# RESPONSE OF LOBLOLLY AND SLASH PINE TO HUMIC, FULVIC ACIDS AND BIOLOGICAL STIMULANTS

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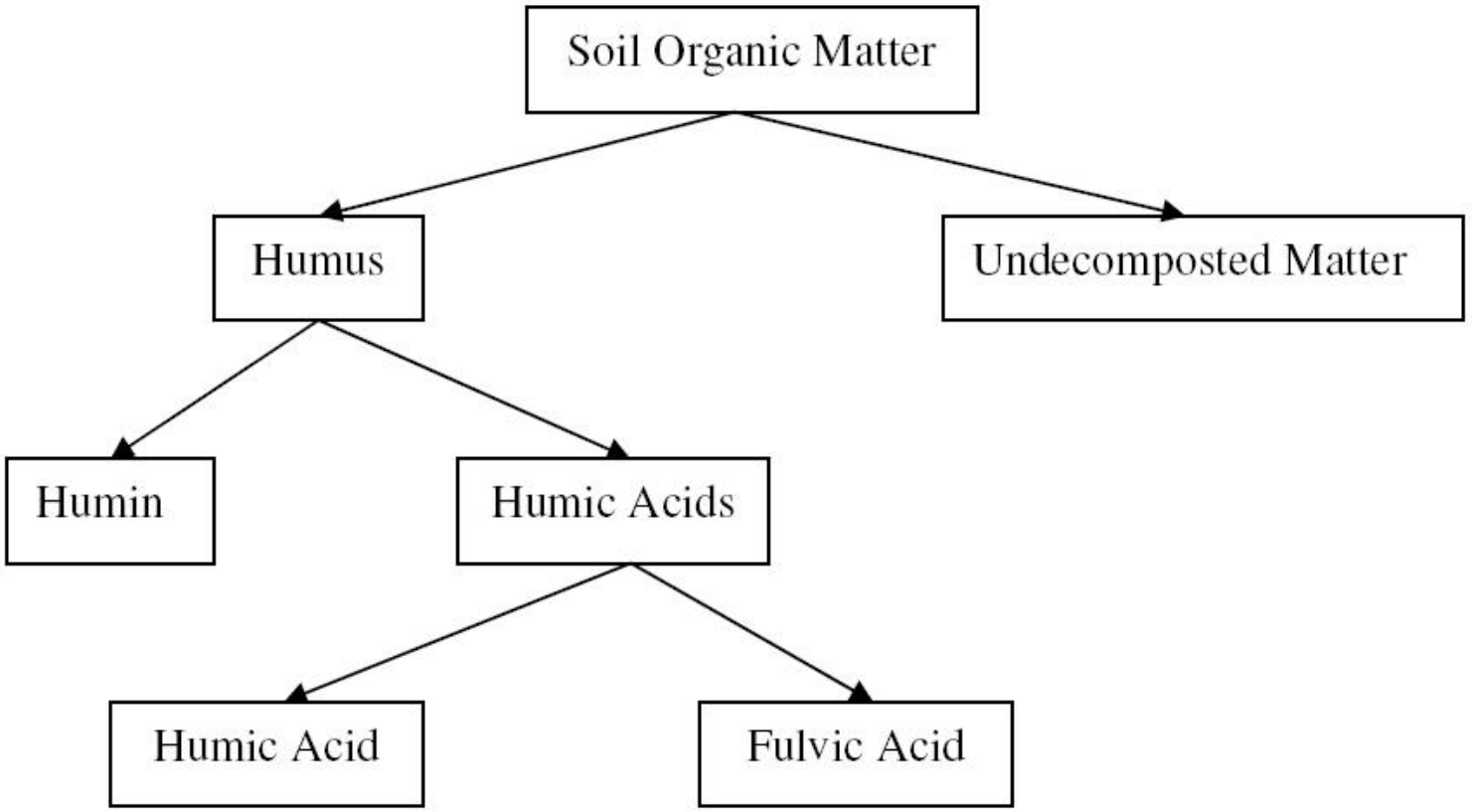
**Southern Forest Nursery Management Cooperative**

# Where do Humic Acids Come From?



# What are "Humic Acids"?

| Humic Acids | Fulvic Acid |
| --- | --- |
| HA defies a precise definition. It is a black or very dark brown, high molecular weight water soluble at pH >2. | FA light yellow to yellowish brown in color and are small molecular weight water soluble at all pH ranges |
| The color has been used very effectively as a sales or advertising attribute – conjuring up images of dark fertile soils. | More active in the plant than HA |

# What are "Humic Acids"?

**Humic Acids**

- Some studies have shown HA to increase the effectiveness of inorganic fertilizer by improving nutrient uptake and enhancing the physical, chemical and biological properties of the soil.

