BIBLIOGRAPHY

CAYABAS, APOLONIA B. APRIL 2010. Effect of ANAA Concentrations on the Rooting of the Shoot Tip Cuttings of the Three Varieties of Medinilla. Benguet State University, La Trinidad ,Benguet.

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ABSTRACT

This study was conducted at BSU Ornamental Area, Department of Horticulture, College of Agriculture fro January to March 2010 to determine the effect of different concentrations of ANAA an the rooting shoot tip cuttings of different varieties of Medinillia and determine the rooting characteristics of the shoot tip cuttings of the different varieties of Medinilla.

Results revealed that there were no significant differences observed on the number of days from sticking to root initials as affected by Medinilla varieties evaluated. Shorter days from sticking to rooting were noted respectively on *Medinilla cumingii* and *Medinilla dolichophylla*. Highly significant differences was likewise, obtained on the average number of roots produce per cuttings. *Medinilla dolichophylla,* has the highest number of roots, longer roots and higher percentage of rooting compared to the two other varieties. No significant differences obtained on the survival percentage as affected by three varieties.

Shoot tip cuttings that were not treated with ANAA promoted roots earlier. There were no significant differences noted on the percentage of rooting, root length and percentage survival as affected by the different ANAA concentrations.

Significant interactions were not observed between the different varieties and ANAA concentrations in all of the parameters gathered.

Full strength ANAA is recommended for the production of more and longer roots in the shoot tip cuttings of Medinilla. *Medinilla dolichophylla* and *Medinilla scotechenii* good propagules for the rooting shoot tip cuttings in Medinilla.

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INTRODUCTION

Among the most exciting plants in the World are the Medinilla. With tropical foliage and stunning flowering clusters of pink abandon, Medinilla as a show stopper, suitable for zone 10 outdoors but surprisingly as a houseplant anywhere.

Medinilla is a genus of about 150 species of flowering plants in the family Melastomataceae, native to tropical regions of the Old World from Africa (two species) east through Madagascar (about 70 species) and southern Asia to the western Pacific Ocean islands. The genus was named after J. de Medinilla, governor of the Mariana Islands in 1820.

They are evergreen shrubs or lianas. The leaves are opposite or whorled, or alternate in some species. The flowers are white or pink, produced in large panicles.

Semi-epiphytic in the wild, Medinilla will thrive growing lush tropical foliage and cluster after cluster of orchid-like pink blossoms. After blooming baby pink, the flower turn a deeper pink, then magenta and finally finished dark red like sweet ripe cherries. Indoors, bright light, but no direct sun except morning sun is the ticket to success. Provide indoor warmth, for the blooming of flowers starting November with flowers lasting until fall of “berries”. Medinilla performs extremely well in shaded areas.

Some varieties of medinilla are *Medinilla cumigii* which have large pendant clusters of bright pink flowers followed by showy clusters of blue berries, similar to *Medinnila magnifica*, but without the pink bracts. Blooms spring through fall. Handsome leathery leaves on this shrubby plant, and are native to the Philippines and hardy to 35 F. Another variety is the *Medinilla scortechenii* that have bright orange stems in panicles, Leathery dark green oval leaves and thrive at a minimum temperature of 40 F. And other variety is

Medinilla *dolichophylla* a beautiful epiphytic flowering shrub with brilliant light pink flowers. This auction is for one established cutting grown plant, currently in a 75mm pot. Approx 25 cm high .This spectacular small shrub grows to around 75 cm high. It is cloaked in dark emerald, linear foliage and produces pendulous light pink flowers. This plant may be grown as a pot specimen, in particular in a hanging basket, which allows the flowering display to be seen to full effect or as a garden plant in tropical or sub-tropical zones. Other varieties are the *Medinilla magnifica*, *Showy medinilla*, *Magnifica myriantha, Medinilla kinabalu.*

Due to the economic potential and aesthetic value of midinilla as a potted and bedding plant for outdoor and indoor landscaping, it is important to study the effective technique of clonally multiplication using shoot tip cuttings and hormone concentration. With some varieties of this plant that are very hard to root and yet they are very in demand on the markets problems on the propagation of this plant using cutting will be solve. In relation to this problem different varieties of medinilla and different concentration of ANAA had been tested to enhance the rooting of medinilla shoot tip cuttings, improve survival and faster production of planting materials.

