PROMOT WP GROWTH EFFECTS ON POINSETTIA

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Introduction:

Promot WP is a biological soil additive which contains the beneficial fungi Trichoderma harzianum and Trichoderma koningii. Trichoderma have been used in commercial agriculture and horticulture for their symbiotic association with roots which leads to enhanced growth, mass and vigor of treated plants. A large number of flowers and horticultural crops[1] responded consistently under experimental and industrial conditions to treatment with Trichoderma spp. Steamed or raw soil infested with Trichoderma spp. consistently hastened flowering of periwinkle, marigold, portulaca, geranium, snapdragons, petunia, alyssum and other bedding plants. Increases in dry weight of almost 300% were observed in radishes over non-treated controls.[2] Increases in growth and yield of tomatoes, peppers, and cucumbers resulted from treatment with Trichoderma spp.[3] Cuttings of carnations and chrysanthemums can be 'rooted' in a formulation containing Trichoderma.[4]

The mode of action for the growth response from Trichoderma is speculated to occur from several possibilities. Among these include inducing a growth response by way of plant hormone production, disease pressure prevention by antagonism or increasing the availability of nutrients to the roots.[5]

Objective:

The goal of this trial was to determine the effects of Trichoderma koningii and harzianum (Promot WP) on the rooting and growth of poinsettia plants grown from cuttings in a commercial setting.

Trial Design:

Two varieties were chosen for this trial, they included a red variety called "Eckespoint Prestige Red Unrooted" which was cut and send via airmail on July 16, 2005 to JH Biotech, Inc in Ventura, California; and a white variety called "Snowcap – Unrooted" sent July 17, 2005. Both came from Vivero Internacional S.A. de C.V., Cuernavaca, Morelos, Mexico. Both of these varieties are commercially available in the US.

Once received, plants were kept refrigerated. Upon inspection, plants were observed to be in good health and turgid. Plants were inspected; those found with disease symptoms, frost burn or other abnormalities were discarded. It was noted that the size of cuttings varied especially in respect to internode length. As a result, plants were sorted according to the length of the lower most internode in order to equalize the treatment groups.

On July 20, 2005, Jiffy pellets were placed on the growing bench at Milgo Nurseries, Inc. located in Oxnard, California. Each Jiffy peat pellet was placed in a plastic tray that allowed drainage and held the Jiffy pots upright. Jiffy pots were hydrated with reverse osmosis water by overhead misters. Misters applied 30 seconds of water at 7 minute intervals. After 24 hours the Jiffy pots were hydrated and ready for the cuttings to be stuck.

On July 21, 2005 the length of the lowest internode of each cutting was measured, the data is presented on Tables 1-4. Cuttings were then stuck in to Jiffy pots, placed in plastic trays, assigned to a treatment group and randomly arranged on the growing bench (complete randomized design). Cuttings in Jiffy pots were placed four per plastic tray. Each tray was counted as one treatment unit. Each treatment contained four replications (units) for a total of 16 individual plants per treatment. The trial contained 144 plants divided into 9 treatment groups. This trial design was repeated two times each for the red and white varieties for a total of 576 individual plants.

Treatments for this trial included two Promot WP formulations. Promot A was produced in such a way as to contain a higher concentration of the Trichoderma's natural growth factors. Promot B was produced using the standard manufacturing process and contains the usual amount of the natural growth factor. Each formulation was applied at four different rates. A control treatment of reverse osmosis water only was also included for comparison. The application rate of 0.1 gram / 100 ml / Square Meter is the normal recommended rate of application. 0.5 is five times the recommended rate, 1.0 is ten times the recommended rate and 1.5 is fifteen times the recommended rate.

Treatments and rates were as follows:

Promot WP-A: 0.1 gram / 100 ml / Square Meter
0.5 gram / 500 ml / Square Meter
1.0 gram / Liter / Square Meter
1.5 gram / 1.5 Liters / Square Meter

Promot WP-B: 0.1 gram / 100 ml / Square Meter
0.5 gram / 500 ml / Square Meter
1.0 gram / Liter / Square Meter
1.5 gram / 1.5 Liters / Square Meter
Control

Treatments were applied July 21, using an overhead application through a shower type nozzle. Application were made by hand and calibrated to the correct amount per one square meter. After application a 100 ml wash of reverse osmosis water was applied by the same method. Each treatment received one application and one wash in this trial.

The grower's standard procedure for growing the cutting was used in this trial. Plants were continuously misted for 4 weeks with the automatic overhead misting system using only reverse osmosis water. Relative humidity inside the greenhouse was maintained at approximately 90% throughout the trial. Temperature was maintained at 85°F. During this four week period no fertilizer or fungicide applications were made to the treatments. Assessments for this trial included changes in the length of internodes, quality of the rooting and leaf size.

Results:

Internode Length

On July 21, internode length was measured and recorded to establish a base line for all treatments in the four trials (see Tables 1-4). The first complete internode above the cut was measured on each plant.

Table 1. Internode Length at Week 1 (Red Group 1)

Red Group 1 Internode Length (cm) 7-21-05
Replication #1

	Plant				
Treatment	1	2	3	4	Average Length
A1	1.5	1.7	1.8	1.5	1.63
A2	1.5	1.5	1.6	1.7	1.58
A3	1.5	1.5	1.5	1.7	1.55
A4	1.5	1.5	1.6	1.7	1.58
B1	1.5	1.5	1.6	1.6	1.55
B2	1.5	1.5	1.5	2.0	1.63
B3	1.5	1.5	1.5	2.0	1.63
B4	1.4	1.4	1.5	2.0	1.55
Control	1.5	1.5	1.4	2.0	1.55

Table 2. Internode Length at Week 1 (Red Group 2)

Red Group 2 Internode Length (cm) 7-21-05
Replication #1

	Plant				
Treatment	1	2	3	4	Average Length
A1	1.6	1.8	1.7	1.6	1.68
A2	1.8	2.0	1.7	1.5	1.75
A3	1.7	1.8	1.6	1.6	1.68
A4	1.5	1.7	1.5	1.6	1.58
B1	2.1	2.0	1.6	1.8	1.88
B2	2.0	2.0	1.6	1.8	1.85
B3	2.0	2.0	1.5	1.5	1.75
B4	2.0	2.0	1.6	1.6	1.80
Control	2.1	2.0	1.5	1.5	1.78

Table 3. Internode Length at Week 1 (White Group 1)

White Group 1 Internode Length (cm) 7-21-05

Replication #1

	Plant				
Treatment	1	2	3	4	Average Length
A1	2.0	1.5	1.5	1.5	1.63
A2	2.0	1.6	1.5	1.5	1.65
A3	2.0	1.5	1.5	1.5	1.63
A4	2.1	1.5	1.5	1.5	1.65
B1	2.2	1.5	1.5	1.5	1.68
B2	2.0	1.5	1.5	1.5	1.63
B3	2.0	1.5	1.6	1.5	1.65
B4	2.0	1.5	1.5	1.5	1.63
Control	2.0	1.5	1.5	1.5	1.63

Table 4. Internode Length at Week 1 (White Group 2)

White Group 2 Internode Length (cm) 7-21-05

Replication #1

	Plant				
Treatment	1	2	3	4	Average Length
A1	2.0	1.8	1.5	1.5	1.70
A2	2.0	1.8	1.5	1.5	1.70
A3	2.0	1.8	1.5	1.6	1.73
A4	2.0	1.9	1.5	1.4	1.70
B1	2.0	1.8	1.8	1.5	1.78
B2	2.0	1.7	1.8	1.5	1.75
B3	2.0	2.1	1.7	1.5	1.83
B4	2.0	2.0	1.7	1.5	1.80
Control	2.0	1.7	1.7	1.7	1.78

ANOVA was performed on each group and no statistical difference at the 95% level was found.

Internode length was again measured on the same plants four weeks after treatment. The results from this date are listed in tables 5-8.