**Fulvic Acid**

- Used as a fertilizer additive, compatible with most fertilizers and pesticides. Commonly applied as foliar/soil application

# What are "Humic Acids"?

## Humic Acids

- Humic Acid is probably the most common carrier in the many "biologicals" that are being marketed today.
- Used as a carrier for many chelated iron solutions.
- It has very high cation exchange capacity (CEC) – 500 to 600 meq/100 g soil (sandy soil - 3 to 25 meq/100 g soil)
- Available in both liquid and granular form

## Fulvic Acids

- Studies using marked FA have shown that FA is capable of entering the plant while HA remain outside.
- Available in liquid form.

# Nursery Cooperative Studies

- 2008 – Greenhouse study comparing HA and 2 biologicals on growth of slash and loblolly pine
- 2009 – Study at 2 nurseries looking at 3 rates of granular HA. (Applied post sowing)
- 2009 – Greenhouse study comparing 2 "biologicals" with HA and FA.
- 2010 – Rate response of 3 levels of HA & FA

# 2009 "Biologicals" vs Humic and Fulvic Acids

1. Nature's NOG - The MSDS sheet describes the product as processed and modified seaweed extract and humate derivatives. Forty elements and compounds are listed..
2. Hydromax - A liquid extract from metal tailings from the Iron King Mine. Tailings were used for production of Ironite® which contains 22 beneficial elements.
3. Hydra-Hume – 12 % Humic Acid +
4. NutrAsyst – 5% Fulvic Acid
5. Fertilizer (Control) – 30-10-10 water soluble

SPECIMEN

# Hydra-Hume

**0-0-1**

**GUARANTEED ANALYSIS:**
Soluble Potash ($K_2O$).....1.00%

Derived from potassium hydroxide.

**ALSO CONTAINS NON-PLANT FOOD INGREDIENTS:**

ACTIVE INGREDIENTS: 12.00% .....Humic Acid (Derived from leonardite)
INERT INGREDIENTS: 87.00%.....INERT INGREDIENTS

**KEEP OUT OF REACH OF CHILDREN**

## CAUTION

**See Inside Panel for Additional Precautionary Statements.**

SN 0505/0108-Ag WEIGHT PER GALLON: 8.8 lbs (3.99 kg)

NET CONTENTS:
- ☐ 5 gal (18.93 L) Net Wt. 44 lbs (19.96 kg)
- ☐ 250 gal (946.25 L) 2,200 lbs (997.92 kg)
- ☐ 275 gal (1,040.88 L) 2,420 lbs (1,097.71 kg)

Information about the components of this lot of fertilizer may be obtained by writing to Helena Chemical Company, 225 Schilling Boulevard, Suite 300, Collierville, TN 38017 and giving the lot number which is found on the container.

Information regarding the contents and levels of metals in this product is available on the Internet at http://www.aapfco.org/metals.htm .

F224
**MANUFACTURED FOR**
**HELENA CHEMICAL COMPANY**
**225 SCHILLING BOULEVARD, SUITE 300**
**COLLIERVILLE, TN 38017**

SPECIM

# NutrAsyst

FERTILIZER ADDITIVE

ACTIVE INGREDIENT(S):
5.00%.....Fulvic Acid.
95.00%.....Other Ingredients
100.00%.....TOTAL

THIS PRODUCT IS NOT A PLANT FOOD OR SOIL AMENDMENT

KEEP OUT OF REACH OF CHILDREN

## CAUTION

See Inside Panel for Additional Precautionary

SN 090308
NET CONTENTS: 5 Gallons (18.93 Liters)
30 Gallons (113.55 Liters)
275 Gallons (1040.88 Liters)
Bulk gallon

WT. PER GALLON: 8.5 lbs. @ 68°F (3.95 kg PER LITER @20°C)

MANUFACTURED FOR
HELENA CHEMICAL COMPANY
225 SCHILLING BOULEVARD, SUITE 300
COLLIERVILLE, TN 38017

GENERAL INFORMATION

# 2009 "Biologicals" vs Humic and Fulvic Acids

- Rate used were suggested label rates.

