Southern Forest
Nursery Management Cooperative

RESEARCH REPORT 19-07

ESSENTIAL PLUS 1-0-1 GREENHOUSE TRIALS

by
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INTRODUCTION

Numerous chemical, biological, physical, and physiological seed treatments are regularly used to increase both seed germination and seedling survival (Taylor and Harman 1990). The seed treatment techniques commonly used in conifer forest tree nurseries include imbibing with water, cold stratification, and pesticide treatment. Biological or biostimulant seed treatments are less commonly used.

The Southern Forest Nursery Management Cooperative has tested numerous biological and biostimulant products on southern pines and their seed. Allen and Enebak (1999) tested nine biological seed treatment products on longleaf pine (*Pinus palustris*) finding none to affect germination. Carey et al. (2004) found that fungicidal seed treatment for longleaf pine increased total germination while a biological seed treatment harmed total germination in some cases. While biological products contain microorganisms reported to be beneficial they also contain "carriers" such as humic and fulvic acids.

Humic and fulvic acids have been individually tested for bio-stimulating properties. Humic acid is known to facilitate the uptake of essential nutrients (Starkey and Enebak 2009). Starkey and Enebak (2011) found that humic acid positively affected seedling quality while two biological soil inoculants negatively influenced seedling quality. Starkey and Enebak (2011) also reported that slash pine (*Pinus elliotii)* responds to both humic and fulvic acids, while loblolly pine (*Pinus taeda)* responds to fulvic acid and may respond to humic acid at rates higher than were tested. Humic acid can function like a plant growth regulator (Cacco and Dell'Agnola 1984, Senn and Kingman 1973) and promotes root development when applied as a seed treatment (Hartwigsen and Evans 2000). Additional effects of humic acid are well documented (Chen and Aviad 1990).

For this study, the Southern Forest Nursery Management Cooperative tested the biostimulant product Essential Plus 1-0-1 (Essential) (produced by Growth Products, Ltd. New York). Essential is marketed as a root stimulator and contains several ingredients including macronutrients, micronutrients, humic acid, and non-plant food ingredients. Essential was evaluated for its potential effect on total seed germination, taproot elongation, and survival.

MATERIALS AND METHODS

Comparisons for the study were between untreated seed, seed treated with Essential, and seed treated with a humic acid product (this was done because Essential is a humic acid solution) (Table 1). Stratified loblolly and slash pine seed was treated and sown in starting trays (21″ long, 11″ wide, 2.5″ deep) filled with a mixture of sand, cat litter, and crushed brick (88%, 6%, and 6%, respectively). Three rows (one treatment per row) of twenty seeds per row were sown in each tray with five trays (replicates) per species; this resulted in one hundred seeds per treatment and species combination. The treatments were randomly assigned a row within each tray, with all treatments being included in each tray (this arrangement resulted in a randomized complete block design).

The number of germinated, live seedlings was recorded daily with any deaths and abnormal growth noted. Daily germination counts continued for at least two days after germination ended. Within 4 days of ceasing germination counts, seedlings were removed from the trays and taproot length measured.

From the data collected, statistical analyses were undertaking using an analysis of variance (ANOVA) and post-hoc tests for the root length data. For germination and survival counts a non-parametric Friedman and post-hoc tests were used, as the data was not normally distributed.

RESULTS AND DISCUSSION

Seed treatment with Essential prior to sowing had no effect on loblolly pine germination when compared to either of the controls (Figure 1). Loblolly pine seedling survival was not affected when treated with Essential compared to the untreated control, however, it was greater than the humic acid treated control (Figure 2). Loblolly pine seed treated with Essential had similar root lengths to the untreated control, however, the root lengths of seed treated with humic acid were significantly shorter than those of seed treated with Essential (Figure 3).

Seed treatment with Essential prior to sowing had no effect on slash pine germination (Figure 4), survival (Figure 5), or root length (Figure 6) when compared to the treated and untreated controls.

From previous research undertaken at the Nursery Cooperative, we anticipated that the humic acid treated control would have outperformed the untreated control in this study; however, this was not the case. While humic acid is known to directly and indirectly increase plant growth (Chen and Aviad 1990) higher concentrations are known to decrease plant growth (Starkey and Enebak 2011). In this study humic acid treated seed performed consistently worse than both the Essential treatment as well as the untreated control.

MANAGEMENT IMPLICATIONS

This study tested Essential 1-0-1 as a seed treatment in loblolly and slash pines by comparing seed treated with Essential to untreated seed and seed treated with humic acid. The product's impact on total seed germination, taproot elongation, and survival was tested.

- Results of this trial indicate that Essential did not significantly improve germination, survival, or taproot growth compared to that of the untreated control seed.

- Essential treated seed had better survival and taproot lengths compared to that of the humic acid (treated control) used in this study, in some cases.
- Essential was not phytotoxic to the pine tested.

