: Woody ornamental plants. Forestry plants.
All Year	Leafy & leafless cuttings: Hard-to-root cuttings.

EQUIPMENT

Dispense Rooting Solutions into small cups.

ROOTING PRODUCTS USED

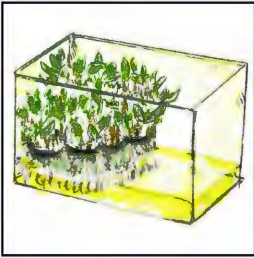
To make Rooting Solutions:

- **Hortus IBA Water Soluble Salts.**
- **Rhizopon AA Water Soluble Tablets**

HOW TO USE THE BASAL QUICK DIP METHOD

- Wound woody cuttings by making a 3/4 inch slit at the side of the basal end is optional. Herbaceous cuttings are not wounded.
- Immerse the basal end of the cuttings about 3/4-1 inch into the Rooting Solution for about five seconds.
- Stick the treated cuttings in the media, or put in plastic bags and store until sticking or planting out.
- Turn on misters as required.
- After treatment discard the used Rooting Solution.

The Basal Long Soak Method



Using the **Basal Long Soak Method**, propagate plants from cuttings that are difficult to root. It is also used on easier to root cuttings. Both hard to woody plant cuttings and herbaceous cuttings benefit. Low Rooting Solution rates are used. Basal Long Soak eliminates high rates by the Quick Dip Method rates or Dry Dip rooting powders.

In the growing season	Leafy cuttings: annuals, perennials, ornamental and forestry plants.
All year	Ornamental and forestry plants.
Winter dormant cuttings	Ornamental and forestry plants.



Dutch nursery. Stem rose propagation using the basal long soak method. Photo: Rhizopon

EQUIPMENT

Use a tank.

ROOTING PRODUCTS USED

To make Rooting Solutions:

- **Hortus IBA Water Soluble Salts.**
- **Rhizopon AA Water Soluble Tablets.**

HOW TO USE THE BASAL LONG SOAK METHOD

- Wounding of woody cuttings is optional. Herbaceous cuttings are not wounded.
- Bundle cuttings so they are erect in the tank.
- Immerse the basal end of the cuttings about 3/4-1 inch into the Rooting Solution. (See pages 26-27 for photos)
- Soak about 12-48 hours.
- Stick the treated cuttings in the media, or put in plastic bags and store until sticking or planting out.
- Turn on misters as required.
- After treatment discard the used Rooting Solution.

USE THE BASAL LONG SOAK METHOD TO IMPROVE ROOTING OF HARD-TO-ROOT CUTTINGS

When propagating plants from cuttings, if roots do not form, some growers unsuccessfully apply plant rooting hormones at high concentrations. They may use rates above 5000 ppm IBA and perhaps get variable results. If alcohol based Rooting Solutions are used they will cause burns and plant mortality.

SOLUTION

Use the basal long soak method to replace other high concentration methods.

High plant rooting hormone concentrations may inhibit root formation. For difficult to root cuttings, the Basal Long Soak Method can successfully replace the Basal Quick Dip or Dry Dip Methods. The Basal Long Soak Method uses very low concentrations of Rooting Solution.



Bundle cuttings, then immerse basal end 3/4-1 inch into the Rooting Solution for 12-48 hours, then plant or store.

MODE OF ACTION

Using the Basal Long Soak Method, cuttings slowly absorb the Rooting Solution. The plant stores the plant rooting hormones at the basal end where it slowly releases them for root formation.

TIMING

The Basal Long Soak Method is used all year on all types of cuttings. Used in the fall, cuttings can be kept in cold storage and planted out in the spring. They can also be treated before planting.

The Basal Long Soak Method is as important as ever! Developed in the 1940's, the Basal Long Soak Method is successful for growers to propagate **HARD TO ROOT CUTTINGS**, as well as root stocks like grape, rose, and prunus.

The Dry Dip Method



Using the **Dry Dip Method**, propagate plants from cuttings from easy to difficult to root. **Rhizopon AA #1, #2 and #3** rooting powders are used. When treating cuttings with different rate needs, simply switch powders.

As a **VISUAL** indicator, **color coding** assures that the proper product is used.

USE ON MANY TYPES OF PLANT CUTTINGS

In the growing season.	Leafy cuttings: annuals, perennials, woody ornamental and forestry plants.
All year.	Tropical plants annuals, perennials, woody ornamental and forestry plants.
Winter dormant cuttings.	Woody ornamental and forestry plants.
All year.	Hard to root cuttings.

EQUIPMENT

Rooting powders are taken from the stock container and put into small cups. It is handy to keep three containers available for each of the three **color coded** concentrations.

ROOTING PRODUCTS USED

Dry Dip Rooting Hormones (color coded):

- **Rhizopon AA #1 (0.1% IBA) is PINK color**
for easier to root cuttings
- **Rhizopon AA #2 (0.3% IBA) is GREEN color**
for root many types of cuttings
- **Rhizopon AA #3 (0.8% IBA) is WHITE color**
for more difficult to root cuttings

HOW TO USE THE DRY DIP METHOD

- Take off a small portion of the powder for immediate use. Do not contaminate the stock container by returning used portion to the container.
- Take plant cuttings, usually 4-6 inch stem cuttings, from the current year's growth.
- Wound woody cuttings by making a 3/4 inch slit at the side of the basal end is optional. Herbaceous cuttings are not wounded.
- Dip the basal end of the cuttings 3/4-1 inch into the Rhizopon AA powder. Tap off the excess powder.
- Avoid contact between the powder and foliage and other over ground parts of the stem. A small amount of powder on the leaves will not affect the quality of the rooting.
- Stick the treated cuttings in the media, or put in plastic bags and store until sticking or planting out. A dribble hole is useful to allow entry of the cutting into the media without pushing off the rooting powder.
- Turn on misters as required.
- After treatment discard used rooting powder.