Component treatments applied at all biweekly applications.

| | Total Water | Hydromax | NOG | Hydra-Hume | NutrAsyst | Fertilizer |
|---|---|---|---|---|---|---|
| Hydromax | 15.1 l | 15.8 ml/l | | | | 0.4g/l |
| Natures NOG | 15.1 l | | 15.8 ml/l | | | 0.4g/l |
| Hydra-Hume | 15.1 l | | | 1.6 ml/l | | 0.4g/l |
| NutrAsyst | 15.1 l | | | | 1.6 ml/l | 0.4g/l |
| Fertilizer | 15.1 l | | | | | 0.4g/l |

- 15 container sets (replication) /treatment. 20 cavities (experimental unit) of Loblolly pine and 20 cavities (experimental unit) of Slash pine per container set.
- Biweekly applications of treatments began 6/18/09. There were a total of 9 applications over the season

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## Loblolly Pine

| | October 2009 Final | | | | |
|---|---|---|---|---|---|
| | RCD (mm) | HT (cm) | Top Dry (gm) | Root Dry (gm) | Total Top Dry (gm)[1] |
| Hydromax | 2.8 b | 28.5 a | 1.30 a | 0.397 b | 1.34 a |
| Natures NOG | 2.5 c | 27.2 b | 0.94 c | 0.429 ab | 0.98 c |
| Hydra-Hume | 2.7 b | 26.4 b | 1.07 b | 0.398 b | 1.09 b |
| NutrAsyst | 3.0 a | 28.5 a | 1.26 a | 0.467 a | 1.30 a |
| Fertilizer | 2.7 b | 28.6 a | 0.97 bc | 0.333 c | 1.00 bc |
| *lsd* | *0.12* | *1.2* | *0.101* | *0.524* | *0.101* |

[1] Total Top Dry = includes dry weight of top clippings from July

**Boxes in yellow are significantly greater than fertilizer control**

## Slash Pine

| | October 2009 Final | | | | |
|---|---|---|---|---|---|
| | RCD (mm) | HT (cm) | Top Dry (gm) | Root Dry (gm) | Total Top Dry (gm)[1] |
| Hydromax | 3.1 b | 29.1 a | 1.54 a | 0.506 b | 1.61 a |
| Natures NOG | 2.9 c | 25.8 b | 1.11 c | 0.642 a | 1.17 c |
| Hydra Hume | 3.1 b | 26.2 b | 1.29 b | 0.522 b | 1.36 b |
| NutrAsyst | 3.3 a | 28.6 a | 1.46 a | 0.556 ab | 1.52 a |
| Fertilizer | 3.1 b | 26.5 b | 1.26 b | 0.522 b | 1.33 b |
| *lsd* | *0.12* | *1.2* | *0.126* | *0.109* | *0.115* |

[1] Total Top Dry = includes dry weight of top clippings from July

**Boxes in yellow are significantly greater than fertilizer control**

# Price (w/o quantity discounts)

- **Hydromax** - Per acre rate of 88 fl oz/acre = $17.18 ✔
- **Nature's NOG** - Per acre rate of 88 fl oz/acre = $41.25
- **Hydra Hume** – Per acre rate of 1 gal/acre = $11.50 (Humic Acid)
- **NutrAsyst** – Per acre rate of 1 gal/acre = $12.50 ✔ (Fulvic Acid)

# 2010 Rate Study of Humic and Fulvic Acid

- Purpose: to test three rates of humic and fulvic acid to determine response range.
- 15 container sets (replication) /treatment. 20 cavities (experimental unit) of Loblolly pine and 20 cavities (experimental unit) of Slash pine per container set.
- Biweekly applications of treatments began 5/17/10. There were a total of 10 applications over the season.

