

## Establishment of *Grewia tenax* (Forssk.) Fiori from Seeds and Stem Cuttings in the Nursery

K.F. Elkhalfa and S.M. Mahmoud

*Faculty of Forestry, University of Khartoum,  
Post Office of Agricultural and Veterinary Colleges,  
Shambat, postal code 11314, Sudan*

**ABSTRACT.** Guddeim (*Grewia tenax* Forssk.) is one of the important trees native to Sudan. Despite its economic importance in agroforestry, medicine, and nutrition, little or no information is available on its propagation. The present study is an attempt to report on its production by seedlings and stem cuttings in the nursery.

For seedling production, three soil media and three watering intervals were tried.

Above ground parameters (diameter at collar, shoot height, number of leaves/ plant and shoot dry weight) and below ground parameters (root length and root dry weight) were measured. The condition for growth was found to be the use of pure river silt soil with daily irrigation for the first six weeks as initial establishment, and watering every four days thereafter under partial shade.

For stem cutting propagation, Indole butyric acid (IBA) and Naphthalene acetic acid (NAA) were used. However, neither of the two hormones did improve rooting percentage, compared to the control.

Guddeim (*Grewia tenax*) is a member of family Tiliaceae. It is a small tree with branches of white lenticels, alternate simple leaves, numerous stamens and small orange-red fruits.

Guddeim is used as food. FAO (1982) and Abd Elmuti (1991) reviewed the uses of the fruit. The pulp is either eaten fresh or left to dry for later consumption. It also gives a delicious drink and light porridge. It is used as famine food and snack

food. Native people used it for increasing haemoglobin level and for treating malaria. The bark contains many alkaloids and alcohol (Parkash *et al.* 1979).

Guddeim is a multi-purpose tree native to Sudan. Beside the nutritive and medicinal values, the tree has other uses: as fodder and fuel wood tree. The tree can play a great role in the economy. However, little or no information is available on its silviculture. The present study aims at starting the compilation of such information beginning with its establishment in the nursery by seedlings and stem cuttings.

### Materials and Methods

Seeds of Guddeim were obtained from Eldilling area, western Sudan. The experiments were carried out under partial shade in the nursery of the Faculty of Agriculture, University of Khartoum in 1995.

For the seedling experiment a factorial (3x3x3) experiment with a completely randomized design with 20 replicates was adopted. The size of the experiment amounted to 540 poly-thene tubes. The factors chosen and their appropriate level are shown in Table (1).

**Table 1.** Factors selected for the seedling experiment of *Grewia tenax*.

Treatment factors	Level of treatments factors	Treatment factors description
Soil media	3	Pure sand, pure river silt and sand/silt mixture (50/50 by volume).
Watering intervals	3	Every two, four, and six days
Presowing soaking in water	3	Soaked initially in hot water (24 hrs), soaked in cold water at room temp. (48 hrs) and no soaking (control)

Shoot height, diameter and dry-weight as well as root length and dry weight were measured by random sampling throughout the course of the experiment (of 6 months). As far as the cutting experiment is concerned, 20-25 cm long and 1-1.5 cm thick hardwood cuttings were taken from the lower branches. The cuttings were

immersed immediately after preparation in the prepared auxin concentrations (IBA and different levels of their concentrations are shown in Table (2)).

**Table 2.** Treatment factors of stem cutting propagation of *Grewia tenax*.

Treatment factors	Level of treatments factors	Treatment factors description
Auxin types	2	Two auxin were used for dipping the cuttings which are 1. commercial powder of Naphthalene Acetic Acid (NNA) 2. commercial prep preparation, seradix containing Indole Butyric Acid (IBA)
Auxin	3	4000 P.P.M, 8000 P.P.M, and 1200 p.p.m. solutions of each auxin type
Control	0	No auxin

Rooting percentage, number of roots per cutting, root length and number of leaves were recorded at the end of the experiment (after two months from planting).

The experimental data were analyzed using software packages. Comparisons between means were done using least significant difference (LSD) test.

## Results and Discussion

### Seedlings establishment:

#### *Impact of soil media and irrigation interval (days) on growth:*

Table 3 shows that diameters at collar of *Grewia tenax* seedlings were significantly different at  $P = 0.05$  due to soil media. Silt and mix did not differ

**Table 3.** Effect of soil media on diameter at collar (cm) of *Grewia tenax*.

Soil media			
Month	Sand	Silt	Mix
June	0.13 b	0.20 a	0.19 a
July	0.16 b	0.24	0.22 a
August	0.17 b	0.27 a	0.25 a
September	0.15 b	0.26	0.24 a

Means within the same row followed by the same letter do not differ significantly at  $P = 0.05$  using Fisher's Protected LSD.

significantly from each other, but they differed significantly from sand.

With regard to irrigation intervals (days), diameter at collar of *Grewia tenax* did not differ significantly at  $P = 0.05$ .

Soil media used also produced significant differences in shoot height at  $P = 0.05$ . Although, in June and July the differences were clear between soil media, in August and September silt and mix did not differ from sand (Table 4).

**Table 4.** Effect of soil media on shoot height (cm) of *Grewia tenax* seedlings.

Soil media			
Month	Sand	Silt	Mix
June	19.36 c	31.27 a	27.22 b
July	15.96 c	34.38 a	28.91 b
August	21.11 b	39.56 a	36.71 a
September	19.27	39.96 a	36.64 a

Means within the same row followed by the same letter do not differ significantly at  $P = 0.05$  using Fisher's Protected LSD.

With regard to irrigation intervals (days), shoot height (cm) did not differ significantly at  $P = 0.05$  throughout Fisher's Protected LSD.

With regard to irrigation intervals (days), shoot height (cm) did not differ significantly at  $P = 0.05$  throughout the experiment course.