Table 5. Internode Length at Week 4 (Red Group 1)

Red Group 1 Internode Length (cm) 8/24/2005
Replication #1

	Plant				
Treatment	1	2	3	4	Average Length
A1	1.5	1.7	1.8	1.5	1.63
A2	1.5	1.5	1.6	1.7	1.58
A3	1.5	1.5	1.5	1.7	1.55
A4	1.5	1.5	1.6	1.7	1.58
B1	1.5	1.5	1.6	1.6	1.55
B2	2.0	1.5	1.5	1.7	1.68
B3	2.0	1.5	1.5	1.5	1.63
B4	2.0	1.5	1.5	1.4	1.60
Control	1.5	1.5	1.4	2.0	1.60

Table 6. Internode Length at Week 4 (Red Group 2)

Red Group 2 Internode Length (cm) 8/18/2005
Replication #1

	Plant				
Treatment	1	2	3	4	Average Length
A1	1.6	1.8	1.7	1.6	1.68
A2	1.8	2.0	1.7	1.6	1.78
A3	2.0	1.8	1.5	2.0	1.83
A4	2.0	2.0	1.5	1.6	1.78
B1	2.6	2.0	1.8	1.8	2.05
B2	2.0	2.0	1.6	1.8	1.85
B3	2.0	2.2	1.5	1.5	1.80
B4	2.0	2.2	1.6	1.6	1.85
Control	2.2	2.0	1.5	1.5	1.80

Table 7. Internode Length at Week 4 (White Group 1)

White Group 1 Internode Length (cm) 8/18/2005
Replication #1

	Plant				
Treatment	1	2	3	4	Average Length
A1	2.0	1.5	1.6	1.7	1.70
A2	2.0	1.6	1.5	1.5	1.65
A3	2.0	1.6	1.5	1.7	1.70
A4	2.1	1.5	1.5	1.5	1.65
B1	2.2	1.5	1.5	1.5	1.68
B2	2.0	1.5	1.5	1.5	1.63
B3	2.2	2.5	1.6	1.5	1.95
B4	2.0	1.5	1.5	1.5	1.63
Control	2.1	1.7	1.6	1.8	1.80

Table 8. Internode Length at Week 4 (White Group 2)

White Group 2 Internode Length (cm) 8/23/2005
Replication #1

	Plant				
Treatment	1	2	3	4	Average Length
A1	2.0	1.8	1.5	1.5	1.70
A2	2.0	1.8	1.5	1.5	1.70
A3	2.0	1.8	1.6	2.0	1.85
A4	2.0	2.0	1.5	1.4	1.73
B1	2.0	1.8	1.8	1.5	1.78
B2	2.0	1.8	1.8	1.5	1.78
B3	2.0	2.1	1.8	1.5	1.85
B4	2.0	2.0	1.7	1.7	1.85
Control	2.0	1.9	1.7	1.7	1.83

ANOVA was performed on each group and no statistical difference at the 95% level was found.

No significant difference of internode length was found between any of the treatments from week one to week four. A marginal amount of elongation was observed in week four with some plants, however the amount was not found to be significant. Slight elongation of internode length is expected to be seen after four weeks in normal production.

Leaf Size

The length of the midribs for the lowest three leaves of each plant was measured on July 22 for one red and one white group. Data from that date was averaged together for each treatment group. Data is presented in Table 9. After four weeks, data for these groups was taken again. However, due to the normal leaf drop of the lower leaves of some plants and irregular watering, one or more treatment groups from each color were unavailable to obtain a second measurement. The White #2 Group was measured on August 18 and the Red #1 Group was measured on August 24. The data presented in Table 9, measurements for week one, shows that there was no significant difference among treatment groups at the start of the trial. Data on table 10 shows that after four and five weeks, there was still no significant difference between treatment groups and the control with the exception of treatment group White#2 B2-1.

Table 9. Average Leaf Size for all treatments on July 22, 2005 (Week 1)

Red#2 Group	Average	**White #1 Group**	Average
Promot A1-1	8.80	Promot A1-1	9.97
Promot A2-1	9.00	Promot A2-1	10.89
Promot A3-1	8.23	Promot A3-1	11.08
Promot A4-1	8.25	Promot A4-1	9.67
Promot B1-1	9.09	Promot B1-1	8.48
Promot B2-1	8.18	Promot B2-1	9.13
Promot B3-1	8.58	Promot B3-1	8.72
Promot B4-1	9.09	Promot B4-1	9.59
Check	8.62	Check	8.73

Table 10. Average Leaf Size for all Treatments on August 18 for White #2 and August 24 for Red #1 (Week 4 and 5)

Red #1 Group	Average	**White #2 Group**	Average
Promot A1-1	9.23	Promot A1-1	7.81
Promot A2-1	8.65	Promot A2-1	9.13
Promot A3-1	9.37	Promot A3-1	8.68
Promot A4-1	8.42	Promot A4-1	9.50
Promot B1-1	9.04	Promot B1-1	8.52
Promot B2-1	8.54	Promot B2-1	10.10
Promot B3-1	9.45	Promot B3-1	9.04
Promot B4-1	8.04	Promot B4-1	8.70
Check	8.88	Check	8.70

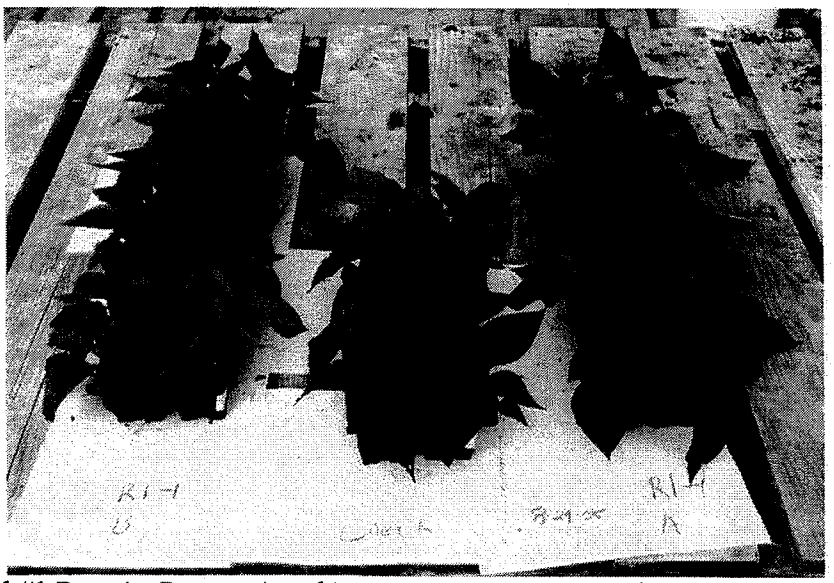
Rooting Quality

Plant were measured for rooting quality based on a 0-5 scale (0= no visible roots, 5= completely rooted, growing out of pot).

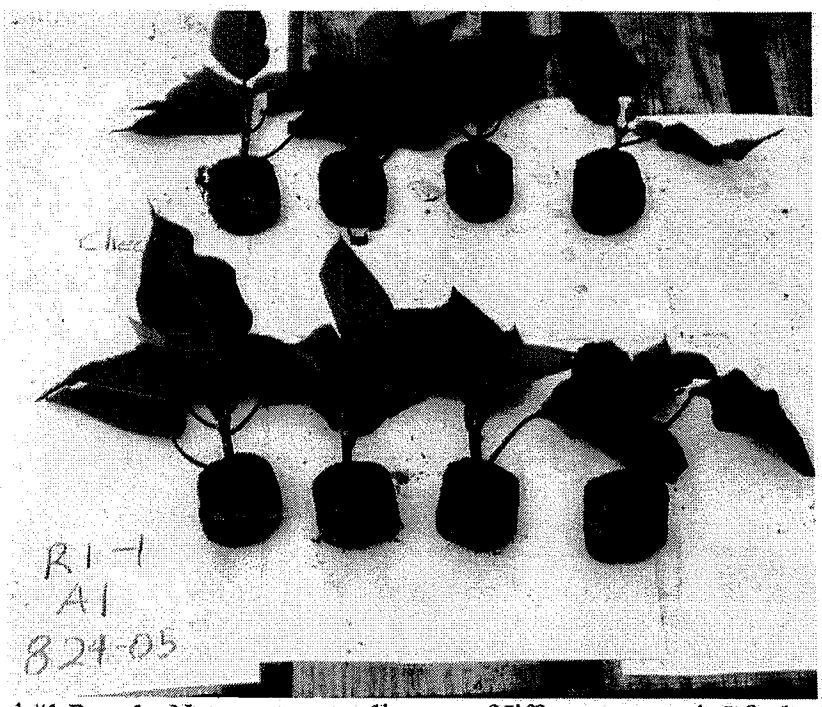
Red #1 Group

Table 11. Statistical Summary for Red Poinsettia Rooting Data.