# Amount of water and treatments applied to each 15 container sets per treatment at each biweekly application.

| Treatment | Total Water | Hydra-Hume | NutrAsyst | Fertilizer |
|---|---|---|---|---|
| HA 1 | 15.1 l | 1.6 ml/l | | 0.4g/l |
| HA 2 | 15.1 l | 4.0 ml/l | | 0.4g/l |
| HA 3 | 15.1 l | 8.0 ml/l | | 0.4g/l |
| FA 1 | 15.1 l | | 1.6 ml/l | 0.4g/l |
| FA 2 | 15.1 l | | 4.0 ml/l | 0.4g/l |
| FA 3 | 15.1 l | | 8.0 ml/l | 0.4g/l |
| Control | 15.1 l | | | 0.4g/l |

## Slash Pine

| | | FULVIC ACID | | | HUMIC ACID | | |
|---|---|---|---|---|---|---|---|
| | **Control** | **FA1** | **FA2** | **FA3** | **HA1** | **HA2** | **HA3** |
| **RCD** | 2.44 | 2.63 ** | 2.55 ** | 2.66 ** | 2.63 ** | 2.76 ** | 2.54 |
| | | | | | | | |
| **Root DW** | 0.31 | 0.40 ** | 0.32 | 0.35 | 0.39 ** | 0.32 | 0.37 ** |
| **Shoot DW** | 0.67 | 0.91 ** | 0.75 ** | 0.72 | 0.79 ** | 0.83 ** | 0.83 ** |
| **Total DW** | 1.05 | 1.32 ** | 1.12 | 1.13 ** | 1.24 ** | 1.19 ** | 1.24 ** |

** - *Significantly different from Control at the 0.05 level using Dunnetts test*

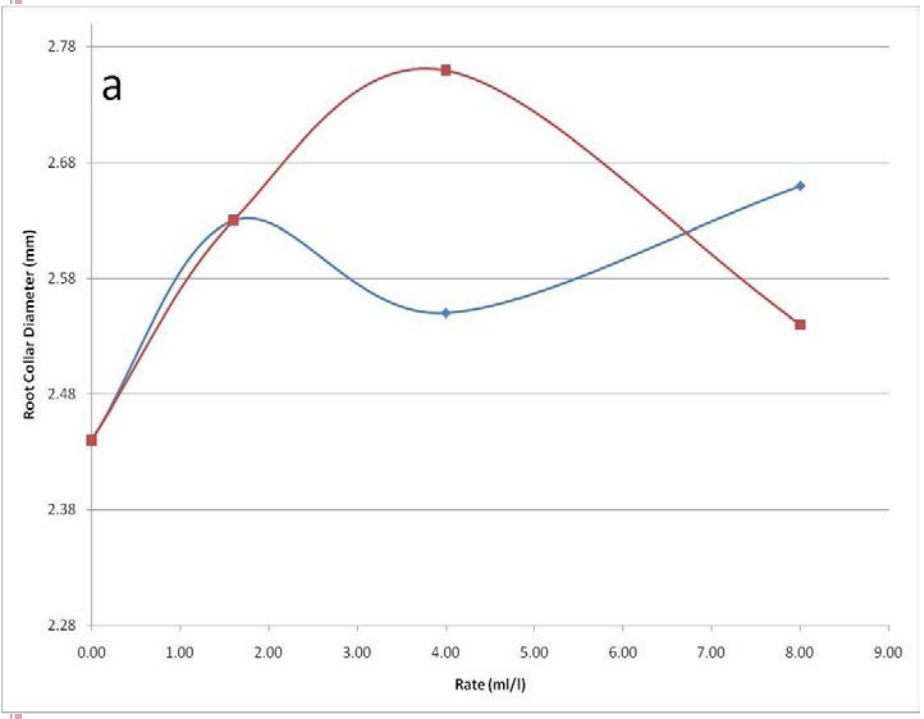
## Loblolly Pine

| | | FULVIC ACID | | | HUMIC ACID | | |
|---|---|---|---|---|---|---|---|
| | **Control** | **FA1** | **FA2** | **FA3** | **HA1** | **HA2** | **HA3** |
| **RCD** | 2.29 | 2.38 ** | 2.30 | 2.33 | 2.30 | 2.32 | 2.33 |
| | | | | | | | |
| **Root DW** | 0.29 | 0.33 ** | 0.42 ** | 0.31 | 0.31 | 0.31 | 0.32 |
| **Shoot DW** | 0.69 | 0.79 ** | 0.77 ** | 0.69 | 0.69 | 0.72 | 0.73 |
| **Total DW** | 1.01 | 1.15 ** | 1.24 ** | 1.04 | 1.02 | 1.05 | 1.07 |