The experiment was conducted at the Floriculture, Department of Horticulture, College of Agriculture Benguet State University La Trinidad Benguet from November 2009 to March 2010 to determine the effect of different concentrations of ANAA on the shoot tip cuttings of the varieties of medinilla and evaluate what varieties of Medinilla and concentrations of ANAA have faster and uniform rooting using the shoot tip cuttings.

REVIEW OF LITERATURE

Cutting as Propagules

Propagation cuttings are the most widely used method of asexual plant propagation. It is quickly, easy and inexpensive. It is made possible by the cells' ability to an undifferentiated condition once again initiating the root, stems and leaf tissue necessary to form a complete plant (Ingels, 1994). In addition, Hartman and Kester (1975) stated that vegetative propagation is inexpensive, rapid and simple and does not require special techniques necessary in grafting or budding.

Moreover, Edmund *et al.* (1978) said that plants propagated by cuttings and other vegetative means are more economical than by seeds. Many seed germinate with difficulty and the resulting plants do not often resemble their parents. In fact, valuable varieties that are perpetuated by vegetation production make possible the production of high quality products. Furthermore, Smith (1982) mentioned that most in commercial establishments, growing plants aim to produce a crop that meets the quality of the market at the shortest possible time is possible through this method of propagation.

According to Reiley (2002) softwood cuttings generally root easier and quicker than hardwood cuttings because they respond to treatment with rooting hormones. High concentrations may injure or kill cuttings and may be ineffective. Plant root easily or with difficulty at different stages of maturity.

Rooting Hormones

Plant growth regulators have found wide applications in Horticulture, particularly for the stimulation of rooting, fruit set, and fruit thinning (Fletcher and Kirlwood, 1982). Furthermore, Weaver (1972) and Hartman and Kester (1975) mentioned that application of growth regulators to cuttings is important for the improvement of the quality of roots formed, stimulation of root initiation and for the improvement of the quality.

In wide variety of plants, rooting is markedly increased by addition of synthetic auxins. It was noted that in a variety of such compounds, the highest degree of rooting success has been achieved with IBA. In addition, it was also observed that other auxins have a very narrow of effective concentrations and that below critical level, it inhibited root growth an also cause morphological injury. Bayeng (1999) found that one-half strength ANAA has more effective in hasting root initiation in mum cuttings than full strength. Hormex with a dipping duration of 15 minutes hasten easier visible root formation on arbor tree leafy stem cuttings. Earlier studies found that the dipping duration, which exceeds the recommended dipping time, can inhibit root formation. It was also rooted that cuttings treated with hormex had the highest percentage survival and highest return of investment (ROI) (Manawag, 2000).

Moreover, Hartman and Kester (1968) reported that application of growth regulators to the cuttings is important for the improvement of the quality of roots formed in the stimulations of rooting periods of cuttings. In 1995, they recommended NAA and IBA to generate use in rooting stem cutting of the majority of the plant species. They revealed that IBA was already tested for its activity in promoting roots in the stem

segments. Results showed that IBA and NAA, although not normally occurring, were even more, effective than naturally occurring.

Hormone Concentration

Adriance and Brinson (1955) reported that growth regulators are more effective if the concentration relations are just concentrations of regulators do not produce abnormalities in root formation and necrosis on tissues.

As studied by Dela Rosa (2000) she found out that application of 1000ppm and 750ppm ANAA improved the rooting of Medinilla shoot tip cuttings. Furthermore, Macli ing (2004) stated that dipping of Milflores shoot tip cuttings in 500ppm ANAA is the best concentration since it hastened early root initiation promoted the production of the longer roots and more produced per cuttings.