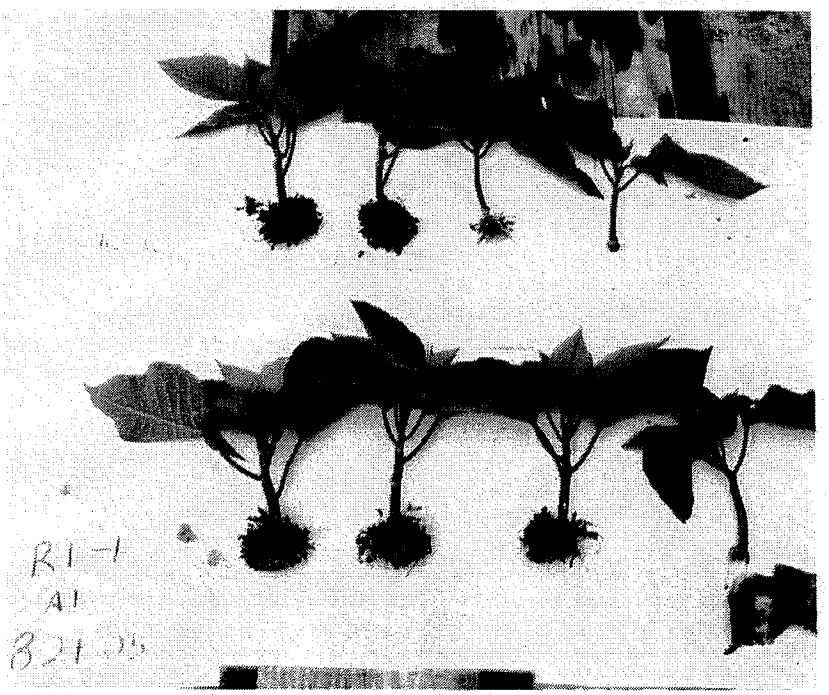
8/24/2005	R-1 Dash 1 Root Quality Plant Number				
	1	2	3	4	Average
Promot A1-1	5	5	5	1	4.00
Promot A2-1	5	5	5	1	4.00
Promot A3-1	5	5	5	5	5.00
Promot A4-1	5	4	3	0	3.00
Promot B1-1	5	5	5	4	4.75
Promot B2-1	5	5	5	4	4.75
Promot B3-1	5	5	5	1	4.00
Promot B4-1	5	5	5	5	5.00
Check-1	4	4	2	0	2.50



Group Red #1 Rep. 1 - Promot A and Promot B treatments vs. the Control at Week 5. No obvious color or size differences were observed.



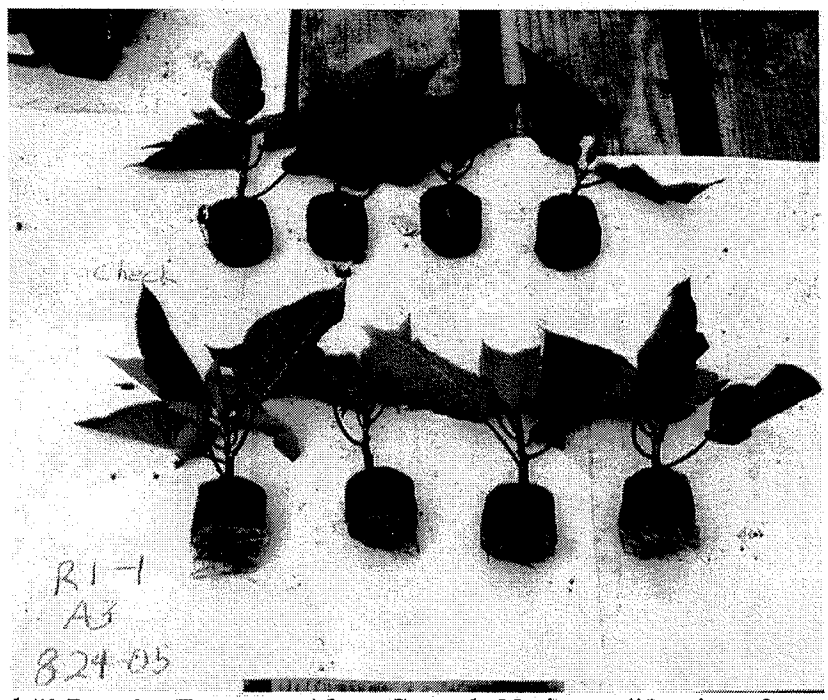
Group Red #1 Rep. 1 - Note roots extending out of Jiffy pots at week 5 for both Control and Treatment A1.



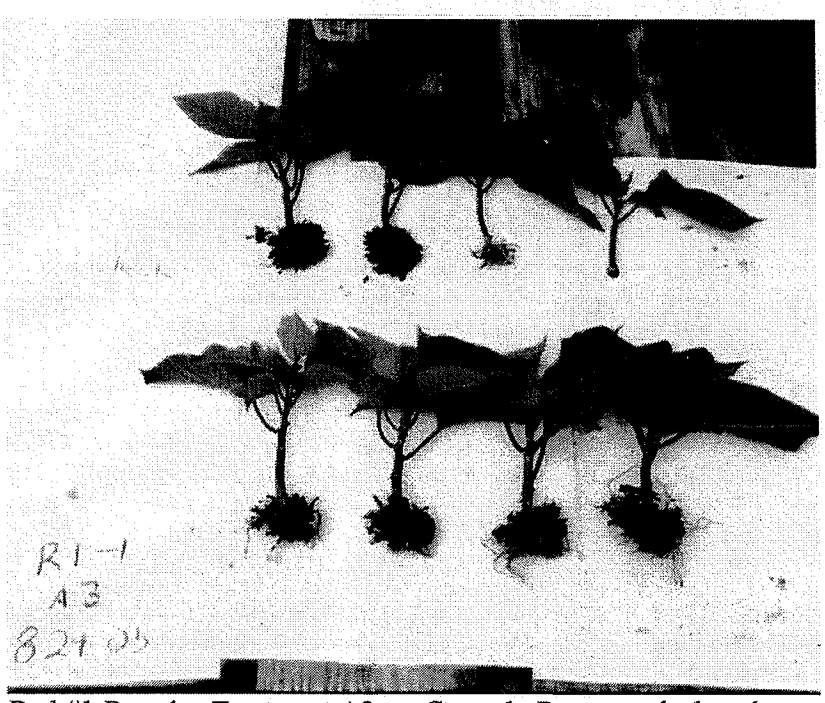
Group Red #1 Rep. 1 - Jiffy pots are removed and roots washed. Treatment A1 is the lowest rate. Root growth is comparable to water treated control.

Group Red #1 Rep. 1- Treatment A2 vs. the Control. Roots can be seen growing out of Jiffy-Pots.

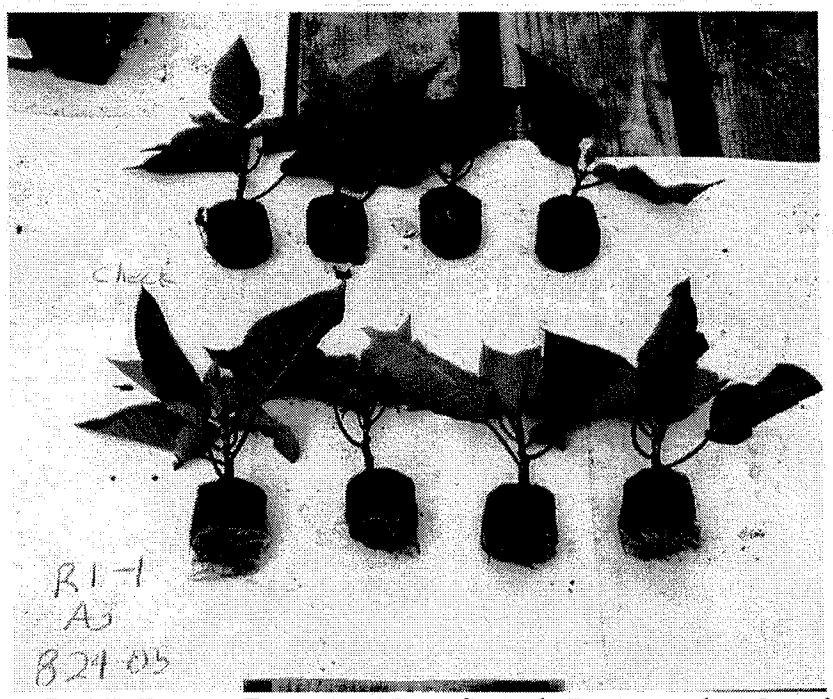
Group Red #1 Rep. 1 – Treatment A2 vs. Control with the roots washed.



