

Survival Rate of Grafted Pummelo (*Citrus maxima*) Using the Conventional Cleft Grafting Method and the Modified Crown Grafting Method

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ABSTRACT

Comparison of the survival rate of grafted pummel using conventional cleft grafting method and modified crown-grafting method was conducted. Results revealed that modified crown grafting method using both half-cut scion leaves and whole scion leaves performed significantly better compared to conventional cleft grafting method (defoliated scion) in terms of percentage of success, weekly shoot growth increment and exhibited low percentage of mortality. This implies that pummelo grafted using modified crown grafting method both half-cut scion leaves and whole scion leaves have higher survival rate. However no significant difference was observed in the number of new shoots and in the number of days from grafting to first shoot formation.

Keywords: Citrus maxima, cleft grafting, crown grafting, pummel, asexual propagation

INTRODUCTION

Pummelo (*Citrus maxima*) locally known as “suha” is a high value crop in the Philippines because of its vital economic importance. It can be grown in many parts of the country. They are low growing and more trees can be grown on one hectare as compared to mangoes. The fact that they are low growing, pummelos are not as susceptible to damage by strong winds as tall trees (Savian 2000).

Traditionally, pummelos are planted in the field through sexual propagation. In most cases, sexually propagated plants do not grow true-to-type. To minimize this effect, planting materials should be asexually propagated. Asexually propagated plants using grafting bear earlier and carry desirable characteristics thereby producing good quality fruits, if selection of needed materials in grafting is done properly.

Cleft grafting method is the most common grafting method used in citrus. This is the conventional or traditional cleft grafting method. The scion about eight inches to a foot long is taken from the mother tree. Then the leaves of the scion are removed. The leafless stem or scion is then inserted or grafted into the rootstock. After attaching it to the rootstock, it is totally wrapped with a plastic tape.

In the new technique of Modified Crown Grafting (MCG), which was developed by Pamplona, (1993), the leaves of the scion are not removed. The

leaves are intact when grafted into the rootstock. Then the newly grafted plant is placed inside a big plastic bag and totally closed to prevent transpiration. Pamplona says that the modified crown grafting can be used to propagate the indigenous lanzones or the imported ones such as duku and longkong. Aside from lanzones the technique could also be used in propagating grafted durian and mango (Sarian 1998).

Modified Crown Grafting has not been tried yet in citrus, particularly in pummelo, hence this study was conducted to compare the survival rate of grafted pummelo using the conventional cleft grafting method and modified Crown grafting method at Western Philippines University orchard, Aborlan, Palawan.

METHODOLOGY

Selection of Rootstock

Vigorous native pummelo rootstocks six to eight months old were selected from the nursery.

Preparation of Soil Media

The planting medium consists of a mixture of partially decomposed rice hull, river sand and topsoil on 1:1:2 proportions. These were mixed thoroughly and placed in polyethylene bags.

Rebagging

Pummelo seedlings were watered thoroughly before rebagging. Seedlings were carefully transplanted to bigger polyethylene bags to ensure better growth of the rootstocks. Newly rebagged seedlings were placed in a nursery with 50% shade.

Watering, Fertilizing and Control of Pests and Diseases

Watering was done whenever necessary. Two grams per plant of ammonium sulfate was applied monthly. Control of pests and diseases was done whenever necessary.

Selection of Scion

Scions were selected from healthy and promising mother plant.

Grafting Activities

A skilled propagator, particularly in grafting, was hired to do the grafting activity.

Conventional Cleft Grafting

Using a sharp budding knife, the top of the rootstock was cut to a height between 20-30 cm where there is active growth. A wedge cut of 4-5 cm long on the basal end of the scion forming a tapering wedge was made. A vertical cut about 4-5 cm long was done at the top of the rootstock. The scion was inserted or attached to the rootstock. The joint or the attached scion was tied firmly using a grafting tape. The grafted seedlings were placed in a shaded nursery.

Modified Crown Grafting

The same procedure as the Conventional Cleft Grafting was done except that 4-6 terminal leaves of the scion were not removed. The grafted seedlings except those in Treatment 1 (Conventional Cleft Grafting Method) were placed inside the big plastic bag and totally closed to prevent or lessen transpiration or the escape of moisture. These were placed in a shaded nursery while the grafts are being healed.

Maintenance of the Experimental Plants

Regular watering and fertilizing were done to the grafted plants. Proper shading was also observed to prevent the occurrence of pests and diseases. Clean surrounding was maintained.

The Experimental Design

This study was conducted using a Completely Randomized design (CRD) with three treatments. Each treatment was replicated three times. There were ten (10) samples per replication. The treatments were as follows:

Treatment 1 – Conventional Cleft Grafting Method

Treatment 2 – Modified crown Grafting Method with half cut scion leaves

Treatment 3 – Modified Crown Grafting Method with whole scion leaves.

Data Gathered

1. Percentage of Success

Percentage of success was obtained by counting the number of successful union. The formula was $[(S/N) \times 100]$ where S is the number of successful union and N is the number of samples per treatment.

2. Number of Days from Grafting to First Shoot Formation

The number of days from gathering to first shoot formation in each sample plant was observed and recorded.

3. Number of New Shoots

Data on the number of new shoots were gathered weekly by counting the shoots that emerged in every sample plant.

4. Weekly Shoot Growth Increment (in cm)

The weekly shoot growth increment in centimeter was obtained by measuring the shoot from its base to the tip using a foot rule.

Data Analysis and Statistical Tools

Data were analyzed using Analysis of Variance for the Completely Randomized Design (CRD). Duncan's Multiple Range Test (DMRT) was used to test differences among all possible pairs of treatment means involved. Square root transformations were also used.