Misting

Misting in sprinkling water can increase relative humidity, thus transpiration has to be slowed down by keeping the relative humidity high in the vicinity of the cuttings and keeping the temperature relatively lower.

Root formation in cutting is not only affected by hormones but also by other factors like environment, rooting medium, chemical treatment, mechanical treatments as well as the plant itself as a factor (Adriance and Brinson, 1955).

MATERIALS AND METHODS

The materials used in the study were shoot tip cuttings of the three varieties of Medinilla, rooting hormones (ANAA), pruning shear, 6x6 inches polyethylene bags, graduated cylinder, measuring stick, and rooting media (sandy loam and compost, 1:1).

Experimental design and treatments. The experiment were laid out in factorial Completely Randomized Design (CRD) with 3 samples per treatment replicated three times. Factor A were the three varieties of medinilla , different concentrations of ANAA were the factor B.

Shoot Tip Preparation

The shoot tip cuttings were properly cleaned and the stem ends were cut into slanting cuttings were dipped in the different concentrations of ANAA for 30 minutes, and then sticked into the prepared rooting media. Cuttings were misted twice a day to ensure sufficient moisture as shown in Figure 1.

Treatments

Factor A - Varieties of Medinilla

V_1 - *Medinilla cumingii*

V_2 - *Medinilla scotechenii*

V_3 - *Medinilla dolichophylla*

Factor B- ANAA Concentration

T_1 - distilled water

T_2 - 500ppm (half strength)

T_3 - 1000ppm (full strength)

Figure 1. Overview of the study one month from sticking of Medinilla shoot tip cuttings

Data Gathered

1. Days from sticking to root initiation. This was taken by counting the days from sticking to root initials.

2. Number of days from planting to transplanting (3cm). This was taken by counting the days from sticking to 3cm root formation.

3. Average number of roots produce per plant. This was taken by counting the roots that were produced per cuttings after 60 days using the formula:

$$\text{Average roots produce/ cuttings} = \frac{\text{Total Number of Roots Produced}}{\text{Number of Samples Rooted}}$$

4. Average root length (cm). This was taken by measuring the longest of all roots that will be develop per stem two months from sticking of cuttings.

5. Rooting percentage. This was taken by counting the number of cuttings rooted after 60 days using the formula:

$$\% \text{ Rooting} = \frac{\text{Number of Rooted Cuttings}}{\text{Total Number of Cuttings}} \times 100$$

6. Percentage of survival. This was obtained by counting the number of cuttings that survived using the formula:

$$\% \text{ Survival} = \frac{\text{Cuttings Survived}}{\text{Total Number of Samples}} \times 100$$

7. Documentation. Documentation of the study was done through taking of pictures based on the data to be gathered.

RESULTS AND DISCUSSION

Days to Visible Root Initials

Effect of variety. There were no significant differences obtained on the number of days from sticking to root initials as shown in Table 1.

Effect of ANAA concentrations. Highly significant differences prevail on the numbers of days from sticking to production of root initials. Earlier rooting was significantly noted in shoot tip cuttings that were treated with full strength ANAA but statistically comparable with cuttings treated with half strength ANAA.

These results could be explain by Bleasedale (1973) who stated that although hormones were known to promote earlier rooting in various kind of cuttings, it is important to take into consideration that individual plants species and cultivars need specific concentration to be used. In addition, Ingels (1994) stated that rooting hormones are generally used to aid in root formation, some plants more easily than others are because they produce higher level of natural hormones. These plants need less synthetic rooting hormones to root satisfactorily.

Interaction effect. There was no significant interaction effects observed between the different ANAA concentration varieties about the number of days from planting to the production of root initials.

Figures 2 to 4 show the rooting characteristics of the three varieties of Medinilla rooted in the three different concentrations of ANAA.