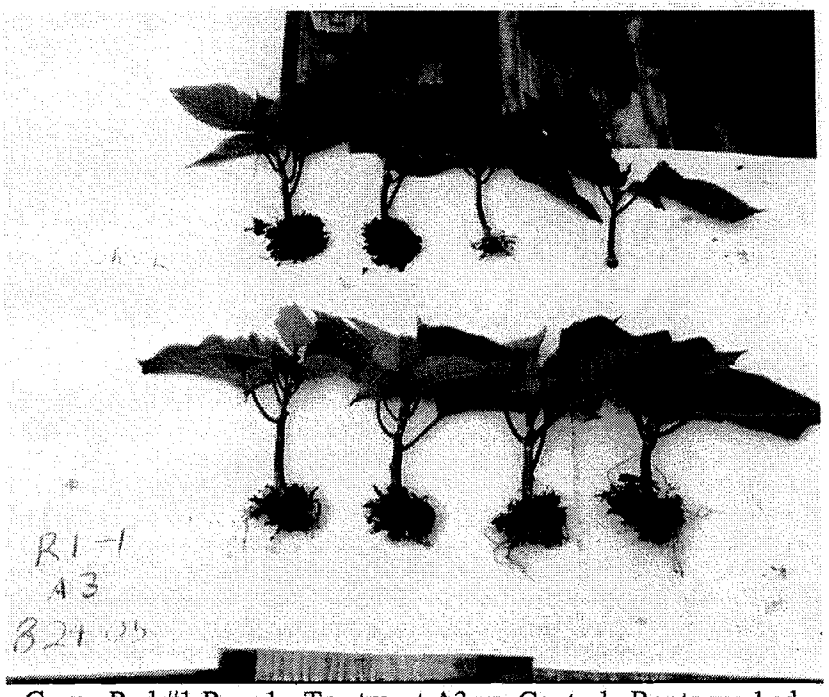
Group Red #1 Rep. 1 – Treatment A3 vs. Control. Notice proliferation of roots growing out of the treated group.



Group Red #1 Rep. 1 – Treatment A3 vs. Control. Roots washed to show growth.

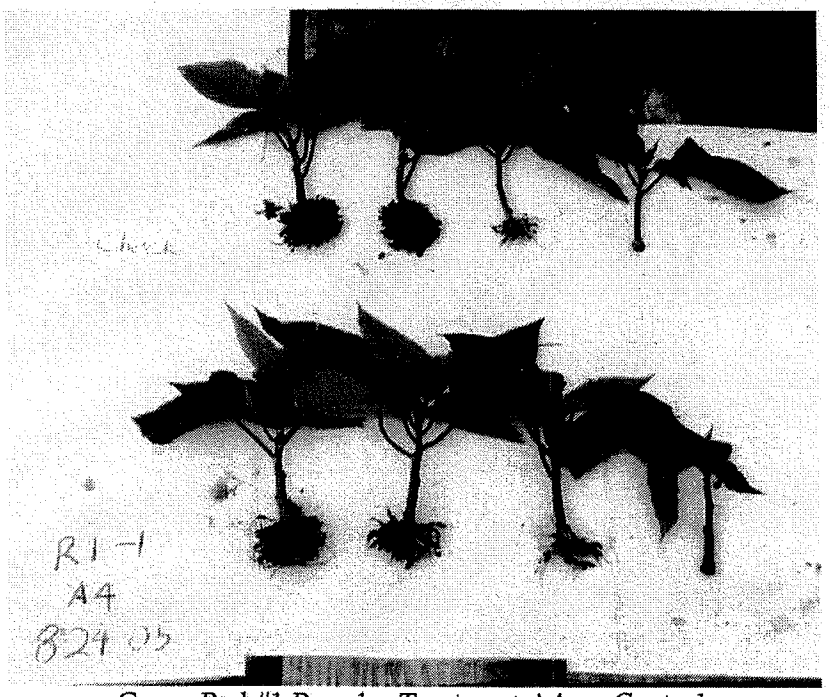


Group Red #1 Rep. 1 - Treatment A3 vs. Control. Root growth at 5 weeks is significantly greater than control.



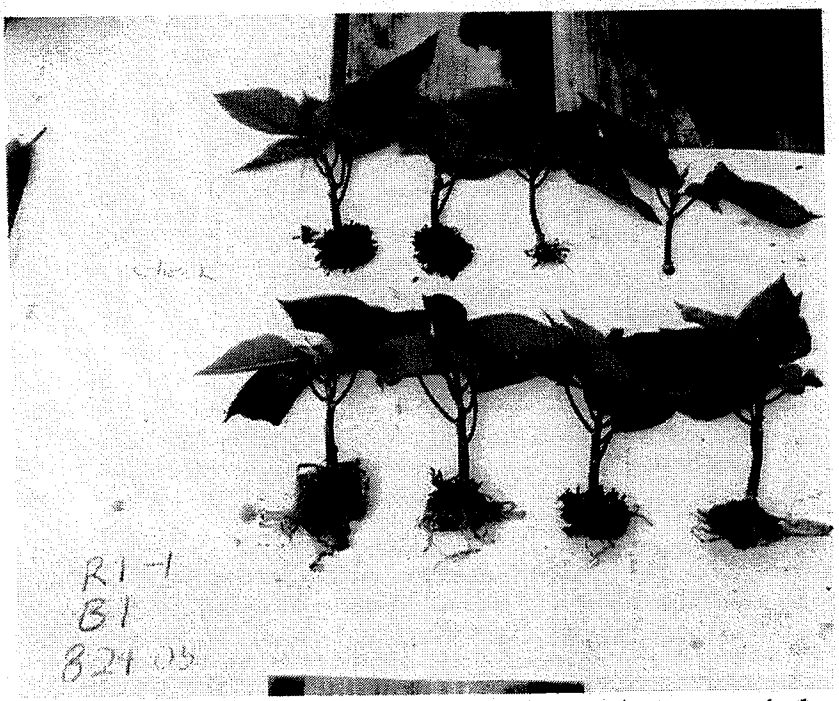
Group Red #1 Rep. 1 - Treatment A3 vs. Control. Roots washed.

Group Red # 1 Rep. 1 – Treatment A4 vs. Control. Notice plants one through three from the left are healthy. Plant four was insufficiently watered throughout the trial.

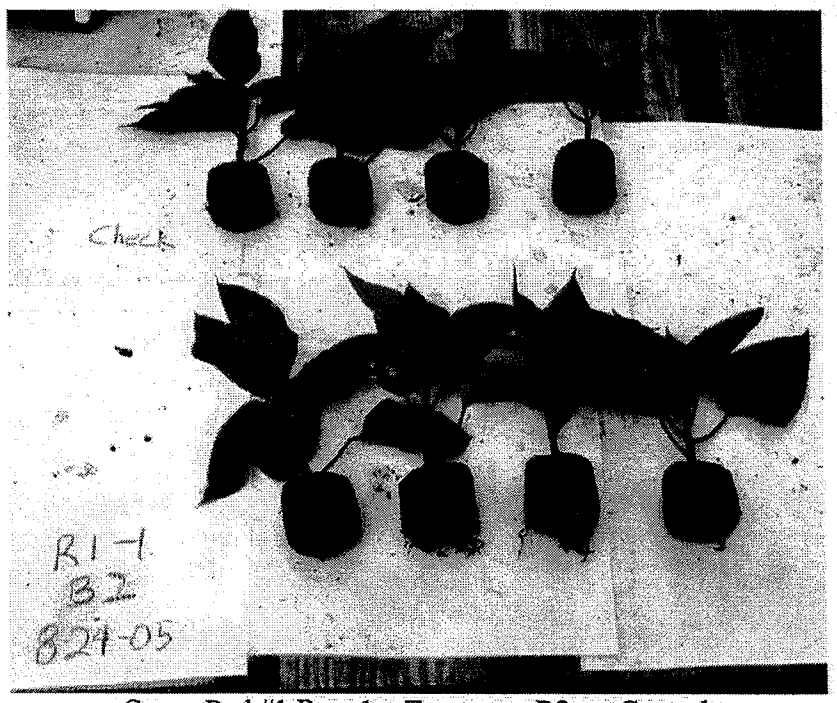


Group Red #1 Rep. 1 – Treatment A4 vs. Control.

