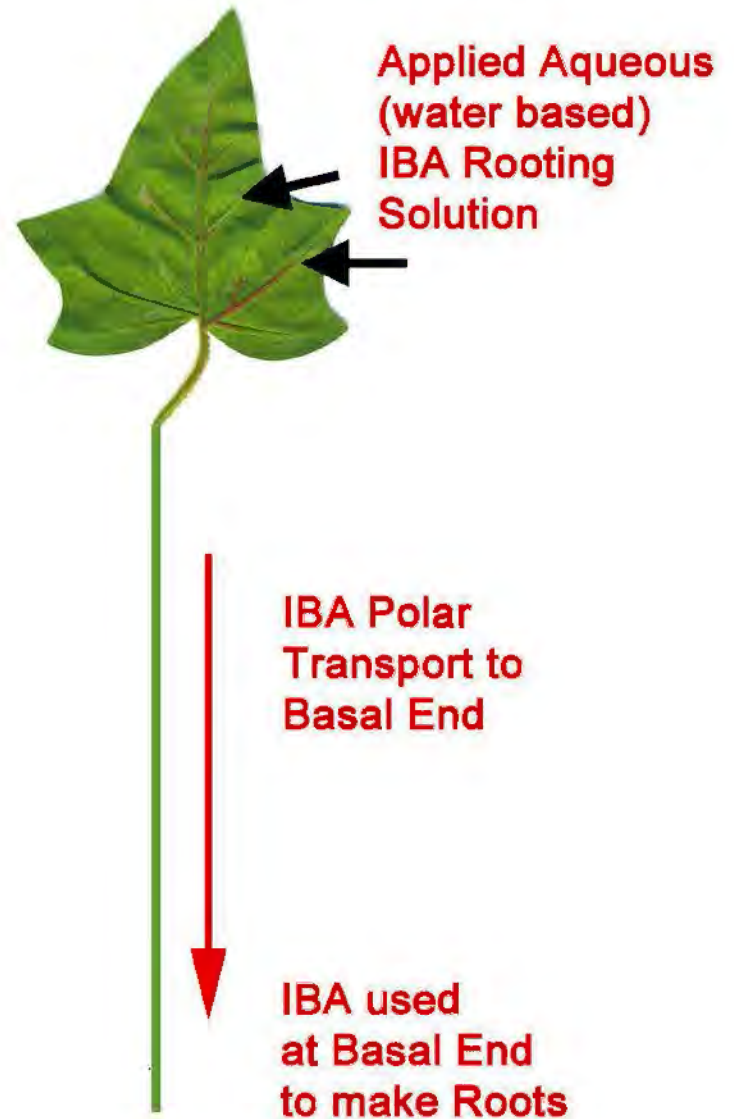
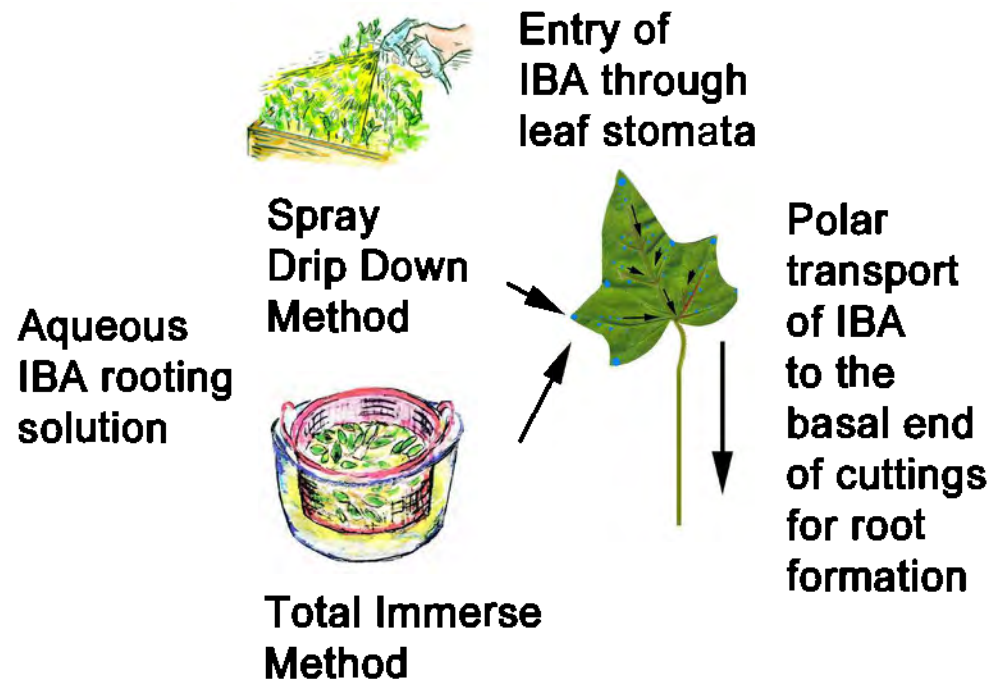