Table 1. Number of days from sticking to root initials

TREATMENT	(DAYS)
Variety	
Medinilla cumingii	24.889[a]
Medinilla scotechenii	27.556[a]
Medinilla dolichphylla	26.667[a]
ANAA Concentration	
Control	33.444[a]
Half strength	24.000[b]
Full strength	21.667[b]

Means with a common letter are not significantly different at 5 % level of DMRT

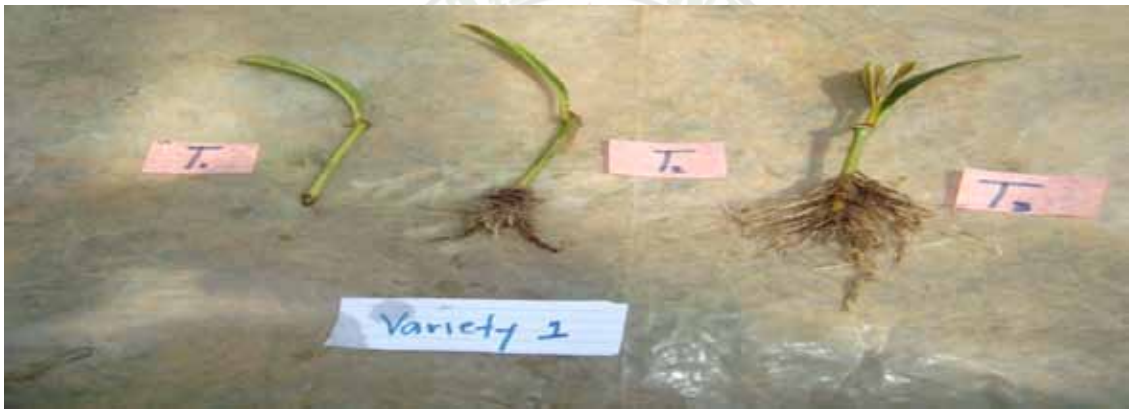

Figure 2. Rooting characteristics of *Medinilla cumingii* two months from sticking. From Left (T_1) control, (T_2) half strength, (T_3) full strength

Figure 3. Rooting characteristics of *Medinilla cumingii* two months from sticking. From left (T_1) control, (T_2) half strength, (T_3) full strength.

Figure 4. Rooting characteristics of *Medinilla cumingii* two months from sticking. From left (T_1) control, (T_2) half strength, (T_3) full strength.

Days to Transplanting From Sticking

Effect of variety. Table 2 shows that *Medinilla cumingii* and *Medinilla dolichopylla* significantly had the least number of days from sticking to transplanting. On the other hand, significantly longer duration to transplanting was observed on the cuttings of *Medinilla scotechenii*.

Effect of ANNA concentrations. There were no significant differences on the number of days to transplanting but shoot tip cuttings dipped in full strength had the shortest days to transplanting compared to the two concentrations.

These results can be explained by Weaver (1972) and Hartmann and Kester (1975) who reported that the application of growth regulators is important for the stimulation of root initiation and for the acceleration of rooting periods of cuttings. Ingels (2000) also added that commercially available growth regulators accelerate root

Table 2. Number of days from sticking to transplanting

TREATMENT	NUMBER OF DAYS
Variety	
Medinilla cumingii	18.333[b]
Medinilla scotechenii	21.667[a]
Medinilla dolichphylla	18.556[b]
ANAA Concentration	
Control	20.000[a]
Half strength	19.889[a]
Full strength	18.667[a]

Means with a common letter are not significantly different at 5 % level of DMRT

formation such as the auxins which can speed rooting time considerably, assuming other requirements for the growth are not limited

Interaction effect. Statistical analysis shows that there were no significant differences observed on the combination of varieties and ANAA concentrations.

Number of Roots Per Cuttings

Effect Variety. Significantly higher average number of roots per cuttings were obtained from *Medinilla dolichophylla* shoot tip cuttings with a mean of 7.444 from two months of sticking compared to the two varieties is shown in Table 3.