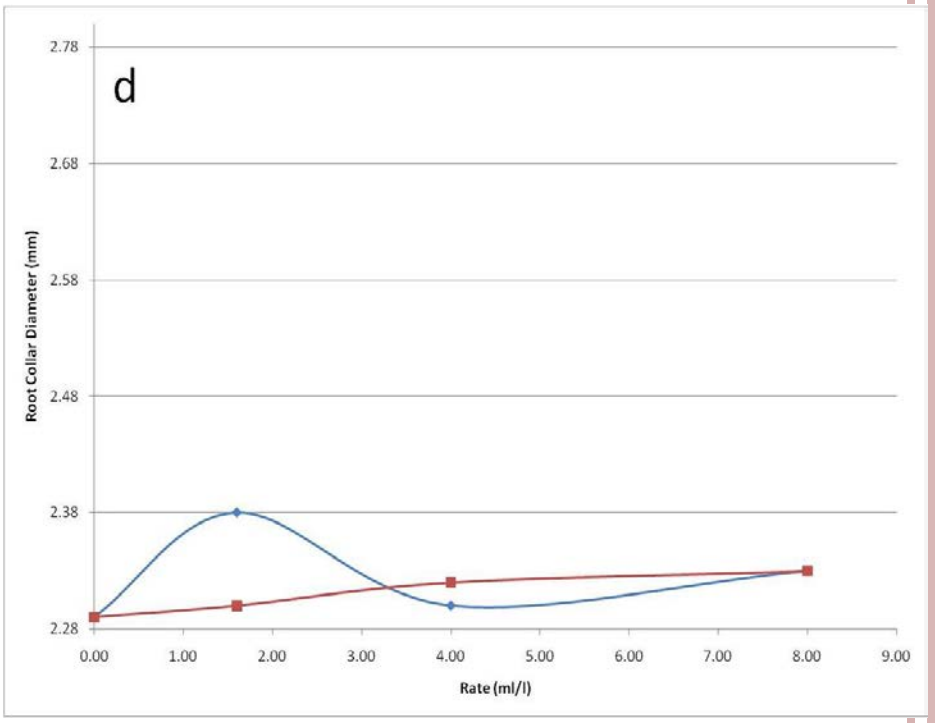
** - *Significantly different from Control at the 0.05 level using Dunnetts test*

