

**EFFECT OF SOME CHEMICAL MATERIAL AND
GERMINATION MEDIA ON SEED GERMINATION
AND GROWTH OF GRAFTED CASIMIROA
TRANSPLANTS**

[23]

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ABSTRACT

This investigation was carried out in the plastic house of Horticulture Research Institute, Agriculture Research Center, Giza during two consequent seasons (2002 – 2003) and (2003 – 2004). The study was aimed to enhance growth of Casimiroa rootstock seedlings to reach grafting size in a short time, beside defining the suitable method of grafting. In this concern, results revealed that seed soaked in MgSO₄ at 5 % for 15 min. and planted in media consists of peat and sand at 1 : 1, was increased seed germination percentage (92.1 and 94.8 %) and minimized the germination period (19.1 and 19.3 days), as compared with the other treatments. Thus it reached to the grafting size at a period of (179 and 180 days) in both seasons, respectively. However, Dormex (hydrogen cyanamide) treatment at 2% gave the highest root length (24.6 and 24.8 cm), and number of roots per plant (19.4 and 19.0). Results also showed that shield budding by using soft wood grafts, gave the highest percentage of success (69.2 and 72.4%), shortest period of bud / scion (23.0 and 24.0 days), highest values of scion length (26.5 and 25.7 cm) and highest leaf area (38.28 and 40.67 cm²). However, cleft grafting with softwood grafts increased average number of leaves per sprouted graft (6.0 and 6.6) and shoot scion diameter (0.6 and 0.5 cm). Generally, seeds treated with MgSO₄ at 5% before sowing in media consists of peat and sand at 1 : 1 in volume, induced healthy and sizeable rootstocks in a short time. Moreover, grafting rootstocks by soft wood grafts was the best method.

Keywords: Casimiroa, Chemical materials, Germination media, Seed germination, Growth of grafted casimiroa

INTRODUCTION

In the high lands of Mexico and Central America, where it is believed to be indigenous, the white sapote (*Casimiroa*

edulis) ranks among the principal fruits (**Chandler, 1986**). Seedlings of white Sapote do not come into bearing until seven or eight years old and many produce fruit of inferior quality. For this rea-

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son it should be vegetatively propagated. Shield – budding is successfully practiced and stock plants should be selected from young vigorous seedlings whose stems are about 0.6 – 0.8 cm in diameter at the base. Growth of rootstocks in containers are greatly influenced by the growing media. The traditional media is a mixture of equal parts (by volume) of manure, fine sand and soil, it is low in cost and allows plants to grow well (**Whincho, 2004**). Container media in horticulture serves primarily as a mechanical support for the plant. It has only small reserves of water supply and short substrate columns affect drainage of water (**Brunchner, 2004**). In addition, **Conver and Poole (1977)** and **(1983)** **Koranski (1979)** and **Pertuit and Mazur (1981)** found that, different media had varied greatly in rooting success and growth of newly established plants. Media containing completely decomposed organic matter such as peat moss or decomposed leaves were the best media for rooting and growth. **Neha et al (1999)** on *Annona squamosa* seeds found that, seeds were sown directly in Coco peat vermiculite or standard mixture of silt farmyard manure and sand (2:2:1), either in earthen ware pots, or in root trainer. Pure Coco peat pure vermiculate were significantly superior to the standard pot mixture in terms of germination percentage root number, root length, seedling height and number of leaves per plant. However, root length was significantly greater in Coco peat than in vermiculate. **Eddossa et al (2003)** on *Avocado* seeds and eight media types, found that different media types significantly influenced the total fresh and dry weight of the seedlings, plant height and diameters were highly and significantly affected by media types. Concerning the

effect of some chemical substances on germination and growth, **Harrera, (1991)** on coffee seeds reported that when seeds were treated with 0-5% hydrogen cyanamide as (Dormex) for 0-15 minutes, all treatments increased percentage of germination immersion periods, radicle length, seedling D.W. and growth. **Shashikala and Madhulika (1992)** found that seeds of *Ephedra foliata* when soaked for 24 h in aqueous solutions of different concentrations (10 – 1000 ppm) of KNO_3 , KH_2PO_4 or MgSO_4 , all 3 compounds promoted germination compared with the water soaked (control) but high concentrations were inhibitory. The most effective treatments (93.3 – 96.6 %) germination were MgSO_4 at 50–200 ppm and KNO_3 at 200 ppm. **Savita and Joao (1999)** on *Rangpur lime* seeds found that when seeds were treated for 24 h with 0.1 and 0.2 % KNO_3 and 50,100 and 250 mgL^{-1} of GA_3 , the growth regulator did not enhance seed germination and KNO_3 at 0.1 and 0.2 % inhibited germination.

