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PROPAGATION OF LACQUER TREE (*TOXICODENDRON SUCCEDANE*UM) BY GRAFTING METHOD

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ABSTRACT

Through the interviews and investigations of comparative tree method, 30 dominant Lacquer trees having straight and balance trunk, no pests, and higher annual average resin yield of 205g/year/tree has been selected as the source of the mother trees to get the material to produce seedlings with high and stable resin yield. Different grafting methods were carried out in order to find out the suitable method to propagate Lacquer plants. The results showed that Lacquer trees can be successfully graft with several different grafting methods and the highest survival rate shown by wedge grafting method is 58.85% and the best grafting season for this is spring.

KEYWORDS: Dominant Tree, Grafting, Lacquer Tree

INTRODUCTION

Lacquer tree (*Toxicodendron Succedane*um) is a small wooded tree, belongs to the *Anacardiaceaeum* family. Height of this tree can be up to 10 m, leaves have 7-15 leaflets without hair, oval in shape, 5-10 cm in length and 1.5-3.5 cm in width. Flowers have short panicles, 5 petals which are 2-3 times as long as the calyx, stamens have 5 filaments which are as long as petals. Fruits are in the form of hard nuts, quite flat, pale-yellow in color, 6-8 mm in diameter (Vo Van Chi, 1999)

At present, Lacquer tree can be taken as a highly commercial species and main source of income for many households in Vietnam. Resin of Lacquer tree is a very precious and essential resource for many large and small scale industries and highly used in fine arts such as painting, patchwork items by attaching bamboo craft products, church furniture, paint Lacquer, varnishes, painting boats and production of insulation materials, etc. (Yun-Yang, Du, Fang-Xing, Ying, Rong-Zhi, & Kennedy, J. F.2006) Besides, the roots, leaves and bark of this species can also be used as medicines in some diseases such as asthma, chronic hepatitis, stomach pain, bleeding wounds, tuberculosis and the like (Chan and Huyen 2000).

As there is increasing demand of resin of Lacquer trees on the domestic market as well as in the foreign market, the demand in planting Lacquer tree is also increasing. Especially the Lacquer trees with high and stable resin yield are highly demanded. However, up to now there was very few scientific research carried out on selection and propagation of this species.

The Lacquer trees with the origin from seeds takes about 3 years for providing resin (Nguyễn Chí, 2011). The seed germination rate of Lacquer tree is high with chemical treatment methods (TANG, ZHANG, FU & ZHONG, 2011). However, the yield and quality of resin is not stable because of the variation as well as inheritance of sexual reproduction

(Ho, 2000). Grafting is one of the best methods to produce Lacquer tree seedlings which will be rich in resin and the time for providing resin is shorter. Nevertheless, for the grafted trees originated from asexual reproduction method, their genetic characteristics are remained unchanged. The slips are taken from the selected mother trees with the preeminent characteristics remained from them and also the stocks are taken from the seedlings origin from seeds so that the growth will be quite strong.

Grafting materials (slip) can be selected from dominant mother tree with the preeminent characteristics (rich and good quality of resin) in order to produce the seedlings which has strong growth and the best characteristic of the mother trees as well as shorten time for providing resin because of the maturation of the matured slips.

Application of the trial of grafting methods is aimed at finding out the best grafting method and the best grafting season for the highest rate of survival of seedling.

Thus, the selection of the promising mother plants and finding the proper grafting methods to propagate plants were carried out.

OBJECTIVES

General objective of this research is to find out the best grafting methods suitable for propagating Lacquer plants *(Toxicodendron Succedaneum).* Other specific objectives of this research are as under:

- To identify the suitable season for grafting.
- To find out the climatic conditions of four Grafting season.
- To find out and compare the survival rate on the ground of the different grafting method and different grafting season.
- To find out the suitable time and grafting method for harvesting resin.

RESEARCH METHODOLOGY

Materials and Research Area

Phu Tho province of Vietnam is taken as a location of this research and 3-7 years old Lacquer trees found at this location will be selected for research purpose.

Grafting Materials

- Rootstocks from 8-10 months old Lacquer trees having seed origin with 0.7-1.5 cm in diameter will be selected.
- Scions were created from the selected dominant Lacquer trees (exceed in resin).