# Plant Propagation from Cuttings using Foliar Applied Aqueous IBA Rooting Solutions



# Foliar Methods

- **Brief History**
- **How 'Foliar' Works**
- **Methods**
- **Solutions**
- **Rates**
- **Cuttings**
- **Physiology**
- **Considerations**



# How Rooting Hormones Have Been Used

**1880:**

**Darwin - described plants produce regulating substances in leaves**

**Before 25 years ago:**

**Propagation of plants from cuttings using rooting hormones limited to basal methods**

**1979:**

**Fred Davies - studied cutting maturity using foliar applied (water based) IBA solutions**

**1985:**

**Kees Eigenraam, in Holland - developed commercial foliar methods.**

**1990's:**

**Foliar systems using aqueous IBA solutions were formalized and introduced to US growers**

**Today:**

**Using Foliar methods, growers propagate plants from cuttings**

- **in the growing season**
- **leafy cuttings**
- **annual, perennial, & woody plants**
- **using foliar applied water based IBA rooting solutions**
- **Spray Drip Down Method**
- **Total Immerse Method**

**Compared with Basal - Foliar Methods:**

- **SAVE LABOR - BATCH PROCESSING**
- **SAVE MATERIAL - LOW RATES**
- **NO INDIVIDUAL TREATMENT MISS**

**Some Users:**

**Perennials - Aris Green Leaf Plants & Keepsake Plants**

**Annuals - Dummer Red Fox's rooting stations**

**Annuals - Yoder's Chrysanthemums**

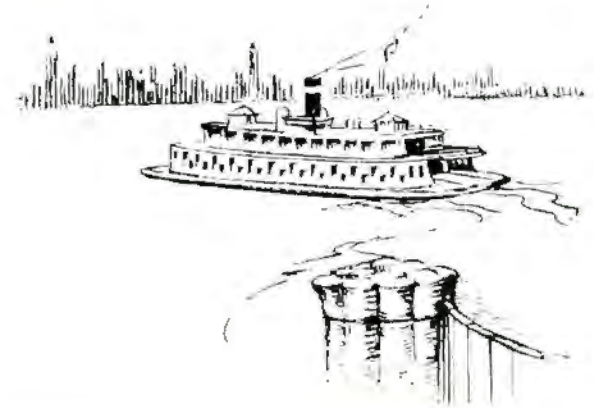
**Woody Ornamentals - Bailey Nurseries**

**TC - Driscoll's blueberries**

# How Do Foliar Methods Work?

Look at IBA Flow like a Ferry Boat Model

- Ferry Boats pickup increasing numbers of passengers on the departure side
- Transport across the river to a small arrival loading dock
- If overload, some passengers are returned



The **ROOTING SOLUTION** is applied in large amount of IBA to plant **LEAVES**, entering the plant though open **STOMATA**.

The IBA

- is one-way **TRANSPORTED** to the **BASAL END**. ↓↓
- need amount **ACCUMULATES** at the **BASAL END**
- initiates **NEW ROOTS** ✓
- excess is returned to leaves and other plant parts ↑↑

At **BASAL END** the IBA induces new roots to form

# Spray Drip Down Method

- **Stick cuttings**
  - **Use a sprayer**
  - **Spray solution on leaves until DRIP DOWN**
  - **Use about 200 sf/gallon**
  - **Excess solution is best**
  - **After 30-45 minutes or until the solution dries on leaves, turn on Misters**
- 
- No PPE needed to sticking untreated cuttings
  - Used on many small production lots at one time
  - Solutions are used one time