MATERIAL AND METHODS

This study was carried out at the plastic house of Horticulture Research Institute, Agriculture Research Center, Giza, Egypt, during the two successive seasons of 2002/03 and 2003/04.

The study included two parts

First part

Such study aimed to reveal the effect of using some inorganic materials and different planting media to produce good rootstocks in a short time. In this concern, fruits of white Sapote (*Casimiroa edulis*) were harvested from trees grown in Al-

kanater Research Station Kalubia Gaver Egypt, on July 25th 2002 and July 21st 2003. Then seeds were carefully extracted from fruits and washed with tap water. Seeds were left at room temperature for 24 hours then subjected to the following treatments for 15 minutes

- 1- MgSO₄ (5 %).
- 2- KNO₃ (1 %).
- 3- KH₂PO₄ (1 %).
- 4- Dormex (2 %).
- 5- Tap water (control).

The following growing media were used for planting the treated seeds

- 1- Peat moss + clay (1:1) by volume.
- 2- Peat moss + sand (1:1) by volume.
- 3- Sand + clay (1:1) by volume.
- 4- Sand + clay + peat moss (1: 1: 1) by volume.

Each treatment included 75 seeds divided into 3 replicates.

The following data were recorded at 30 days intervals after sowing seeds as follow

- 1- Germination percentage.
- 2- Germination Period.
- 3- Plant height (cm).
- 4- Stem diameter (cm).
- 5- Number of leaves/plant.
- 6- Number of branches/plant.
- 7- Root length (cm).
- 8- Number of roots.
- 9- Days for reaching grafting time.

Second part

Grafting methods: This study was planned to explore the best method of grafting to induce healthy and sizeable grafted *Casimiroa* seedlings in a short time. In this concern, grafting was carried out on the obtained seedlings (6 – 9 month old) as follows

- 1- Shield budding using hard wood buds.
- 2- Shield budding using soft wood buds.
- 3- Cleft grafting using hard wood scions.
- 4- Cleft grafting using soft wood scions.

The following data were recorded

- 1- Percentage of success.
- 2- Growth of grafts.

Statistical analysis of the data was thoroughly carried out and the individual comparisons were compared by using the new L.S.D according to **Waller and Duncan (1969)**. Interaction studies were carried out and calculated as referred by **Snedecor and Cochran (1972)**.

RESULTS AND DISCUSSION

Part I: Effect of some chemical materials and germination media on seed germination and seedlings growth.

I- 1- Germination period

Table (1) shows the effect of growing media and some inorganic treatments on days required for germination of *Casimiroa* seeds in both seasons. The obtained data revealed that, the lowest period for seed germination (22.2 and 22.1 days), was noticed with MgSO₄ at 5 % treatment while the longest (27.5 and 27.2 days), was detected with the untreated seeds. However, (Peat + sand) germinating media gave values of (24.1 and 23.6 days), and the longest values in this concern were (26.0 and 25.9 days), for (sand + clay) germinating media. The obtained data also show that the shortest period required for seed germination was obtained from MgSO₄ at 5 % treatment with (peat + sand) germinating media since the values were (19.3 and 19.1

days), in both studied seasons, respectively .

2- Germination percentage

With regard to Table (1), germination percentage was significantly affected with the tested treatments. Generally, the highest percentage of germination (83.6 and 83.9 %) was obtained with $MgSO_4$ at 5 % while the lowest one (53.5 and 53.8 %) was detected with untreated (control) seeds. In addition, seeds planted in (peat + sand) germinating media gave the highest value (73.2 and 74.8 %) as compared with other tested media. The obtained data also show that, the highest percentage of seed germination was obtained from seeds treated with $MgSO_4$ at 5 % and planted in (peat + sand) germinating media and the values were (92.1 and 94.8 %) as compared with the different tested treatments with all tested media in the two seasons, respectively. In agreement with the obtained results were *Neha et al (1999)*, who found that germination was generally better in peat or clay + peat + sand than in clay, sand, clay + sand media. Germination percentage was greatest in the peat. In addition, *Whincho, (2004)* found that *Avocado* seeds should be planted as soon as possible after their removal from fruit in flats of light porous soil. *Shashikala and Madhulika, (1992)* found that KNO_3 , $KHPO_4$ and $MgSO_4$ each at 10-1000 ppm promoted germination compared with the water soaked control. The most effective treatments (93.3 – 96.6 %) germination were $MgSO_4$ at 20 – 200 ppm and KNO_3 at 200 ppm .