Method for Selecting Dominant Trees

The desirable trees were selected according to the two basic criteria accompanied by the Decision No. 4108/QD/BNN-KHCN of the Ministry of Agriculture and Rural Development of Vietnam. Morphology and quality of plant are the two basic criteria taken under consideration during the time of dominant trees selection. In this research morphology deals with the Lacquer plants with balance stem, well canopy and no pests and quality deals with Lacquer

trees producing higher quantity of average annual resin.

The two main methods used to select dominant tree are as below:

- By using a survey and interviewing households in the research area about the resin yield, quality and the annual cycle of taking resin. Through investigation of the growth and resin yield of the Lacquer tree.

- Using 6 comparable trees method (Kha and Collaborator, 2003) following data were collected. The Diameter at Breast height (D_{bh}); total height (H_t); height to the first branch of tree (H_c); crown diameter (D_c); growth conditions (good, average, bad); yield and quality of resin in 2 years (2011 and 2012). Fifty promising plants were selected according to the characters of the plants.

Grafting Method

Three methods of grafting i.e., Wedge Grafting, Cleft Grafting and Splice Grafting were applied and replicated 3 time. Thirty trees will be used in each method. This will be carried out in spring, summer and autumn season of the year.

Wedge Grafting

Using grafting knife to cut the rootstocks (the point of cutting is at the height of 20-25cm from the base). Using knife to split the middle of the stock, the slips are cut bevel at both sides, putting the slips into the splits point of stocks for at least one side of cambium (layer between bark and wood) of the slip and rootstock overlap. Dedicated plastic tape is used to keep the grafted slip properly, then use 1 thin tape of plastic rolling up the slip in order to retain moisture in the stems and prevent the slips from water and rain or dew which make them to be oxidated and also prevent bacterial and fungal diseases arise to kill slips.

Cleft Grafting

This method is applied if the rootstocks are much bigger than the slips. Firstly, cut bevel at the both sides of slips and rootstock. The deepness of the cutting trace is not over one-third the diameter of the stem. Slip and rootstock will be pressed so that at least one side of the cambium of the slip and rootstock coincide. Then use a dedicated plastic and tightly round whole cutting trace and wrap the slips to avoid dehydration.

Splice Grafting

Applied in case of the diameter of the rootstock and the slips is equal. Firstly use the knife to cut bevel the slips and rootstock with the same length. Then squeezing the two bevel sides of the slip and rootstock so that the cambium strip of them coincide, then round tightly the cutting trace by using the dedicated plastic. Then use a thin layer of plastic to wrap the whole entire slip.

Climatic Conditions of Grafting Season

In the nursery, an experiment was conducted on 30 trees with random samples for each of three methods and was repeated 3 times. Three season use in experiment are categorized as under:

The spring: from January to March

Summer: from April to June

Autumn: from July to September

Table 1: The Climatic Conditions of Three Grafting Season

Climate	Total Rain Fall (Mm)	Total Sunshine Duration (Hr)	Mean Air Temperature (^{0}C)	Mean Humidity (%)
Spring	77.6	126.5	19.7	82.6
Summer	482.5	388.7	27.9	77.6
Autumn	1221.6	350.2	28.3	81.6

For example, for spring (other seasons the same):

Repeated 1: Using 30 trees for Wedge grafting; 30 trees for Cleft grafting; and 30 trees for Splice grafting

Repeated 2: (after 1 week) using 30 trees for Splice grafting; 30 trees for wedge grafting; and 30 trees for cleft grafting

Repeated 3: (after 2 weeks) using 30 trees for cleft grafting; 30 trees for wedge grafting; and 30 trees for Splice grafting

Data were analyzed by using Excel and SPSS software.

RESULTS AND DISCUSSIONS

Selection of the Dominant Trees

Table 2: Some Indicators of 50 Candidate's Dominant Trees in Average

S.No	Location	No. Of Tree	Age	D_{00}	$D._{BH}$	H_t	H_C	D_c	Resin Yield 2011 (G/Tree)	Resin Yield 2012 (G/Tree)	Average (G/Tree)	Resin Yield Average In A Plot (G/Tree)	The Yield Advantage Of The Mother Plant (%)
1	Plot 1 – Di Nau	5	5-6	10	9.7	4.1	2.5	3.5	168	170	169	147	114.97
7	Plot 8 – Di Nau	33	5-6	9.5	8	4.7	2.5	3	172	170	171	130	131.54
8	Plot 1 – Tho Van	12	5-6	9.7	8.2	5.2	2.8	4	166	165	165.5	134	123.51
	Average	**50**							**168.66**	**168.33**	**168.5**	**137**	**123.34**

According to the data, 50 plants were selected as dominant trees. The average resin yield of selected plants was 168.5gr/tree/year. From the above 50 plus trees, using the survey and interview data, the morphological and quality characters of the trees and cycle of resin providing; 30 dominant trees were chosen at the age from 4-6 years. The height at the point under the last branch is about 2-5m and the crown was quite well so that these criteria were contributed on the increasing of resin yield.