**Backpack**

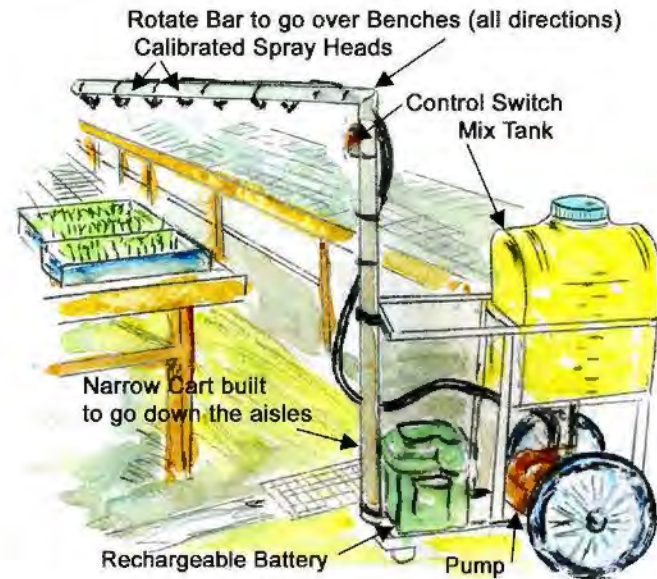


**Hydraulic  
(Bailey  
Nurseries)**

**Robotic - Chrysanthemum  
(Holland)**



**Custom (Aris Green Leaf)**



# Total Immerse Method

- **Use tub & strainer basket**
  - **Dip cuttings until the leaves are completely covered with solution**
  - **Drain**
  - **Stick cuttings**
- 
- Simple equipment. Little setup
  - Use on large & small homogenous plant lots
  - Treat large leaves difficult to spray uniformly





# Rooting Solutions

Use aqueous (water based) IBA solutions

Only 2 US EPA products are registered

- to make aqueous IBA rooting solutions
- labeled for all foliar and basal methods

**Hortus IBA Water Soluble Salts**

weigh salts → mix into water

**Rhizopon AA Water Soluble Tablets**

count tablets → mix into water

- Water is the natural fluid in plants
- Do **NOT** use alcohol base rooting solutions -dehydrate plants  
**'ALCOHOL BURNS'**
- Do not use Dry Powder Rooting Hormones - insoluble in water
- No need to use Wetting Agents

# Foliar Rates

- Apply to BOTH SIDES of leaves at LOW RATES
- Juvenile cuttings need lower rates than mature cuttings
- **Do not use Basal Quick Dip Method rates - TOO HIGH**

Cutting Type	Trial Rates
Annuals & Tender Perennials	80-250 ppm IBA
Perennials	250-1500 ppm IBA
Woody Ornamentals	300-1500 ppm IBA
TC plantlets at 3rd to 5th stage transplants	Rhizopon AA Water Soluble Tablets @1-3 tablets/liter

Select Perennial and Woody

TRIAL RATES: 500, 1000, & 1500 ppm IBA

Above 1500 ppm IBA rarely needed

Below 500 ppm IBA use on juvenile and tender perennial cuttings

# Cuttings

- Use leafy cuttings
- In growing season
- **Do not take dormant or leafless cuttings**
- Do not use hard - woody or old mature cuttings
- Juvenile cuttings: easier to propagate than mature

## Cutting Nodes

- NO nodes or buds at the Basal End

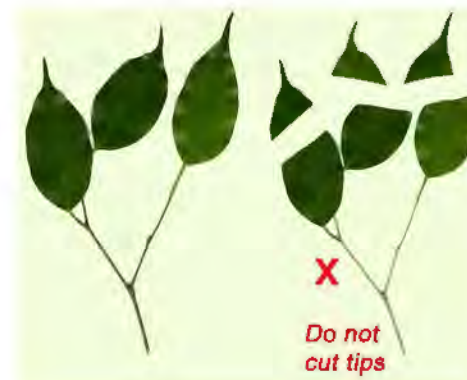


Not acceptable  
bud or node

Acceptable with  
no bud or node

## Do Not Cut Leaf Tips

- Wounds are open to infection. Resources heal, rather than root.
- Reduced natural rooting hormones formed at tips



# Stomata

Stomata are located on all surfaces of plants.