3- Days required for reaching grafting age

The obtained data in Table (1), also show that days required for reaching grafting age of *Casimiroa* treated seeds were the lowest (185.7 and 188.5 days) with $MgSO_4$ at 5 % treatment ,while the longest period (273.8 and 271.3 days), was obtained from untreated (control) seeds . Concerning the effect of media, it is clear that, (peat + sand) media significantly decreased the required days for grafting (226.0 and 224.6 days), as compared with other tested media.

Anyhow, $MgSO_4$ at 5% with (peat + sand) growing media decreased the days required for *Casimiroa* seed to reach grafting age (179 and 180 days), as compared with other investigated treatments and control in both examined seasons, respectively. The obtained results confirm the findings of *Koranski (1979)*, *Pertuit and Mazur (1981)*, *Conver and Poole (1983)* and *Eddossa et al (2003)*.

4- Stem height

Table (2) shows the effect of media and some inorganic chemical treatments on the growth of the emerged seedlings i.e., height of stem in both examined seasons. The obtained results revealed in general that, the longest stem (52.8 and 51.9 cm) was recorded in seedlings emerged from seeds treated with $MgSO_4$ at 5 %, while the shortest one (38.7 and 37.7 cm) was obtained from untreated seeds (control).

However, germination media (peat + sand) increased the height of stem which gave (49.1 and 48.1 cm) in average than other tested media. Obviously, the longest stem resulted from treated seeds with $MgSO_4$ at 5 % and then planted in (peat + sand) media which gave (55.1 and 52.9

cm), while the shortest (36.0 and 35.7 cm) was obtained from untreated seeds grown in (sand + clay) media.

This is true in both seasons. The obtained results agree with the findings of **Eddossa et al (2003)**.

5- Stem diameter

Data in Table (2) show that stem diameter of seedlings treated with $MgSO_4$ at 5 % gave the highest values (0.48 and 0.48 cm) of stem diameter during the first and second seasons, respectively. On the other hand, seedlings produced from seeds treated with Dormex at 2% treatment and control gave the lowest values (0.30 and 0.33 cm) and (0.33 and 0.33 cm) of stem diameter during both seasons, respectively. Concerning the effect of media, it is clear that no significant differences were found, where (peat + sand + clay) media increased stem diameter than other tested media (0.40 against 0.38, 0.38 and 0.36 cm) in the first season and (0.42 against 0.38, 0.40 and 0.36 cm) in the second one, respectively.

Anyhow, the highest value of stem diameter of *Casimiroa* seedlings, resulted from treated seed with $MgSO_4$ at 5 % and growing in (peat + sand) or (peat + sand + clay) media, which gave the same values (0.5 and 0.5 cm) in both seasons, respectively. The obtained results are in agreement with the findings of **Eddossa et al (2003)**.

6- Number of laterals per plant

Table (3) shows the effect of the examined factors on average number of laterals per *Casimiroa* seedlings during 2002 / 2003 and 2003 / 2004) seasons. The obtained data revealed that the highest number of laterals per plant, (2.25 and 2.03) were obtained from Dormex treatment at 2% without significant differ-

ences as compared with other tested treatments. Concerning the effect of growing media the number of branches ranged from (1.20 and 1.42) in the first season and (1.20 and 1.22) in the second one. However, the highest number of laterals (3.0 and 2.1) was obtained from Dormex treatment with (peat + clay) media, but these differences are statistically insignificant.

7- Number of leaves per plant

The data in Table (3), reveal that the seedlings produced from seeds treated with Dormex at 2 % and $MgSO_4$ at 5 % gave the highest number of leaves per plant (11.45 and 11.05) and (11.25 and 10.78) in the first and second seasons, respectively. On the other hand, the lowest number of leaves per plant, (6.33 and 6.23) was obtained from the untreated seeds. As for the effect of growing media, it is clear that (peat + sand) media increased number of leaves per plant, (9.92 and 9.98) against other used media. The obtained data also show that, seeds treated with Dormex at 2 % (12.0 and 12.4) and $MgSO_4$ at 5 % (12.0 and 12.1) in (peat + sand) growing media were superior to other tested treatments. These results confirm the findings of **Harrera (1991)** and **Neha et al (1999)**.