Table 3: Some Criteria of Selected Dominant Trees

.SNo.	Code	Location	Age (Years Old)	Ht (M)	Hc (M)	Dbh (Cm)	Dc (M)	Resin Yield 2012 (G)	The Average Of 6 Comparable Trees (G)	Prominence (%)	Cycle Of Taking Resin (Days)
1	TN 1	Lo 3 khu 8 Di Nau- Tam Nong -Phu Tho	4	4	2	8	2,5	200	143	139,86	3
2	TN 2	Lo 3 khu 8 Di Nau- Tam Nong -Phu Tho	4	5	2	10	4	250	145	172,41	3
3	TN 3	Lo 3 khu 8 Di Nau- Tam Nong -Phu Tho	4	4,5	2,2	6	3	210	131	160,31	3
4	TN 4	Lo 1 khu 8 Di Nau- Tam Nong -Phu Tho	3	4	2	6	2,5	200	147	136,05	3
5	TN 5	Lo 1 khu 8 Di Nau- Tam Nong -Phu Tho	3	5	2,5	7,5	4	210	115	182,61	3
6	TN 6	Lo 1 khu 8 Di Nau- Tam Nong -Phu Tho	3	5,5	2,3	7	3,5	190	116	163,79	3
7	TN 7	Lo 1 khu 8 Di Nau- Tam Nong -Phu Tho	3	5,5	2,2	6	2,5	210	138	152,17	3
8	TN 8	Lo 2khu 8 Di Nau- Tam Nong -Phu Tho	5	6	1,7	8,5	3	220	145	151,72	3
9	TN 9	Lo 2khu 8 Di Nau- Tam Nong -Phu Tho	5	6	1,8	10	3	200	145	137,93	3
10	TN 10	Lo 2khu 8 Di Nau- Tam Nong -Phu Tho	5	5	2	11	4,5	190	135	140,74	3
11	TN 11	Lo 2khu 8 Di Nau- Tam Nong -Phu Tho	5	5,5	3	6,6	3,5	210	133	157,89	3
12	TN 12	Lo 6 khu 8 Di Nau- Tam Nong -Phu Tho	6	6	2,4	9	3,5	200	126	158,73	3
13	TN 13	Lo 6 khu 8 Di Nau- Tam Nong -Phu Tho	6	6	4	9	3	190	136	139,71	3
14	TN 14	Lo 6 khu 8 Di Nau- Tam Nong -Phu Tho	6	6,5	4,5	9	3,5	200	143	139,86	3
15	TN 15	Lo 1 khu 5 Di Nau- Tam Nong -Phu Tho	3	4,5	2,4	7	4	190	113	168,14	3
16	TN	Lo 10 khu 8 Di	6	5,5	4	8,5	5	220	178	123,60	3

