NATIVE PLANT ESTABLISHMENT STUDY PHASE II[1]

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Abstract: The purpose of Phase II of this study was to determine if a single application of a time-released water gel (TRWG) with the added nutrients zinc and acetic acid could provide enough moisture to successfully establish the root system of a native plant during the warmest time of the year. Phase II follows the plants from Phase I throughout a complete growing season. A TRWG was applied to one group of plants providing 90-days of continuous moisture during late summer/fall plantings. Plants that were hand watered (controls) were given 2.5 gallons of potable water, without nutrients, each week for 12 weeks.

The study takes place in Santa Rosa, CA and presents initial results from June 2010 of dry root mass weights from plantings in August, September and October of 2009. Final results for Phase II were gathered in November 2010 showing first season root mass growth and upper plant height measurements.

Planting trees in August appears to provide a sufficient timeline allowing roots to push growth for a few months prior to plants becoming dormant. The challenge is providing cost effective irrigation from August until the dormant season around November. Results for Phase II of this study show root mass had the greatest overall increase when plants went into the ground during August with a TRWG.

Phase II data indicates a 139% average increase in root mass growth and a 68% increase in upper plant growth for plants established in August with a TRWG over controls which were given water on a weekly basis.

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Introduction

Native vegetation evolves to survive and flourish in local climates, soil types, and ecosystems. Due to lands being disturbed by a variety of events, habitats require either mitigation of disturbed lands and/or restoration of wildlife habitat. The most widespread method of establishing plants has been to replant containerized materials in late fall or early winter, protecting plants from harsh summer temperatures while providing them springtime moisture. The new method presented in this study will provide results that show a better outcome by taking a different approach.

Attaining high survival rates without incurring high expenses for maintenance or replanting due to site failure is a common goal in these projects. While late fall early winter planting provide the plants the initial protection and moisture needed to survive the winter, planting at this time of year does not always enable the plant substantial enough root growth needed for long-term sustainability after the fall and winter seasons.

Planting trees in August can provide a sufficient time allotment allowing the plant to push root growth for several months prior to dormancy. The challenge with planting during the heat of summer/early fall has been to provide cost effective irrigation from August until the onset of the rainy season or until the weather is cool enough for the plants to go into dormancy.

The use of TRWG with added nutrients eliminates the need for hand/truck watering or short-term irrigation, while providing a number of benefits for the overall success of a project:

- Providing adequate moisture at the time of planting directly to the root mass of a transplant increases the planting window without solely relying on the undetermined onset of the rainy season.
- With the added nutrient zinc which contributes to the production of essential growth regulators affecting photosynthesis, late summer planting with TRWG, increases the length of time for a plant to produce greater structural integrity before the onset of dormancy. (Mordvedt, et al., 1991)
- With the addition of zinc sulfate (0.112%) and acetic acid (0.047%) to the TRWG, root growth improved an average of 139 % over the use of controls that were given potable water.

Objective

To determine potential benefits of using TRWG with the added nutrients zinc and acetic acid over hand watering for greater root mass and plant growth. To determine if a single application of TRWG could provide enough moisture to successfully establish a root system that could survive through the following growing season with no additional irrigation. To determine if additional photosynthesis (on the front side of transplanting) would have a substantial effect on greater root mass growth, plant height and survivability the following season. If initial results show positive results this indicates further studies in a variety of climates would be relevant.

Materials and Methods

The species used for the study were Quercus Agrifolia (Coastal Live Oak), Quercus Labata (Coastal Valley Oak), Calycanthus Occidentalis (Spice Bush) and Holodiscus Discolor (Ocean Spray). Three sets of plantings took place; August, September and October 2009. In August, half of the species were given a one time application of TRWG on the date of planting while controls were given 2.5 gallons of potable water every Wednesday for 12 weeks, beginning 8/4/09 with the last watering on 10/7/09. One application of TRWG was provided giving a 90 day supply of continuous moisture to the plants. 12 TRWG plants were watered once with 2.5 gallons of potable water at the time of planting.