RESULTS AND DISCUSSION

Percentage of Success of Grafted Pummelo

Table 1 shows the percentage success of Grafted Pummelo. Treatment 2 has the highest percentage of success with a mean of 100 percent followed by treatment 3 with a mean of 96.67 percent. Treatment 1 got the lowest mean of 70 percent.

Table 1. Percent of success of grafted pummelo

Treatment	Percent Mortality			Total	Mean
	I	II	III		
T ₁ – Conventional Cleft Grafting Method (defoliated scion)	70	80	60	210	70 ^a
T ₂ – Modified Crown Grafting Method (half-cut scion leaves)	100	100	100	300	100 ^a
T ₃ – Modified Crown Grafting Method (whole scion leaves)	100	90	100	290	96.67 ^a
Grand Total				800	
Grand Mean					88.89

Note: Treatment means having the same letter superscript are not significantly different at 0.1 level of significance based on DMRT.

Statistical analysis revealed that Treatment 2 and Treatment 3 are found to be significantly different from treatment 1. However, no significant difference was observed between Treatment 2 and Treatment 3. This implies that pummelos

grafted using Modified crown Grafting Method be it with half cut scion leaves or whole scion leaves exhibit high performance in terms of percentage of success

Number of Days from Grafting to First Shoot Formation

Table 2 shows the number of days from grafting to first shoot formation. Treatment 3 got the highest mean of 46.15 days followed by Treatment 1 with a mean of 43.53 days. Treatment 2 has the least number of days from grafting to first shoot formation with a mean of 42.37 days.

Statistical analysis revealed that there were no significant differences observed among the three treatments, hence the three treatments have approximately the same number of days from grafting to first shoot formation.

Table 2. Number of days from grafting to first shoot formation of grafted pummelo

Treatment	Percent Mortality			Total	Mean
	I	II	III		
T ₁ – Conventional Cleft Grafting Method (defoliated scion)	44.44	50.4	35.8	130.6	43.53
T ₂ – Modified Crown Grafting Method (half-cut scion leaves)	43.0	34.7	49.4	127.1	42.37
T ₃ – Modifies Crown Grafting Method (whole scion leaves)	46.9	39.7	51.89	138.49	46.16
Grand Total				396.19	
Grand Mean					44.02

Number of New Shoots of Grafted Pummelo

Table 3 shows the number of new shoots of grafted pummelo. Results showed that Treatment 2 has the highest mean of 2.87 followed by Treatment 3 with a mean of 2.47. Treatment 1 got the lowest mean of 1.87.

Analysis of variance, however, reveals that there were no significant differences among treatment means. This implies that the use of different methods of grafting pummelo has no considerable effect as far as the number of new shoots is concerned.

Table 3. Number of new shoots of grafted pummelo

Treatment	Percent Mortality			Total	Mean
	I	II	III		
T ₁ – Conventional Cleft Grafting Method (defoliated scion)	2.3	1.6	1.7	5.6	1.87
T ₂ – Modified Crown Grafting Method (half-cut scion leaves)	2.4	3.0	3.2	8.6	2.87
T ₃ – Modified Crown Grafting Method (whole scion leaves)	2.5	3.1	1.8	7.4	2.47
Grand Total				21.6	
Grand Mean					2.40

Weekly Shoot Increment (cm) of Grafted Pummelo

Table 4 shows the weekly shoot growth increment (cm) of grafted pummelo. Results showed that Treatment 3 has the highest weekly shoot growth increment with a mean of 2.39 cm followed by Treatment 2 with a mean of 1.44 c. Treatment 1 got the lowest mean of 0.27 cm.

Statistical analysis showed that Treatment 3 is significantly different from Treatment 1. However, no significant difference was observed between the means of Treatment 2 to that of the mean of Treatment 3 and the mean of Treatment 1. This implies that Modified Crown Grafting Method both with half cut scion leaves and whole scion leaves exhibit high performance in terms of weekly shoot growth increment

Table 4. Weekly shoot growth increment in centimeter

Treatment	Percent Mortality			Total	Mean
	I	II	III		
T ₁ – Conventional Cleft Grafting Method (defoliated scion)	0.27	0.34	0.20	0.81	0.27 ^b
T ₂ – Modified Crown Grafting Method (half-cut scion leaves)	0.93	1.70	1.70	4.33	1.44 ^{ab}
T ₃ – Modified Crown Grafting Method (whole scion leaves)	1.88	2.99	2.29	7.16	2.39 ^a
Grand Total				12.3	
Grand Mean					1.37

Note: Treatment means having the same letter superscript is not significantly different at 0.01 level of significance based on DMRT.

Results indicated in the abovementioned tables showed highly significant differences among the treatments in terms of percent mortality, percentage of success, and the weekly shoot growth increment. However, no significant differences were observed among treatments in terms of the number of new shoot of grafted pummelo and the number of days from grafting to first shoot formation.

It can be concluded that the use of the modified crown grafting method with half-cut scion leaves and modified crown grafting method with whole scion leaves significantly resulted to a higher percentage of success, higher weekly shoot growth increment and indicated low percentage of mortality. However, it had no significant effect on the number of days from grafting to first shoot formation and the number of new shoots.

RECOMMENDATIONS

Based on the results, the researcher recommends the use of Modified Crown Grafting Method both half-cut scion leaves and whole scion leaves in grafting pummelo.

The researcher further recommends further study on the survival rate of other citrus plants using the Conventional Cleft Grafting Method and Modified Crown Grafting Method.

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