These results confirm the report of Weighing (1969) that different varieties of a given species have been found to have different number of roots.

Table 3. Average number of roots per cuttings

TREATMENT	NUMBER OF ROOTS
Variety	
Medinilla cumingii	3.889[b]
Medinilla scotechenii	1.667[c]
Medinilla dolichphylla	7.444[a]
ANAA Concentration	
Control	2.222[b]
Half strength	4.889[a]
Full strength	5.889[a]

Means with a common letter are not significantly different at 5 % level of DMRT

Effect of ANAA concentrations. Statistical analysis showed that shoot tip cuttings dipped on the full strength ANAA significantly produced the highest number of roots followed those treated with half strength ANAA. Significantly, the lowest numbers of roots were obtained in the control (untreated cuttings).

Interaction effect. The interaction effect between the varieties of Medinilla and the different ANAA concentrations were not significant.

Average Root Length

Effect of variety. Table 4 shows that although comparable to each other, *Medinilla dolichophylla* and *Medinilla scotechenii* significantly produced longer roots compared to *Medinilla cumingii*.

Table 4. Average root length of the Medinilla varieties and ANAA concentrations

TREATMENT	ROOT LENGTH (cm)
Variety	
Medinilla cumingii	1.222[b]
Medinilla scotechenii	0.856[b]
Medinilla dolichphylla	2.019[a]
ANAA Concentration	
Control	1.079[a]
Half strength	1.567[a]
Full strength	1.452[a]

Means with a common letter are not significantly different at 5 % level of DMRT

This finding as explained by Nye and Tinker (1977) that their differences are in the rooting patterns of different plant species. Every species has its inherent genetic make-up that made the response in rooting different.

Effect ANAA concentrations. There were no significant differences observed on the average root length as affected by the different ANAA concentrations although all the treatments are comparable.

Interaction effect. There were no significant interaction effect observed on the combination of varieties and ANAA concentrations with regards to the length of roots produced in the shoot tip cuttings of Medinilla.

Rooting Percentage

Effect of variety. Statistically differences on the percentage of rooting are highly significant (Table 5). Highest percentage of rooting was obtained in the shoot tip cuttings of *Medinilla dolichophylla* with a mean of 75 followed by shoot tip cuttings of *Medinilla*

scotechenii, while lowest percentage of rooting was obtained in the shoot tip cuttings of *Medinilla cuming*ii.

This finding can be explained by Brown (1996) who stated that using rooting hormones increased the percentage of rooting in cuttings that take and therefore grow vigorously resulting in healthy daughter plants. However, different plant species have different limits of rooting hormones concentration as shown in the above results.

Effect of ANAA concentrations. No significant differences observed on the percentage of rooting after 60 days of sticking on the shoot tip cuttings of Medinilla varieties as affected by different ANAA concentrations.

Results showed that shoot tip cuttings dipped in the different concentrations of ANAA had comparable abilities to survive during the rooting process.

Interaction effect. Statistically, analysis revealed that the different shoot tip cuttings of Medinilla and the different ANAA concentrations had no significant interaction effect on the percentage of root cuttings 60 days after sticking.

Table 5. Rooting percentage

TREATMENT	ROOTING PERCENTAGE
Variety	
Medinilla cumingii	52.036[a]
Medinilla scotechenii	59.443 [ab]
Medinilla dolichphylla	78.000[a]
ANAA Concentration	
Control	59.518[a]
Half strength	59.443[a]
Full strength	70.518[a]

Means with a common letter are not significantly different at 5 % level of DMRT

Percentage Survival

Effect of variety. Table 6 shows that there were no significant differences on the percent survival of shoot tip cuttings as affected by the different the varieties of Medinilla.

Effect of ANAA concentrations. There were no significant differences on the effect of the different ANAA concentrations with regards to the percent survival of the cuttings after 60 days of observations.