	16	Nau- Tam Nong -Phu Tho									
17	TN 17	Lo 10 khu 8 Di Nau- Tam Nong -Phu Tho	6	5,5	4	8,5	4	210	178	117,98	3
18	TN 18	Lo 10 khu 8 Di Nau- Tam Nong -Phu Tho	6	5	4	8	4,5	210	175	120,00	3
19	TN 19	Lo 10 khu 8 Di Nau- Tam Nong -Phu Tho	6	3,5	2,2	6	3,5	190	136	139,71	3
20	TN 20	Lo 10 khu 8 Di Nau- Tam Nong -Phu Tho	6	5,5	3,1	8	4,5	200	171	116,96	3
21	TN 21	Lo 11 khu 8 Di Nau- Tam Nong -Phu Tho	6	4,5	2	8,5	5	210	172	122,09	3
22	TN 22	Lo 11 khu 8 Di Nau- Tam Nong -Phu Tho	5	5,5	2,5	10	5	220	151	145,70	3
23	TN 23	Lo 7 khu 8 Di Nau- Tam Nong -Phu Tho	5	4,5	2,5	8	5	190	143	132,87	3
24	TN 24	Lo 10 khu 8 Di Nau- Tam Nong -Phu Tho	5	6,2	3,5	10	5	220	168	130,95	3
25	TN 25	Lo1 khu 1 Tho Van- Tam Nong -Phu Tho	6	6,5	4	8	4,5	200	160	125,00	3
26	TN 26	Lo1 khu 1 Tho Van- Tam Nong -Phu Tho	6	6	3	7,5	4,5	190	166	114,46	3
27	TN 27	Lo1 khu 1 Tho Van- Tam Nong -Phu Tho	6	6	4	8,5	5	210	161	130,43	3
28	TN 28	Lo1 khu 1 Tho Van- Tam Nong -Phu Tho	6	8,5	5	11	5	220	170	129,41	3
29	TN 29	Lo2 khu 1 Tho Van- Tam Nong -Phu Tho	6	6,5	3	8	5	200	152	131,58	3
30	TN 30	Lo 2 khu 1 Tho Van- Tam Nong -Phu Tho	6	5	1,7	7,5	4	190	158	120,25	3
		Average						**205**	**148,33**	**140,10**	**3**

Table 3 illustrates that the resin yield of the dominant trees wasn't fluctuate much with the average resin yield which was at 205gr/tree/year. The average prominence was at 140.1%. The selected dominant trees brought the quite stable resin yield every year.

Propagation of Lacquer Tree by Grafting Method

The data of survival rate of grafting tree was collected in following table:

Table 4: Results of Observation Time for Sprouting of the Slips

Seasonal	Grafting Method	Quantity (Trees)	Time for Starting to Sprout of The Slips (Days)		No. of Survival Trees	Survival Rate (%)
			from the First Slip	to the Last Slip		
Spring	Wedge grafting	90	7	22	61	67,78
	Cleft grafting	90	12	25	45	50,00
	Splice grafting	90	8	23	52	57,78
	Average		*9*	*23.33*	*53*	58,52
Summer	Wedge grafting	90	12	28	41	45,56
	Cleft grafting	90	15	32	39	43,33
	Splice grafting	90	12	28	36	40,00
	Average		*13*	*29.33*	*39*	42,96
Autumn	Wedge grafting	90	9	25	56	62,22
	Cleft grafting	90	12	30	42	46,67
	Splice grafting	90	10	26	46	51,11
	Average		*10,33*	*29.00*	*48*	53,33
Average	Wedge grafting	90	9,33	25	52,67	58,85
	Cleft grafting	90	13,00	29	42,00	46,67
	Splice grafting	90	10,00	25.67	44,67	49,63
	Average		10,78	*26.56*	46,44	51,60

Table 4 shows that time for sprouting, wedge grafting and splice grafting are the methods that the sprouting happened earlier than cleft grafting with the first bud was appeared after 7-8 days of grafting and the last bud appeared after 22-23 days for the cleft grafting method, the first bud burst after 12 days of grafting. It can be explained that, with the wedge grafting and splice grafting, the top of trees were cut before grafting so the nutrient just focused on nourishing the stocks, unlike the cleft grafting, the nutrient must be spent for the whole tree for the top of tree was still left after 9-10 days of grafting.

In term of the season, time for sprouting was earlier in the spring comparing with autumn and summer. This result was appropriate to the growth cycle of the plant because of the richest nutrient and the best weather was the spring. Summer was the time that plants have the strongest growth, with the young slips, it take time for the adaption to the natural condition so that the starting time of sprouting was later than the spring and autumn.

In term of survival rate, the data were also higher in the spring (58.52%) and lower in the summer (42.96%) which was appropriated to the hypothesis that at the time of the strongest development of the slips and stocks (in spring), the grafting materials was accumulated sufficient nutrients combined with the favorable weather, grafting is conducted more successfully. Moreover, for 3 applied grafting methods, the wedge grafting had the highest survival rate of 58.85%, in contrast, the cleft grafting had the lowest survival rate (46.67%). The reason was for the wedge grafting, the grafting activities were operated faster as well as the grafting wound was fastened better while for the splice grafting, although the

grafting activities were conducted easily, the grafting wound was easy to missed. The cleft grafting was difficult to apply because this method was conducted under the stem.