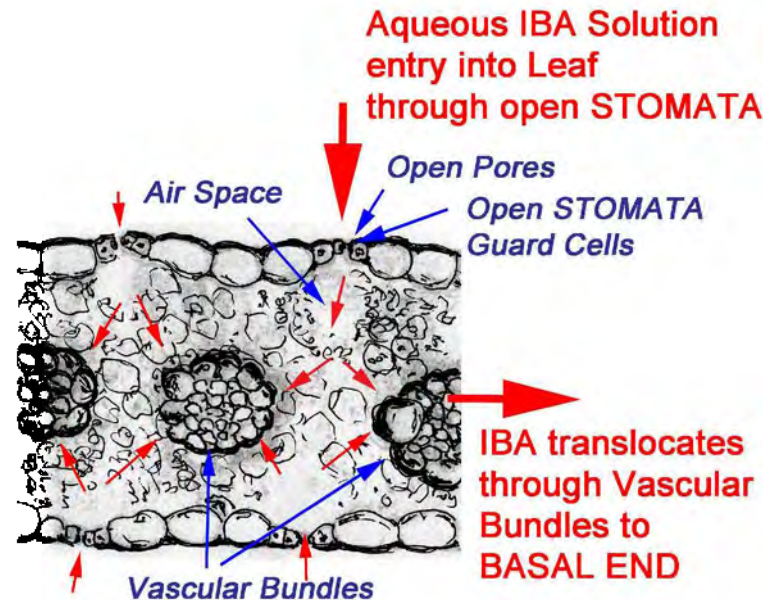
- When open they allow fluid, vapor & gas exchanges.
- Largest are often on the lower side of leaves.

**Open** ○

- cuttings are well hydrated
- temperature foliar application from about 60-90F

**Close** ●

- cuttings are wilted
- temperatures: very low or high



**Leaf Cross Section**

# Deformities on Tender Plant Cuttings Due to Improper Rate

**Leaf curl & spotting:**

**Rate was too high. The IBA was returned to leaf from Basal End.**

**Reversible:**

**Cuttings usually form normal roots & leaves**

**Use a low rate to get best rooting**



## **Foliar Leaf Coverage**

- Total Immerse Method - Solution on both sides of leaves
- Spray Drip Down Method - Spray both top & bottom

## **Concentrate Rooting Solutions**

- Easy-to measure & mix solutions vs dry measures

## **Foliar Method Low Labor Cost**

- Batch treating - low labor

## **Treating Temperature**

- About 60-90°F

## **Secondary Application**

- Level Crops & Boost Rooting
- For leafy cuttings in media first treated by ANY method
- Use Spray Drip Down Method

# Rooting Solution Disposal

Keep unused solutions several weeks - unknown biologicals in the water

- Total Immerse Method - Dispose after production lot or end of the production day
- Spray Drip Down Method - Use one time  
Solutions can be kept until used up

# When Things Went Well Before .. but

- Juvenile cutting root easier than mature
- Genetic variations - Different stock plants
- Quality of the cuttings
- Deviations in the growing area - Cuttings from different parts of the stock area, location, or plantation
- Timing of taking cuttings
- Seasonal variations
- Somebody 'forgot' something!

# **Trials Are Essential Before Doing Foliar Production**

- Evaluate a range of rates & methods
- Time of the year for propagation
- Quality of roots produced on the cuttings
- Facility advantages, labor factors, & setup cost

## **Hybrid System**

**Consider using both basal & foliar methods in the same facility based upon season, facility utilization and crops**



# Conclusions

**Growers worldwide successfully propagate Annual, Perennial, & Woody Plants using leafy cuttings in the growing season**

- **Water based IBA rooting solutions** are used
- **Temperature** - about 60-90°F
- **Cuttings well hydrated** before treatment

**Two methods**

- **Spray Drip Down Method** - cuttings are stuck then sprayed until the solution drips down. Mistlers are turned on after 30-45 min.
- **Total Immerse Method** - cuttings are totally immersed in the solution then stuck

**Labor Savings** - batch processing

- **About 1/3rd labor** vs. individual treatment/sticking
- **Reduced possibility for missed treatment**
- **Low Material Cost @ low rates**