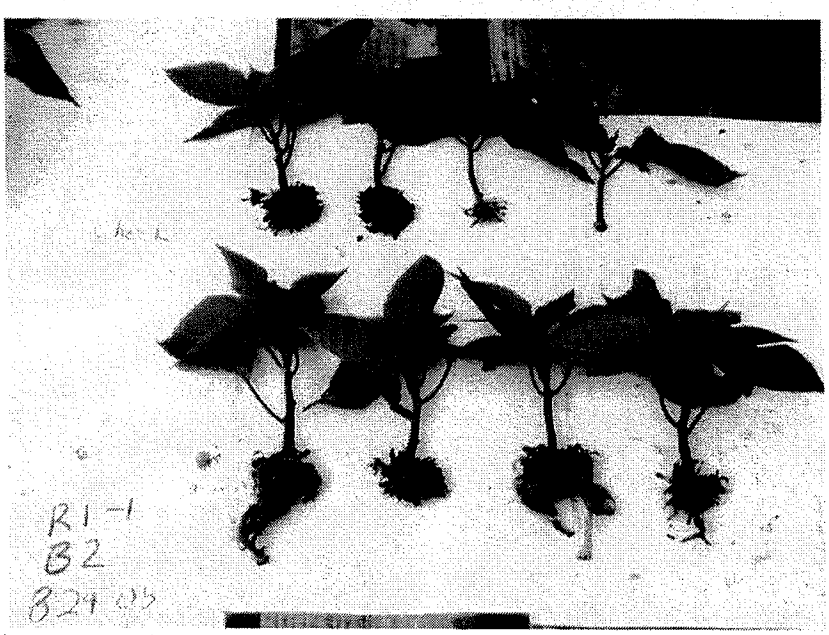
Group Red #1 Rep. 1 – Treatment B1 vs. Control. Notice lush root growth from treatment group.



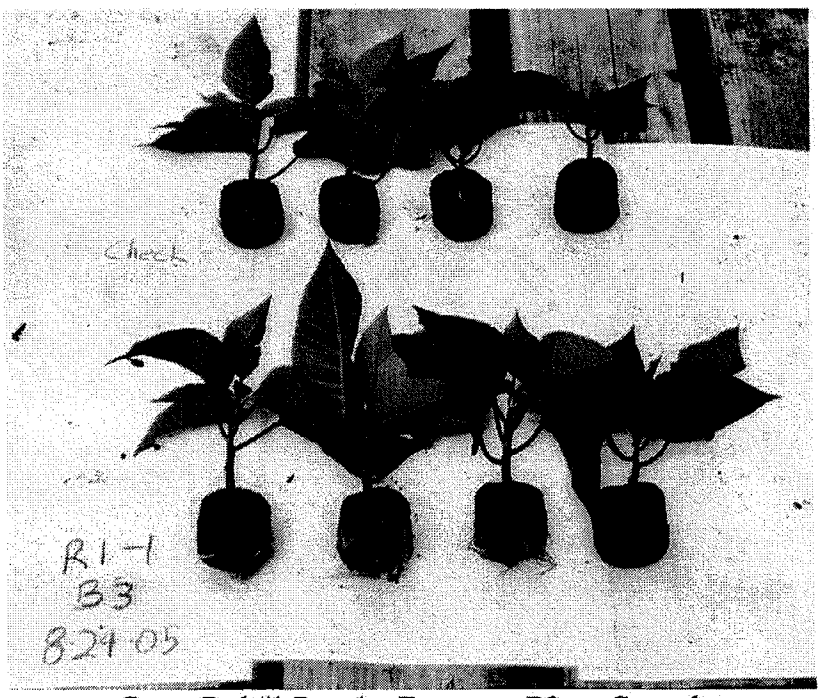
Group Red #1 Rep. 1 – Treatment B1 vs. Control. Roots washed.



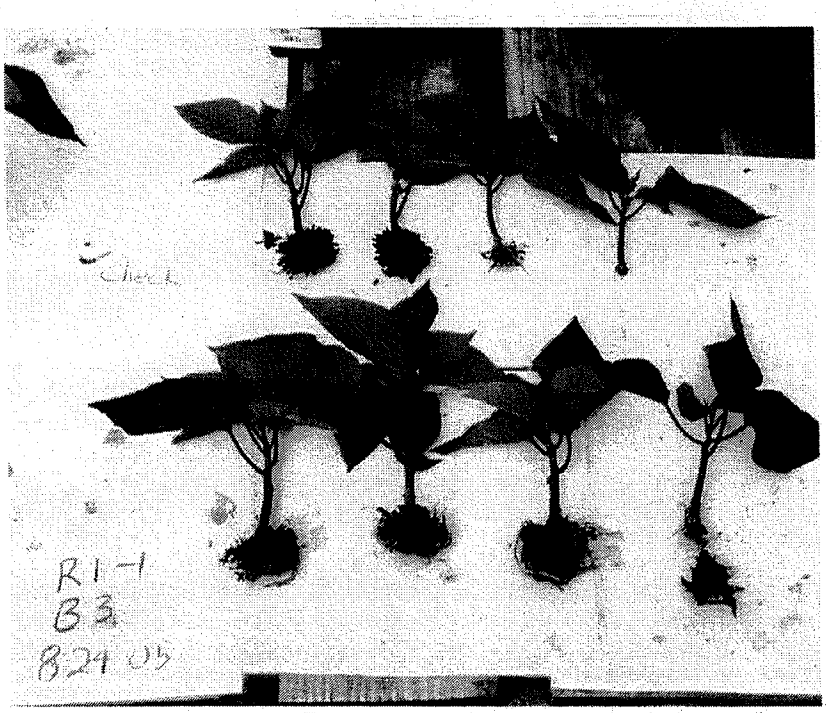
Group Red #1 Rep. 1 – Treatment B2 vs. Control.



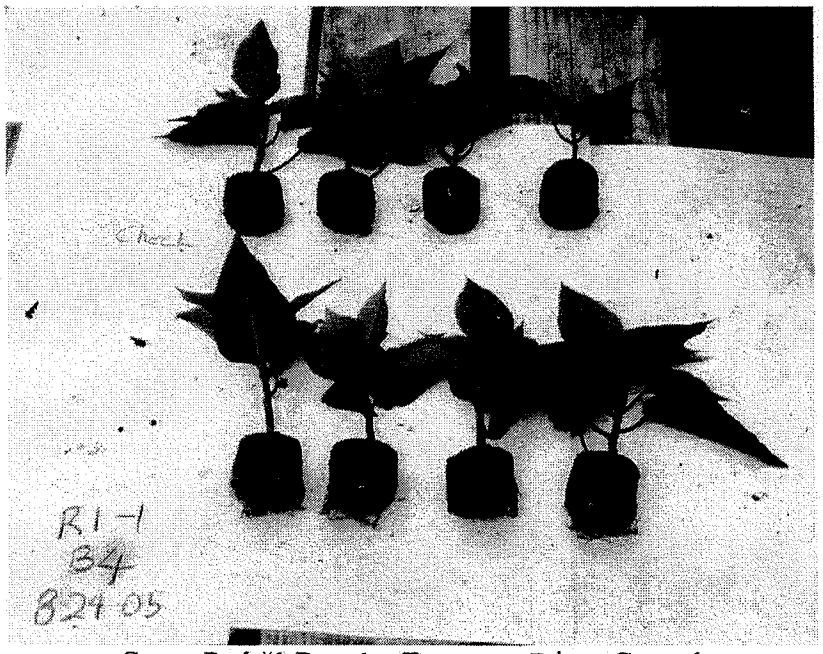
Group Red #1 Rep. 1 – Treatment B2 vs. Control. Roots washed.



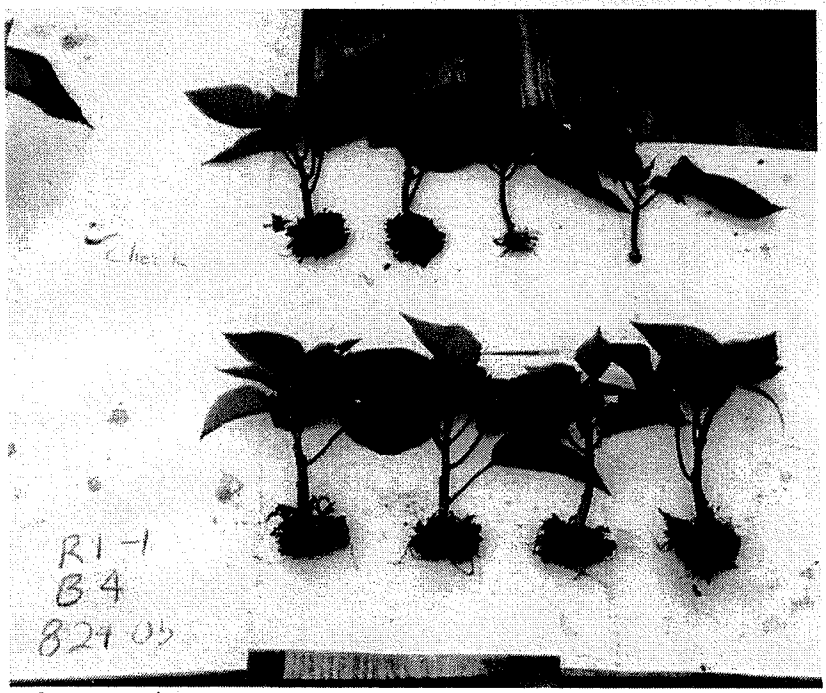
Group Red #1 Rep. 1 – Treatment B3 vs. Control.