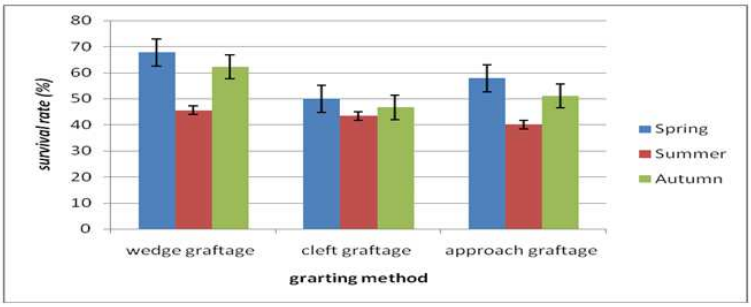

Figure 1: The Survival Rate According to the Different Grafting Method (Bonferroni Comparative Method)

Table 5: Comparison of the Survival Rate According to the Different Grafting Method

Dependent Variable: Survival Rate							
	(I) Grafting Method	(J) Grafting Method	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Bonferroni	Wedge grafting	Cleft grafting	11.8519(*)	4.25601	.016	1.6417	22.0620
		Splice grafting	8.8889	4.25601	.111	-1.3212	19.0990
	Cleft grafting	Wedge grafting	-11.8519(*)	4.25601	.016	-22.0620	-1.6417
		Splice grafting	-2.9630	4.25601	1.000	-13.1731	7.2472
	Splice grafting	Wedge grafting	-8.8889	4.25601	.111	-19.0990	1.3212
		Cleft grafting	2.9630	4.25601	1.000	-7.2472	13.1731

Based on observed means

* The mean difference is significant at the .05 level

Table 5 showed that the survival rate was significantly different (Sig = 0.016 <0.05) between cleft grafting and wedge grafting but did not vary much between other grafting methods. Thus, the wedge grafting was the most appropriate method and had the highest survival rate.

The Survival Rate According to the Different Grafting Seasons

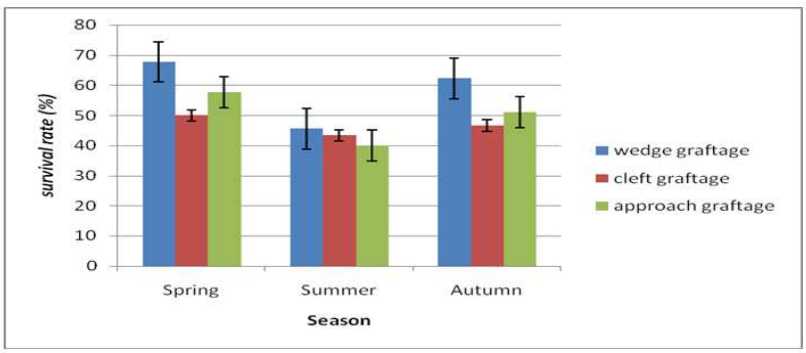

Figure2: The Survival Rate According to the Different Grafting Seasons

Table 6: Comparison of the Survival Rate According to the Different Grafting Seasons

Dependent Variable: Survival Rate							
	I) Grafting Season	(J) Grafting Season	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Bonferroni	Spring	Summer	15.5556(*)	4.25601	.001	5.3454	25.7657
		Autumn	5.1852	4.25601	.670	-5.0249	15.3953
	Summer	Spring	-15.5556(*)	4.25601	.001	-25.7657	-5.3454
		Autumn	-10.3704(*)	4.25601	.045	-20.5805	-.1602
	Autumn	Spring	-5.1852	4.25601	.670	-15.3953	5.0249
		Summer	10.3704(*)	4.25601	.045	.1602	20.5805

Table 5 showed that the survival rate was significantly different between spring and summer, meanwhile did not vary much between spring and autumn. So that spring was the most suitable season for grafting Lacquer tree.

CONCLUSIONS

In Term of Selection of Dominant Trees:30 dominant trees had been selected, of which the resin yield was not significantly different with an average of 205g/tree/year, the prominent of 140.1%. The selected dominant trees were stable in providing resin yield every year which can be used to provide the mother stock to produce Lacquer trees in the future.

In Term of Grafting Lacquer Trees: Branches grafting methods could be used for product plants with high and stable resin yield and short time of harvesting resin. Wedge grafting resulted in the highest survival rate (survival rate 58.85%). The best season was spring (January-March). Applying wedge grafting in spring could reach the highest survival rate (67.78%).

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