# Root Collar Diameter

## Slash Pine




## Loblolly Pine

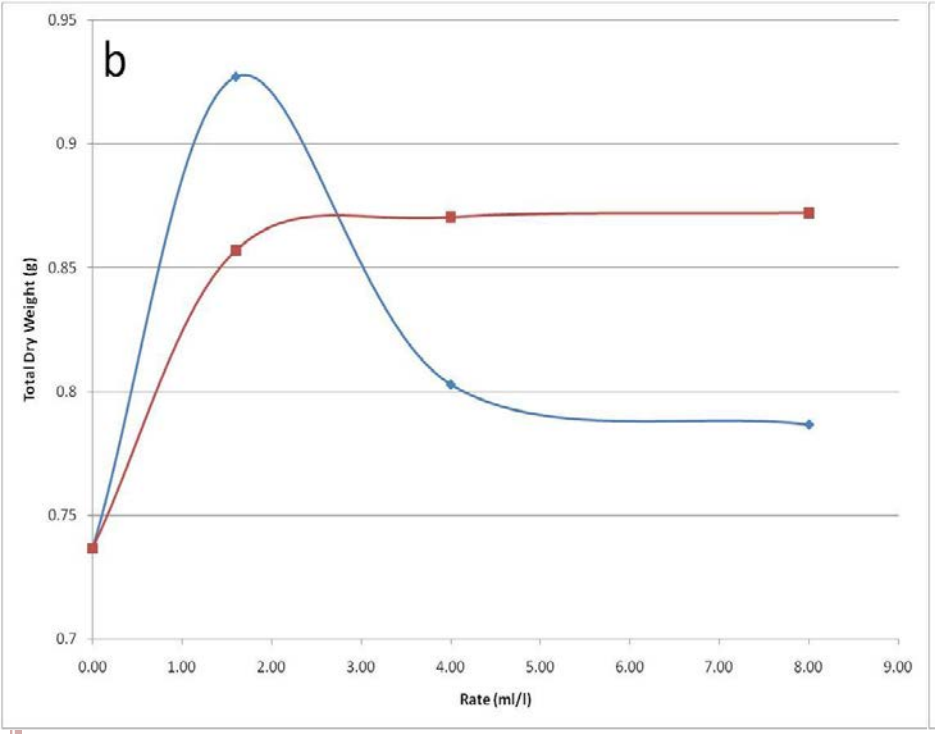



Fulvic Acid

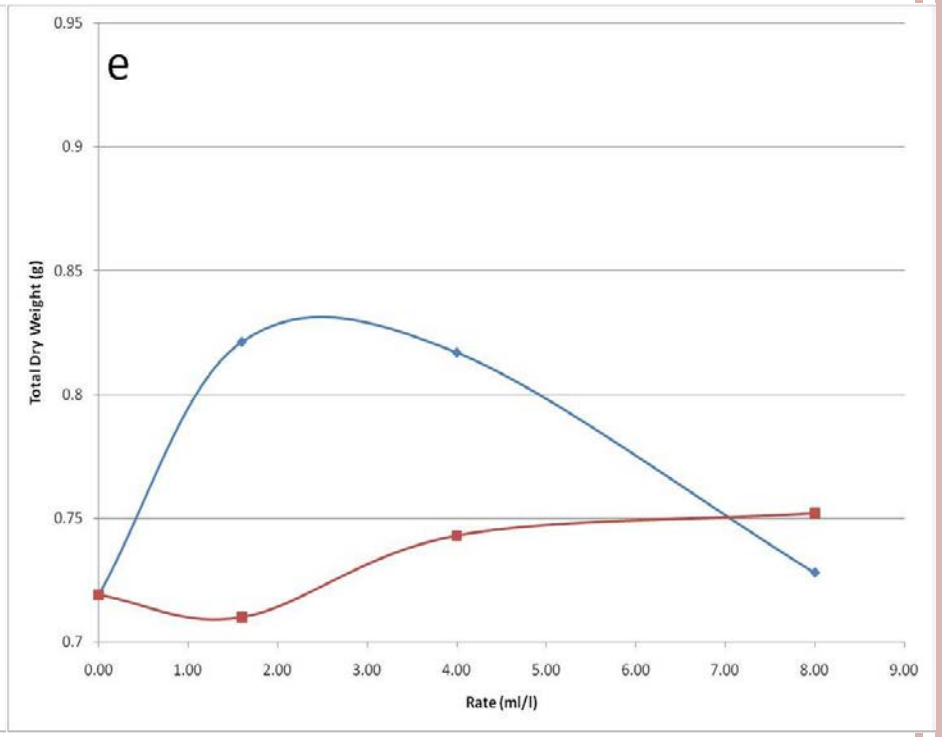
Humic Acid

# Total Seedling Dry Weight

## Slash Pine




## Loblolly Pine

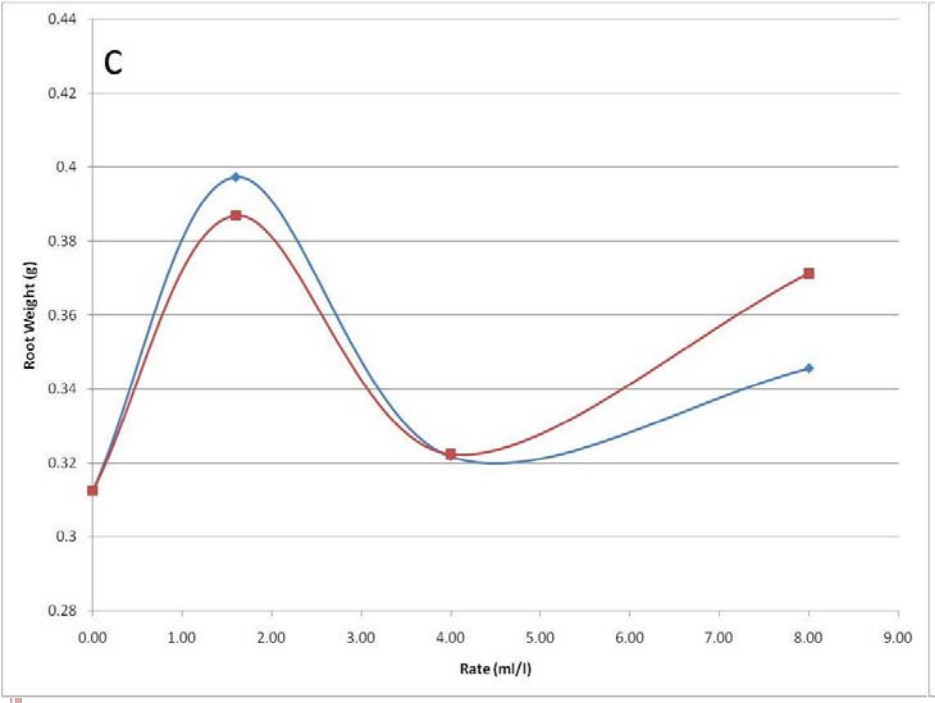



Fulvic Acid

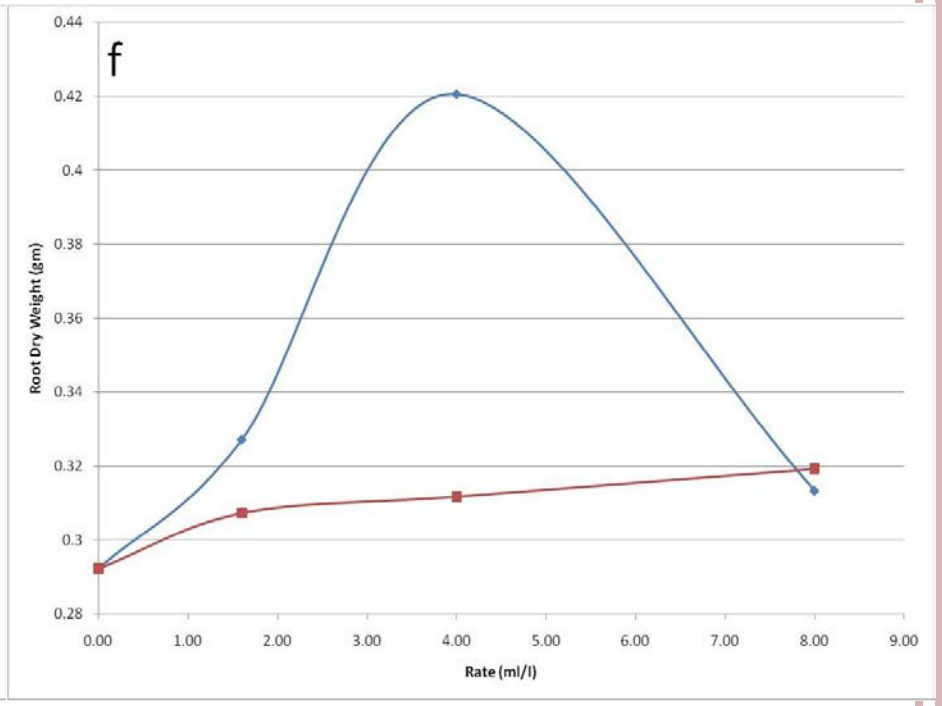
Humic Acid

# Root Dry Weight

## Slash Pine




## Loblolly Pine




Fulvic Acid

Humic Acid

# Conclusions and observations

- Slash pine responded more to "Humic Acids" than loblolly pine.
- Slash pine responded more to fulvic acid than humic acid.
- Rates chosen for FA may have been at the upper range for maximum response. It is possible that a lower rate may be better or equally effective.
- Optimum rate for HA may be higher than study rates
- I see more potential for use in container nurseries which rely on water soluble liquid feed than bareroot nurseries
- HA and FA are safe for use in nurseries @ label rate
- When purchasing HA or FA stay with a reputable vendor. Industry standards (especially for HA) have not been developed.