Plots were set up at the DriWater Inc. manufacturing facility at 1042 Hopper Avenue in Santa Rosa CA. Three separate plots were created at the testing site. Each plot was 10 X 18 feet. All plots were placed to receive full sun exposure. Thirty two plants were planted in each plot on 8/4/09, 9/2/09 and 10/2/09. All plants used for the study were D-40 (40 cubic inch nursery grown plants). Planting holes were dug and watered in thoroughly; no amendments were added to the soil or the planting holes. TRWG plants were watered once at the time of planting and received only one application of a 90-day supply of TRWG in a 3 inch perforated tube placed 2 inches from the root mass. August control plants were given 2.5 gallons of potable water once a week for 12 weeks. September plants were given 2.5 gallons of potable water once a week for five weeks. Because of the closeness to the dormant season, October plants were watered once. The process of this control water regime was to make sure plants had consistent moisture until the beginning of the rainy season beginning in late October early November. Dry weight data was gathered 3 weeks after the post-harvest date. Roots were weighed on a

calibrated scale at the testing facility at DriWater Inc. Dry root mass weight data was gathered on two separate occasions; the first was post spring rains, June 23, 2010; the second was post first year growing season, November 19, 2010.

Plant height data was gathered on October 27, 2010 and plants were measured for height in inches from the bottom of the plant stem to the plants apex.

Results and Analysis

This study indicates that root mass growth improved most dramatically with plants that were established in August with TRWG. The first analysis compares August TRWG plantings to controls. Results show the dry root mass weight of TRWG plantings were an average of a 139% greater that controls.

Our second analysis showed that planting in August with TRWG resulted in a 607% increase in root mass growth over September plantings and a 1000% increase in root mass growth over October plantings. This result indicates that plants that have more time to establish with the aid of TRWG did substantially better than the plants that were either planted later in the fall or were given only potable water on a weekly basis.

Another significant result was upper plant growth after the first season. Results showed that plants that were established with TRWG in August showed a 68% average increase in overall upper plant growth.

Analysis #1: Comparison of August plantings dry root mass weighed on November 19, 2010 (three weeks after harvest) to controls planted in August 2009. Roots are weighed in grams (g).

Table #1: Dry root mass weight (g) of August TRWG to controls

Plant Species	August 2009 Planting with TRWG Dry Root Mass Weight (g) 11/19/10	August 2009 Planting Controls Dry Root Mass Weight (g) 11/19/10	% Difference with TRWG
Coastal Live Oak	78	37	111%
Coastal Valley Oak	89	31	187%
Spice Bush	84	37	127%
Total	**251**	**105**	**139%**

Analysis #2: Comparison of August 2009 plantings with September and October plantings

Table #2: August 2009 dry root mass weights to September 2009 with a TRWG (top). Comparison of August 2009 dry root mass weights to October 2009 plants with a TRWG (bottom).

Plant Species	August 2009 - Planting TRWG Dry Root Mass Weight (g) 11/19/10	September Planting - TRWG Dry Root Mass Weight (g) 11/19/10	% Difference September to August
Coastal Live Oak	78	51	53%
Coastal Valley Oak	89	12	709%
Spice Bush	84	21	300%
Ocean Spray	442	15	2847%
Total	**693**	**98**	**607%**
Plant Species	**August 2009 Planting - TRWG Dry Root Mass Weight (g) 11/19/10**	**October Planting – TRWG Dry Root Mass Weight (g) 11/19/10**	**% Difference August to October**
Coastal Live Oak	78	27	189%
Coastal Valley Oak	89	9	642%
Spice Bush	84	11	664%
Ocean Spray	442	13	3300%
Total	**693**	**63**	**1000%**

Analysis #3: August 2009 Plantings with TRWG; upper plant height in inches compared to controls. Measurements were taken on harvest date, 10/27/10.

Table #3: Comparison of plant height in inches of August 2009 plants; TRWG to controls.

Plant Species	August 2009 Planting TRWG Plant Height in Inches 10/27/2010	August 2009 Planting Controls Plant Height in Inches 10/27/2010	% Difference of Height with TRWG
Coastal Live Oak	42	24	**75%**
Coastal Valley Oak	60	36	**67%**
Coastal Spice Bush	39	24	**63%**
Total	**141**	**75**	**68%**

References

Mordvedt, J. J., Cox, F. R., Shuman, L. M., & Welch, R. M. (1991). *Micronutrients in Agriculture* (2nd ed.). Madison, WI: Soil Science Society of America.