Group Red #1 Rep. 1 – Treatment B3 vs. Control. Roots washed. (Part of the Jiffy Pot is included to show roots that were detached during washing.)



Group Red #1 Rep. 1 – Treatment B4 vs. Control.



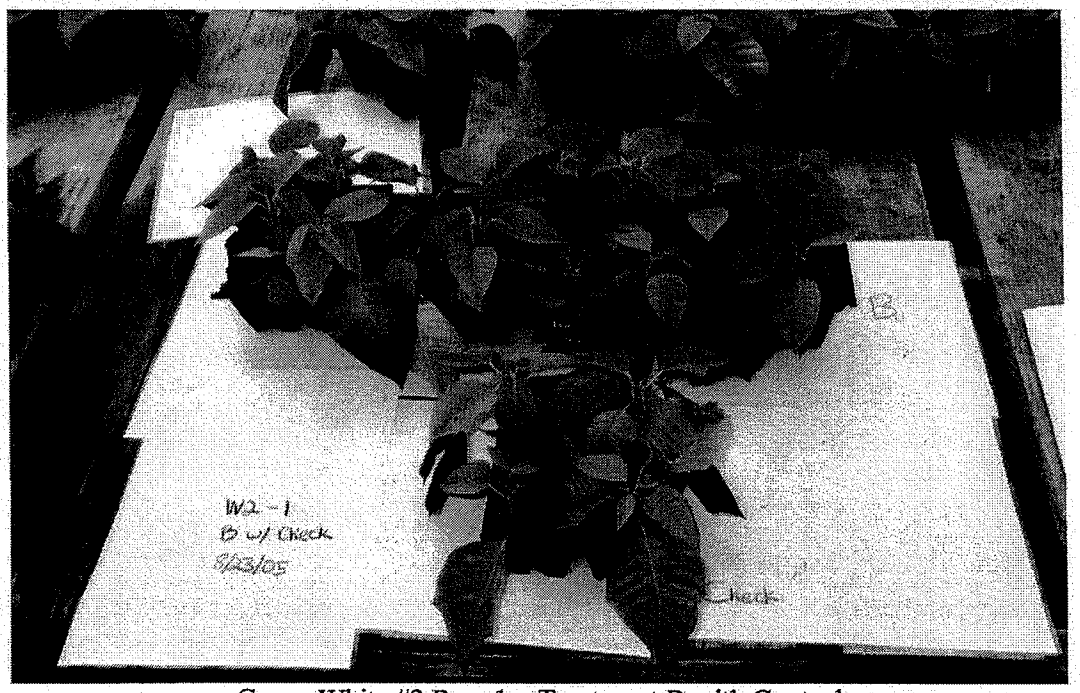
Group Red #1 Rep. 1 – Treatment B4 vs. Control. Roots washed.

White #2 Group

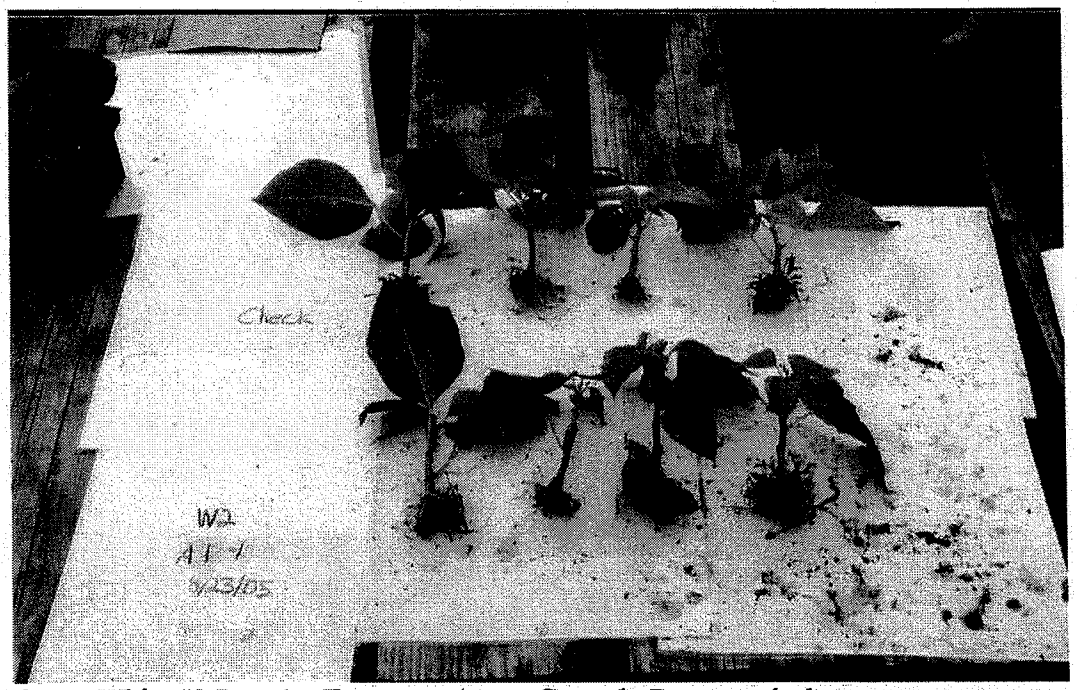
Table 12. Rooting Quality Data for White #2 Group.

8/23/2005	W-2 Dash 1 Root Quality Plant Number				
	1	2	3	4	Average
Promot A1-1	5	5	4	5	4.75
Promot A2-1	5	5	5	4	4.75
Promot A3-1	5	5	5	5	5.00
Promot A4-1	5	5	3	4	4.25
Promot B1-1	5	5	5	1	4.00
Promot B2-1	5	5	5	5	5.00
Promot B3-1	5	5	5	3	4.50
Promot B4-1	5	5	5	5	5.00
Check	4	4	2	3	3.25

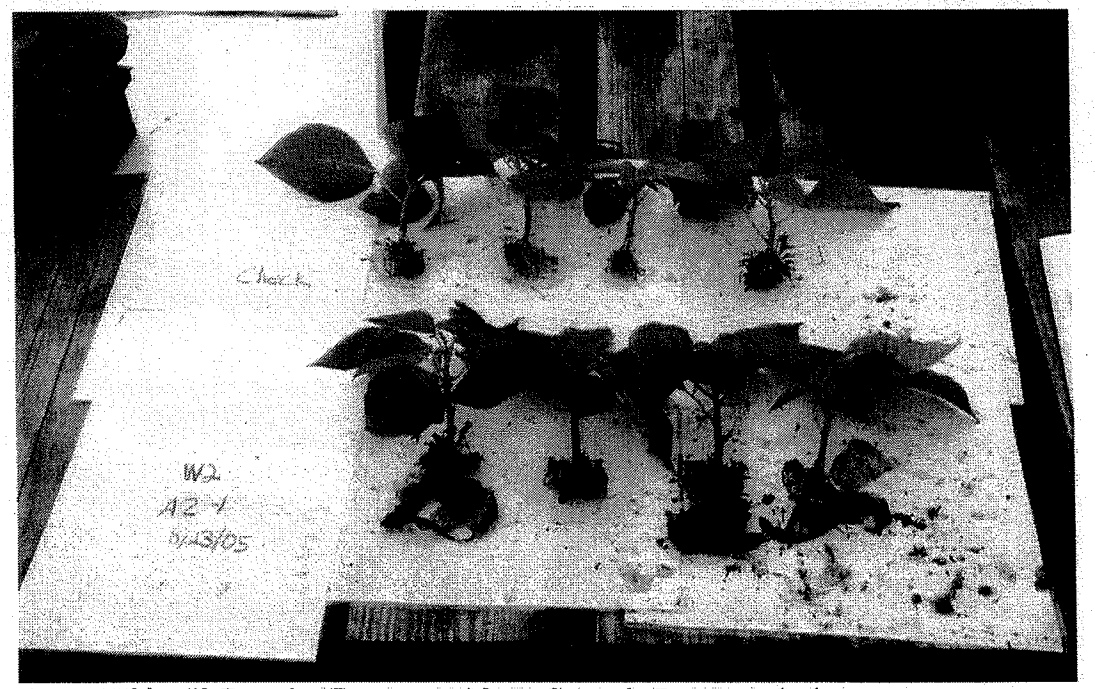
Group White #2 Rep. 1 – Treatment A with Control