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Table 1: Seed treatments for both Loblolly and Slash pine

TREATMENT	MANUFACTURER	LABELLED RATES	HUMIC ACID CONCENTRATION
Essential® Plus 1-0-1	Growth Products	12 oz / 100 lbs of seed	Humic acid – 7%
Hydra-Hume® 0-0-1 (treated control)	Helena Chemical Company	1 gal. / ac	Humic Acid – 12%
Untreated control	Not Applicable	Not Applicable	Not Applicable

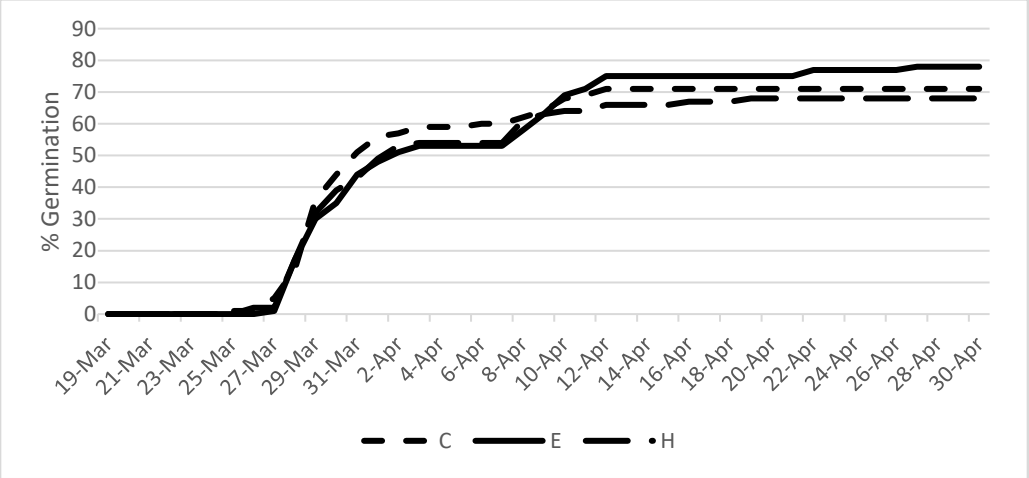

Figure 1. Loblolly pine germination over time. Treatment means (lines) are not statistically different from each other. C=no-treatment control, E=Essential, H=Humic acid.

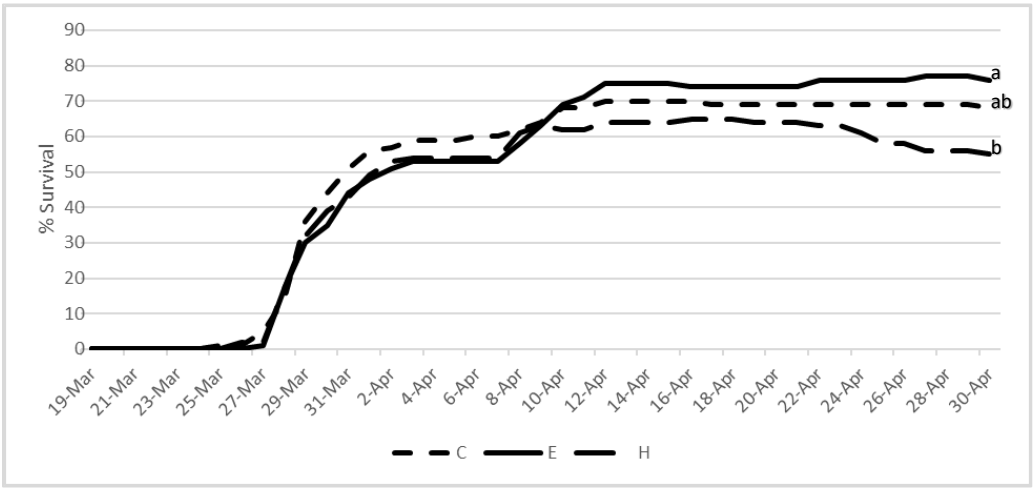

Figure 2. Loblolly pine survival over time. Treatment means (lines) are statistically different from each other with survival of Humic acid-treated seed less than Essential-treated seed. C=no-treatment control, E=Essential, H=Humic acid.

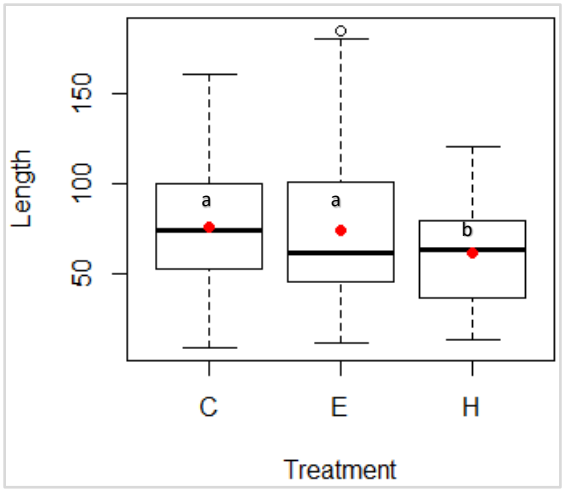

Figure 3. Loblolly pine root length by treatment with means shown as dots. Humic acid root lengths were much smaller than no-treatment control and Essential-treated seed. C=no-treatment control, E=Essential, H=Humic acid.