8- Root Length

The recorded data in Table (4) reveal that root length of the tested seeds was significantly affected by growing media in both seasons. Generally, the longest root, (23.9 and 24.1 cm) was obtained from (peat + sand) media. On the other hand, root length increased by using $MgSO_4$ at 5% (23.5 and 23.5cm) and

Dormex at 2 % (23.2 and 23.1 cm) in both seasons, respectively. Anyhow, the longest root (24.6 and 24.8 cm) was obtained from seeds treated with $MgSO_4$ at 5 % and planted in (peat + sand) followed by Dormex at 2 % (24.2 and 24.2 cm.) in the first and second seasons, respectively.

9- Number of roots per plant

The obtained results in Table (4) reveal that, the greatest number of roots per plant, (18.2 and 18.1) were produced from seeds treated by using Dormex at 2% while the lowest one (13.8 and 13.9) was obtained from the untreated (control) seed.

As for the effect of growing media, it is clearly shown that (peat + sand) and (peat + clay) media increased root number per plant (17.1 & 17.2) and (16.5 & 17.3) in both seasons. Consequently, the highest number of roots per plant (19.4 and 19.0) was obtained from Dormex treated seeds and (peat + sand) growing media. The obtained results are in agreement with the findings of **Conver and Poole (1983)**, **Harrera (1991)** and **Neha et al (1999)**.

Second Part

Effect of grafting method and scion source on percent of success and scion growth of Casimiroa transplants.

1- Percentage of success

Table (5) shows the percentage of success of *Casimiroa* seedlings budded or grafted by shield and / or cleft methods with using buds or scions from soft or hard wood in both seasons. Results of both seasons generally show that, shield budding method by using soft wood as a source of buds gave the highest percent-

age of success (69.2 and 72.4 %) followed by cleft method with soft wood scion (54.8 and 56.1 %) then shield budding by using hard wood buds (52.7 and 49.6 %), whereas cleft grafting by using hard wood scion gave the lowest percentage of success (41.4 and 40.2%) in the first and second seasons, respectively. The obtained results are in harmony with the findings of **Banker (1990)** who found that, the best results were 72 – 78 % with budding methods.

However, **Chauvatia and Singh (2000)** found that grafting success (73.53 %) was higher in average than that of budding (69.81 %).

2- Period of scion bud emergence

Regarding to Table (5), the period of scion bud emergence was clearly affected by budding or grafting method and type of scion in both seasons. In this respect, the shortest period of sprouted buds was recorded with shield budding (24.0 and 23.0 days), with soft wood buds. However, the longest period (32.0 and 30.4 days), of bud emergence was recorded in cleft grafting method by using hard wood scion. These results are in agreement with these of (**Moran et al 1972**, **Kar et al 1973** and **Hamdy, 1989**) who noticed that, the scions had sprouted 20-30 days after budding or grafting according to the method used. Also **Chauvatia and Singh (2000)** found that, bud sprouting occurred after 13.83 days.

3- Number of leaves per scion

As shown in Table (5) the average number of leaves per grafted scion after 6 months of budding and grafting in both season, had declared apparent influence with the different adopted methods. Any

how, cleft grafting by soft wood scion gave the highest number of leaves per graft (6.0 and 6.6), while shield budding method with hard wood bud produced the lowest count per graft (3.2 and 3.0) in the two tested seasons, respectively. These results are in harmony with the findings of **Iglesios and Sanchez (1987)** and **Chauvatia and Singh (2000)**.

4- Scion Length

As shown in Table (5), the ultimate length per shoot, produced from scion grafted or budded *Casimiroa* seedlings, tended to vary in response to methods and / or type of scions in both seasons. In general, length of sprouted shoots after 6 months of practices reached its maximum (26.5 and 25.7 cm) for shield budding with soft wood scion, while the shortest length (23.3 and 22.5 cm) was reached with cleft method when hard wood scion was used.

The obtained data were almost in agreement with the findings of **Iglesios and Sanchez (1987)** who detected that, when scions were budded or grafted by various methods, the shoot development was superior in scions budded than grafted ones.

5- Scion diameter

With regard to data of Table (5), the average diameter of scion after 6 months of practices showed insignificant differences between methods of grafting and budding and / or type of scions in the two seasons. As such cleft grafting with hard wood and soft wood induced the thickest shoots (0.6 and 0.5 cm) and (0.5 and 0.5 cm). However, the thinnest shoots (0.4 cm) were noticed with shield budded soft and hard wood scion in both seasons,

respectively. In this concern, **Iglesios and Sanchez (1987)** found that, development of shoot was best in budded scion as compared with grafted ones.