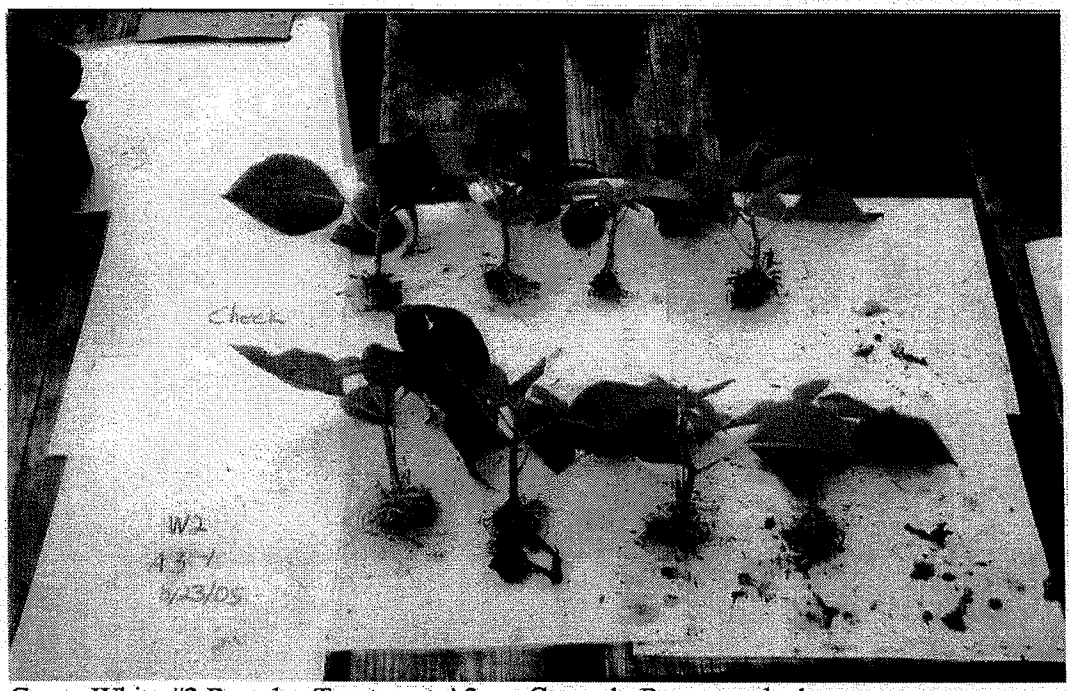
Group White #2 Rep. 1 – Treatment B with Control.



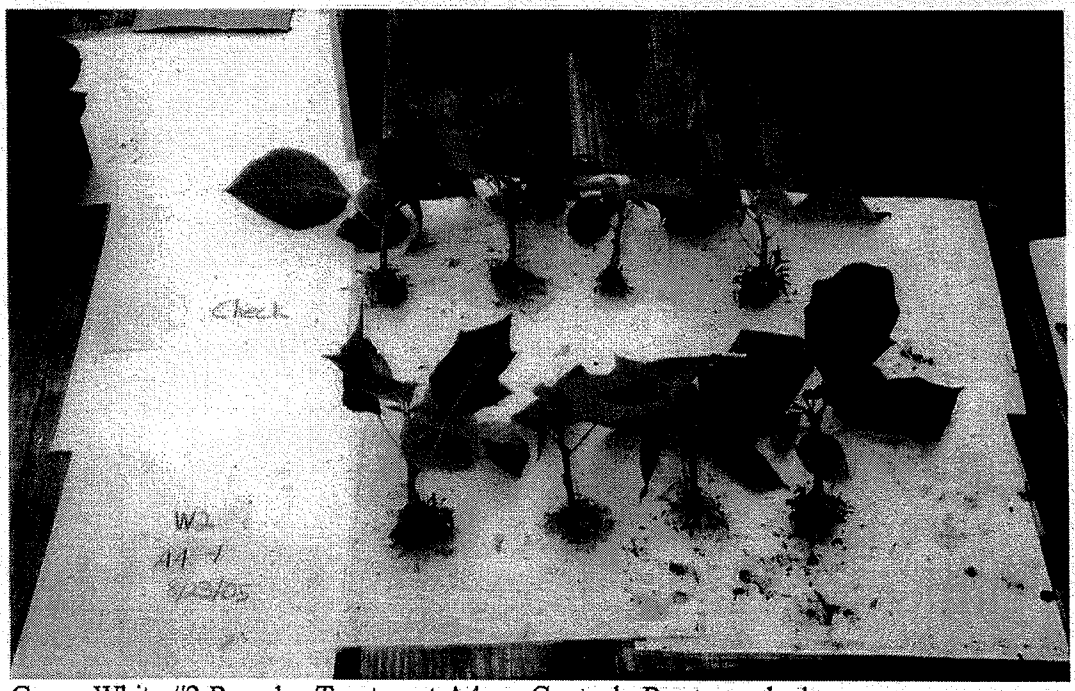
Group White #2 Rep. 1 – Treatment A1 vs. Control. Roots washed.



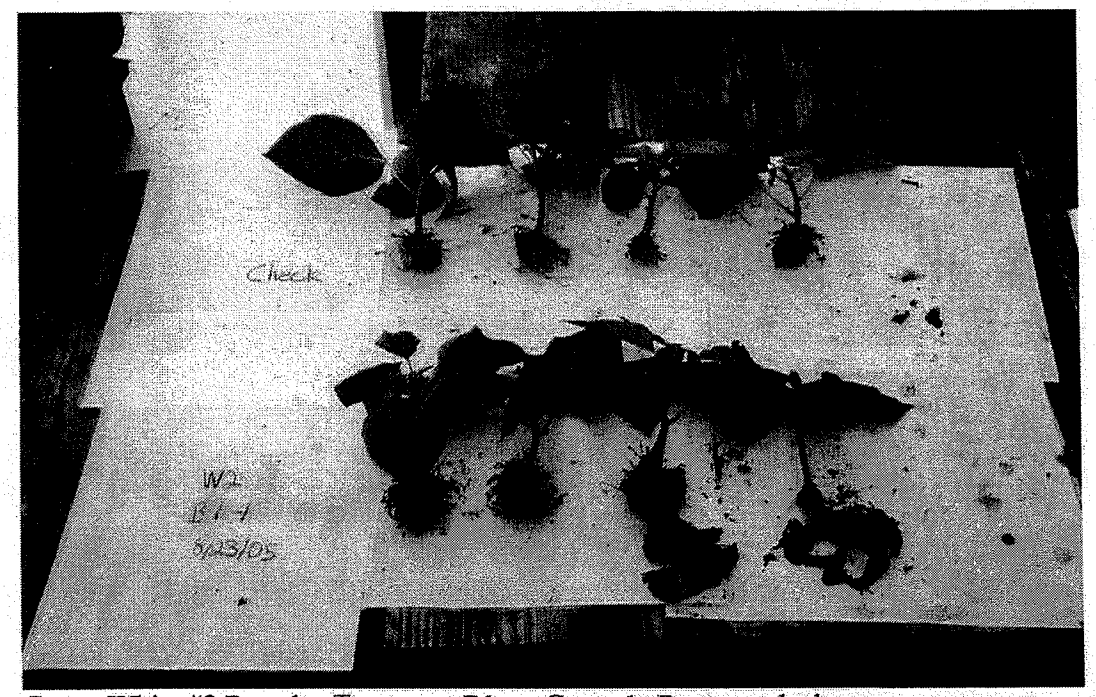
Group White #2 Rep. 1 – Treatment A2 vs. Control. Roots washed.