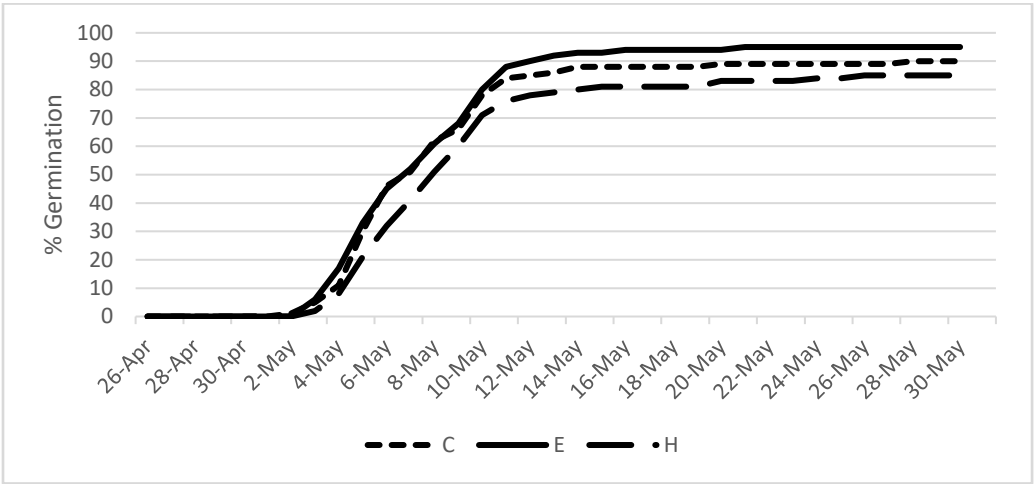

Figure 4. Slash pine germination over time. Treatment means (lines) are not statistically different from each other. C=no-treatment control, E=Essential, H=Humic acid.

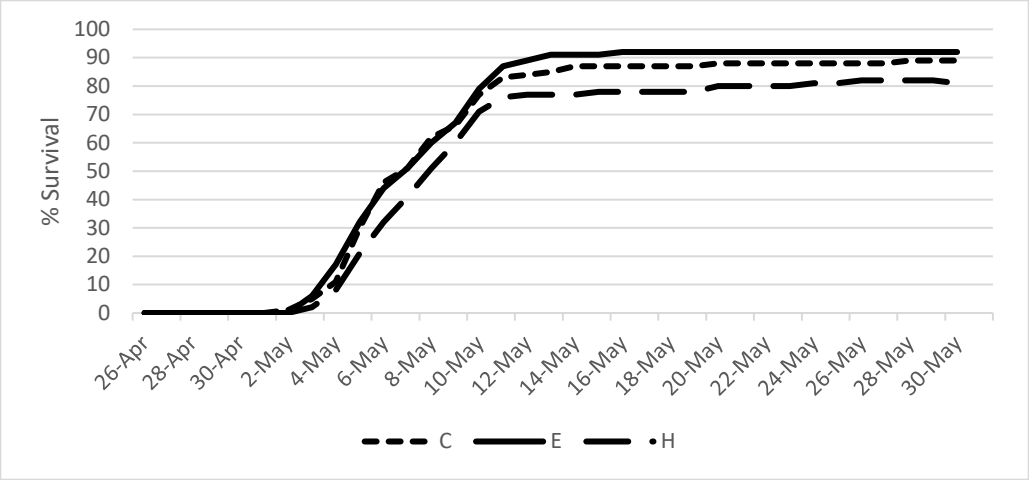

Figure 5. Slash pine survival over time. Treatment means (lines) are not statistically different from each other. C=no-treatment control, E=Essential, H=Humic acid.

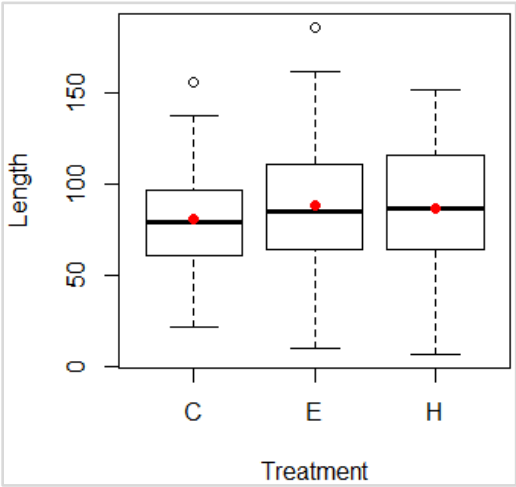

Figure 6. Slash pine root length by treatment with means shown as dots. Treatment means are not statistically different from each other. C=no-treatment control, E=Essential, H=Humic acid.