Interaction effect. The interaction effect between the different varieties of Medinilla and different concentrations of ANAA had no significant effect on the percent survival of shoot tip cuttings after 60 days of sticking on the rooting media.

Table 6. Percentage survival

TREATMENT	PERCENTAGE SURVIVAL
Variety	
Medinilla cumingii	70.667[a]
Medinilla scotechenii	74.333[a]
Medinilla dolichphylla	85.333[a]
ANAA Concentration	
Control	74.333[a]
Half strength	78.000[a]
Full strength	78.000[a]

Means with a common letter are not significantly different at 5 % level of DMRT

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

Matured shoot tip cuttings of the different varieties of Medinilla dipped on the different concentrations of ANAA such as full strength and half strength to determine the effect of ANAA concentrations on the different varieties of Medinila and to determine the rooting characteristics of the Medinilla shoot tip cuttings treated with different ANAA concentrations.

Results revealed that there were no significant differences on the effect of varieties on the first appearance of roots. However, highly significant differences are noted on the *Medinilla dolichophylla* and *Medinilla cumingii* respectively on the readiness of transplanting. *Medinilla dolichophylla* significantly produce the highest number of roots, longer roots and higher rooting percentage compared to the two other varieties. There were no significant differences obtained on the percentage survival as affected by the different varieties.

Shoot tip cuttings that were treated with full strength ANAA significantly promoted earlier rooting. Moreover, no significant differences were noted on the readiness of transplanting, root length, rooting percentage and percentage survival. However, highly significant was noted on the number of roots per cuttings, significantly promoted by shoot tip cutting dipped on full strength.

Statistically analysis revealed that there were no significant differences in all of the results on the effect of combined varieties and ANAA concentrations.

Conclusion

Based from the results of the study, shoot tip cuttings of different Medinilla varieties do not requires root hormone specifically, ANAA for the faster production of roots but it is needed for the production of more roots and longer roots specifically, the used of full strength ANAA. Shoot tip cuttings of different Medinilla varieties can be used as propagules.

Recommendation

Full strength is recommended for the production of more number and longer roots in shoot tip cuttings of Medinilla. *Medinilla dolichophylla* and *Medinilla scotechenii* are good propagules for faster and uniform rooting.

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APPENDICES

Appendix Table 1. Number of days from sticking to root initials

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1T_1	35	36	32	103	34.333
V_1T_2	26	25	20	71	23.667
V_1T_3	20	14	16	50	16.667
V_2T_1	35	30	30	95	31.667
V_2T_2	29	20	26	75	25.000
V_2T_3	24	30	24	78	26.000
V_3T_1	38	35	30	103	34.333
V_3T_2	19	22	29	70	24.000
V_3T_3	26	17	24	67	21.667

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Factor A	2	33.185	16.593	1.15ns	3.55	6.01
Factor B	2	700.074	350.037	24.1714**	3.55	6.01
AB	4	118.370	29.593	2.04ns	2.93	4.58
Error	18	14.481	12.676			
Total	26	1112.296				

Ns. Not significant; * = Significant; ** = Highly significant
Coefficient of variance= 14.43%

Appendix Table 2. Number of days from sticking to transplanting

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1T_1	18	20	19	57	19.000
V_1T_2	19	20	19	58	19.333
V_1T_3	16	15	19	50	16.667
V_2T_1	20	26	18	64	21.333
V_2T_2	24	23	19	66	22.000
V_2T_3	24	19	22	65	21.667
V_3T_1	19	20	20	59	19.667
V_3T_2	17	19	19	55	18.333
V_3T_3	16	19	18	53	17.667

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Factor A	2	62.519	31.259	6.9752**	3.55	6.01
Factor B	2	9.852	4.926	1.10ns	3.55	6.01
AxB	4	9.704	4.246	0.54ns	2.93	4.58
Error	18	80.667	4.481			
Total	26	162.741				