6- Average leaf area of scion

Regarding Table (5), the average area of leaf blade significantly varied from (32.16 to 38.28 cm²) and (34.11 to 40.67 cm²) in budding and grafting methods by soft and hard wood scions in the two seasons. Anyhow, shield budding method with soft wood scions gave the largest leaf area. However, cleft method with hard wood gave the narrowest leaf one. Generally, budding method gave the most largest leaves but grafting method gave the narrowest area, this fact came true in both tested seasons. The results in this respect are in agreement with the findings of **Iglesios and Sanchez (1987)** and **Chauvatia and Singh (2000)**.

7- Average number of shoots per graft

Data in Table (5) show, the number of shoots produced after 6 months of grafted *Casimiroa* seedlings. The obtained results declare that, shield budding with soft and hard wood and cleft grafting with hard wood gave the same values of number of shoots per plant, (2.0 and 2.0) whereas cleft grafting with soft wood scion gave (1.0 and 1.0) in the first and second seasons, respectively .

Meanwhile, budding method with soft or hard wood scions were superior in this concern than cleft grafting. These results confirm the findings of **Marcelineo, (1986)**.

Thus one can conclude that *Casimiroa* seeds soaked in MgSO₄ at 5% for 15 min. before sowing in media, consist

of peat and sand at 1:1 in volume induced healthy sizeable rootstocks in a short time. Moreover, grafting rootstocks by soft wood grafts was the best method for producing excellent transplants.

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تأثير بعض المواد الكيماوية وبيئة الإنبات علي إنبات البذور ونمو الشتلات المطعمه في الكازميروا)

[٢٣]

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الجزر (٢٤,٦ - ٢٤,٨ سم) وعدد الجذور علي النبات (١٩,٤ - ١٩,٠). كما اوضحت النتائج ان البرعمة بالعين باستخدام براعم من الخشب الغض اعطت اعلي قيم لنسبة نجاح الطعوم (٦٩,٢- ٧٢,٤ %) واستغرق خروج البراعم اقصر فترة (٢٣ - ٢٤ يوم) كما اعطت اعلي قيم لطول النمو الخارج (٢٦,٥ - ٢٥,٧ سم) واعلي قيم لمتوسط المساحة الخضرية لنصل الورقة (٣٨,٢٨ - ٤٠,٦٧ سم^٢) ، بينما ادت طريقة التطعيم بالقلم القمي باستخدام اقلام من الخشب الغض الي زيادة متوسط عدد الاوراق الخارجة علي الطعم (٦,٠ - ٦,٦) وقطر الطعم النامي (٠,٥ - ٠,٦ سم). وبصفة عامة كانت كل المعاملات المستخدمة بالنسبة للبذور مشجعة وذلك مقارنة بالكنترول (البذور الغير معاملة) ، وكانت افضل المعاملات علي الاطلاق كبريتات الماغنسيوم (٥%) وبيئة الزراعة (بيت + رمل) ، وكذلك فإن التطعيم بالبرعم (العين) واستخدام براعم من الخشب الغض هي الافضل لتطعيم شتلات الكازميروا.

اجريت هذه الدراسة بمعهد بحوث البساتين بالجيزة - مركز البحوث الزراعية بجمهورية مصر العربية داخل صوبة بلاستيك خلال موسمين متتاليين (٢٠٠٢- ٢٠٠٣ و ٢٠٠٣-٢٠٠٤) علي بذور نباتات الكازميروا بهدف انتاج شتلات ذات صفات جيدة صالحة للتطعيم في اقصر فترة ممكنة باستخدام افضل المعاملات للبذور وافضل بيئة للزراعة.

وقد اوضحت النتائج المتحصل عليها ان المعاملة بكبريتات الماغنسيوم (٥%) واستخدام البيت موس+ الرمل كبيئة للزراعة، ادي الي تقصير الفترة المستغرقة للانبات الي (١٩,٣-١٩,١ يوم) ، كما اعطت اعلي نسبة للانبات (٩٢,١-٩٤,٨%) وقللت الفترة التي تستغرقها البادرات للوصول الي عمر التطعيم (١٧٩-١٨٠ يوم) ، كما اعطت اعلي قيم لطول الساق وقطر الساق . ومن ناحية اخري ، فإن المعاملة بالدورمكس عند تركيز ٢% واستخدام البيت والرمل كبيئة للنمو ، ادي الي زيادة طول

أ.د ميخائيل بطرس بسطوروس

تحكيم: أ.د محمد أبو رواش على بدر