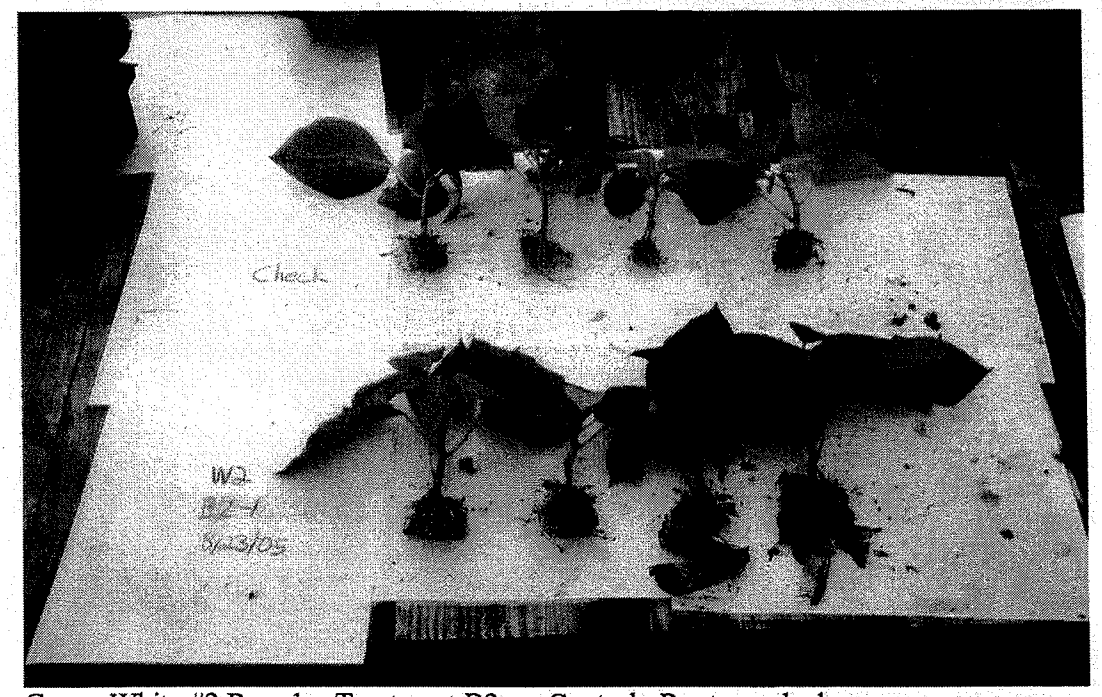
Group White #2 Rep. 1 – Treatment A3 vs. Control. Roots washed.



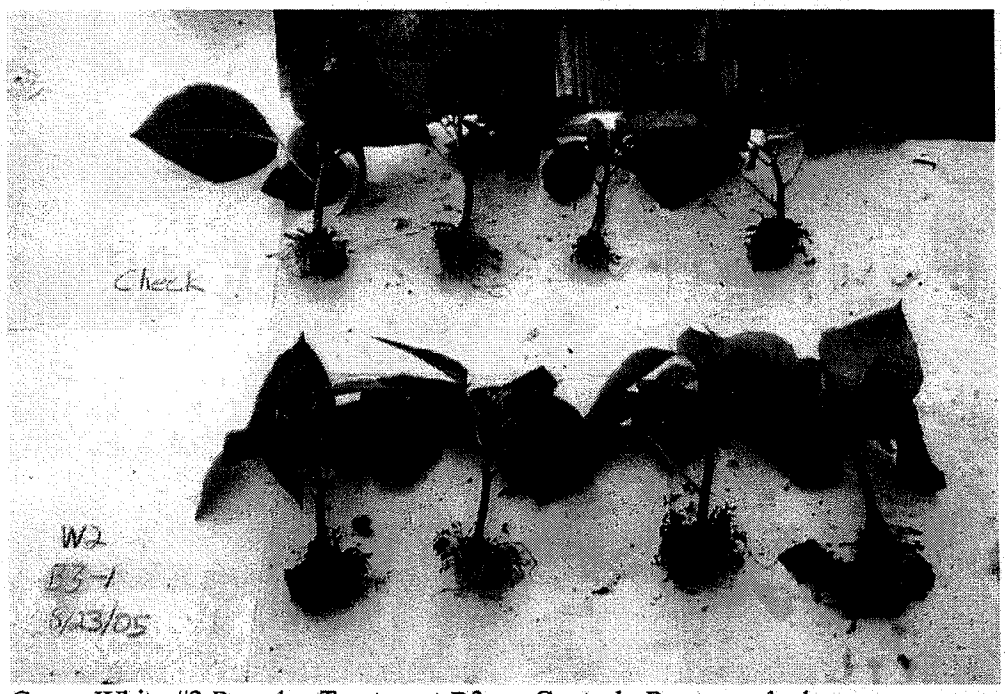
Group White #2 Rep. 1 – Treatment A4 vs. Control. Roots washed.



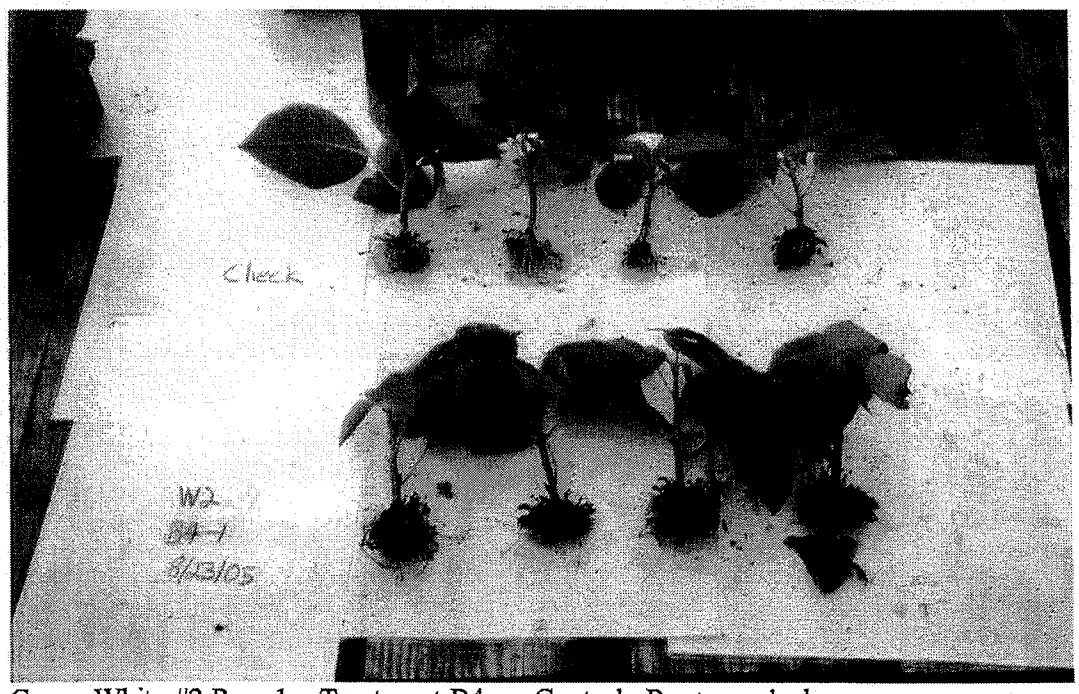
Group White #2 Rep. 1 – Treatment B1 vs. Control. Roots washed.



Group White #2 Rep. 1 – Treatment B2 vs. Control. Roots washed.



Group White #2 Rep. 1 – Treatment B3 vs. Control. Roots washed.



Group White #2 Rep. 1 – Treatment B4 vs. Control. Roots washed.

Conclusion

Internode data comparisons of week 1 and week 4 and 5 did not show any significant difference. Leaf size data also lacked any significant difference among the treatments. It can be concluded that applications of Promot at these rates, regardless of formula, had little to no effect on internode elongation or leaf size. Recall that Promot was applied overhead and came in contact with the leaves prior to being rinsed off. Color of plants was also not affected by treatment with Promot. No significant color changes were noticeable over the coarse of the trial, it should be noted thou that Promot treated plants seemed to look a little greener when compared to the control.

Based on the rooting data, the major effect of Promot is as a rooting stimulant. Observations of Promot treated plants showed greater branching and thicker stems (Similar for both formulas). Over all the roots of Promot treated plants were healthier and more robust. The quality of rooting did not strongly correlate with the increase in rate of application. Rooting quality tended to improve as rates increases, however at the maximum rate, some replications showed reduced growth compared to lower rates.

Overall, Promot treated groups looked healthy and well rooted at the end of four weeks. No phytotoxicity or any other physiological abnormalities

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