Ns. Not significant; * = Significant; ** = Highly significant
Coefficient of variance= 10.85%

Appendix Table 3. Average number of roots

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1T_1	2	1	2	5	1.667
V_1T_2	3	7	3	13	4.333
V_1T_3	5	4	8	17	5.667
V_2T_1	1	1	1	3	1.000
V_2T_2	1	2	2	5	1.667
V_2T_3	2	2	3	7	2.333
V_3T_1	4	4	4	12	4.000
V_3T_2	9	9	8	26	8.667
V_3T_3	12	7	10	29	9.667

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Factor A	2	152.889	76.444	39.6923**	3.55	6.01
Factor B	2	64.66	32.333	16.7885**	3.55	6.01
AxB	4	17.778	4.444	2.31ns	2.93	4.58
Error	18	34.667	1.926			
Total	26	270.00				

Ns. Not significant; * = Significant; ** = Highly significant
Coefficient of variance=32.03%

Appendix Table 4. Root Length (cm)

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1T_1	1.4	1.5	1.0	3	1.300
V_1T_2	1.9	1.2	1.5	4	1.533
V_1T_3	1.0	1.0	1.0	3	1.000
V_2T_1	0.6	0.8	1.0	2	0.800
V_2T_2	1.0	0.5	0.8	2	0.767
V_2T_3	1.4	1.5	1.3	4	1.400
V_3T_1	2.5	3.8	1.5	7	2.600
V_3T_2	2.7	1.2	2.3	6	2.057
V_3T_3	0.5	1.0	1.0	2	0.883

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Factor A	2	6.367	3.184	12.4329**	3.55	6.01
Factor B	2	1.177	0.588	2.30ns	3.55	6.01
AxB	4	1.847	0.462	1.80ns	2.93	4.58
Error	18	4.609	0.256			
Total	26	14.001				

Ns. Not significant; * = Significant; ** = Highly significant
Coefficient of variance=37.06%

Appendix Table 5. Rooting percentage

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1T_1	33.3	33.3	67.0	133	44.553
V_1T_2	33.3	67.0	67.0	167	55.777
V_1T_3	67.0	33.3	67.0	167	55.777
V_2T_1	67.0	67.0	67.0	201	67.000
V_2T_2	33.3	67.0	33.3	133	44.553
V_2T_3	67.0	33.3	100.0	200	66.777
V_3T_1	67.0	67.0	67.0	201	67.000
V_3T_2	67.0	67.0	100.0	234	78.000
V_3T_3	100.0	67.0	100.0	267	89.000

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	0.01
Factor A	2	3220.132	1610.066	4.3271*	3.55	6.01
Factor B	2	730.947	363.473	0.98ns	3.55	6.01
AxB	4	1244.759	311.190	0.84ns	2.93	4.58
Error	18	6697.636	372.091			
Total	26	11893.474				

Ns. Not significant; * = Significant; ** = Highly significant
Coefficient of variance=30.54%

Appendix Table 6. Percentage survival

TREATMENT	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1T_1	67.0	67.0	67.0	201	67.000
V_1T_2	67.0	67.0	100.0	234	78.000
V_1T_3	67.0	67.0	67.0	201	67.000
V_2T_1	67.0	100.0	67.0	234	78.000
V_2T_2	67.0	67.0	67.0	201	67.000
V_2T_3	67.0	67.0	100.0	234	78.000
V_3T_1	100.0	67.0	67.0	234	78.000
V_3T_2	67.0	100.0	100.0	267	89.000
V_3T_3	100.0	67.0	100.0	267	89.000

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Factor A	2	1048.667	24.333	2.17ns	3.55	6.01
Factor B	2	80.667	40.333	0.17ns	3.55	6.01
AxB	4	645.333	161.333	0.67ns	2.93	4.58
Error	18	6697.636	242.000			
Total	26	6130.000				

Ns. Not significant; * = Significant; ** = Highly significant
Coefficient of variance=20.26%