Similar to shoot height, soil media also resulted in significant differences in shoot dry weight (g) throughout the course of the experiment. In June, silt differed significantly from sand and mix, whereas in July and September, silt and mix differed significantly from sand (Tables 5).

**Table 5.** Effect of soil media on diameter at collar (cm) of *Grewia tenax*.

Soil media			
Month	Sand	Silt	Mix
June	0.28 b	0.54	0.35 b
July	0.25 b	0.65 a	0.57 a
August	0.32 c	0.85 a	0.71 b
September	0.32 b	0.86 a	0.72 a

Means within the same row followed by the same letter do not differ significantly at  $P = 0.05$  using Fisher's Protected LSD.

In August the effects of the three soils were significantly different from each other. With regard to irrigation intervals (days), shoot dry weight did not differ significantly at  $\alpha = 0.05$  except in August.

The highest overall mean of diameters at collar (cm), shoot dry weight (g) were obtained in pure river silt followed by the mix (50% sand/50% silt by vol) and sand. Similarly El-Matari (1991) and Moilinga (1992) found that, silt maintained superior growth. This could be due to the better nutritional supply from the silt compared to the nutritional status of light soils (sand and mixture).

Irrigation at 4 days intervals produced the highest overall mean followed by 6 days and 2 days intervals. The superiority of 4 days intervals might be expressed by the fact that watering every 2 days might create bad conditions to the root, that hinder nutrients translocation to shoot or limited aeration in the root area, while 6 days watering causes intervals seedlings might suffer from water deficiency.

The decline in *Grewia tenax* seedlings growth as the irrigation intervals decrease was in line with what has been reported by Kozolowski (1971), that with the decrease of soil water content growth may be retarded.

#### Impact of soil media and irrigation interval on root growth:

Soil media used produced significant differences at  $P = 0.05$  in root length (cm) in June and July. In June silt was not significantly different from sand and mix, while in July sand differed significantly from silt and mix (Table 6).

**Table 6.** Effect of soil media on root length (cm) of *Grewia tenax* seedlings.

Soil media			
Month	Sand	Silt	Mix
June	21.29 a	18.69 ab	17.64 b
July	25.89 a	19.11 b	20.89 b
August	20.02 a	25.98 a	24.24 a
September	26.59 a	24.51 a	26.58 a

Means within the same row followed by the same letter do not differ significantly at  $P = 0.05$  using Fisher's Protected LSD.

Sand resulted in the highest overall means for root length and root weight followed by the mix and silt. This agrees with El-Matari (1991) who found that, sand produced longer roots of *Tamarindus indica* than silt and the mix. Moilinga (1992) observed an increase in root length of *Balanites aegyptiaca* with decrease of silt in

the medium. This might be due to the fact that, the root system is in continuous elongation in search of water, which, in the case of sandy soils, is only available at the bottom of the container. This is also supported by Russel (1973) and Warkentin (1948) who reported that, availability of adequate room makes root extension and growth more favorable. Such root room increased as the soil texture becomes coarse.

For root dry weight silt gave the greatest means followed by the mix and sand. This finding is in contrast to Lavender (1984) who mentioned that root dry weight should be small in silt when the conditions are not limiting.

Root growth of first year seedlings seemed to have been affected by the experiment size, the delicacy of working with roots or the genetic factors more than by the environment.

#### Propagation by stem cuttings:

Stem cuttings of *Grewia tenax* started rooting in the second week after planting. Cuttings rooted easily without auxin application. However the overall rooting percentage appeared to be relatively low (20%). The control gave the highest percentage (30%). While treatment by IBA and NAA resulted in 23% and 6.7% respectively (Table 7).

**Table 7.** Effect of auxin on number and percentage of rooted stem cuttings of *Grewia tenax*.

Parameters	Auxin types		
	Control	IBA	NAA
Number of stem cuttings rooted in each replication:			
Rep. 1 4000 ppm	3	4	2
Rep. 2 8000 ppm	4	2	0
Rep. 3 12000 ppm	2	1	0
Means	3	2.33	0.67
Percentage of stem cuttings rooted	30	23.3	6.7

Means within the same row followed by the same letter do not differ significantly at  $P = 0.05$  using Fisher's Protected LSD.

Throughout the course of the experiment, auxin type and concentration did not affect the number of roots and leaves significantly (Table 8). This result is in contrast to Shamet and Dhiman (1991) working on *Grewia optiva*. However; as they found root length increased significantly with increased auxin concentration.

IBA solutions did hasten rooting, and increased the lengths of root significantly better than NNA (Table 8). This agrees with the findings of Myers (1978). This might be attributed to the nature of IBA, which slowly decomposes and moves into plants, and to its lower toxicity. This is also in line with the work done by Leaky (1987) and Leaky *et al.* (1990) on *Triplochiton scleroxylon* and *Prosopis juliflora* respectively.

**Table 8.** Effect of auxin type on number of roots, number of leaves, root length (cm) of *Grewia tenax*.

Parameters	Auxin types	
	IBA	NAA
Average number of roots per cutting	2.82 a	0.93 a
Average number of leaves per cutting	2.40 a	1.35 a
Average root length (cm) per cutting	2.74 a	0.63 b

Means within the same row followed by the same letter do not differ significantly at  $P = 0.05$  using Fisher's Protected LSD.

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## إكثار شجرة القضم *Grewia tenax* (Forssk.) Fiori بالشتلات والعقل الساقية في المشتل

كمال فضل السيد الخليفة و أس . أم . محمود

كلية الغابات - جامعة الخرطوم - مكتب بريد كليتي الزراعة والبيطرة  
شمبات - رمز بريدي ١١٣١٤ - السودان

تعتبر شجرة القضم من الأشجار المبشرة بمستقبل اقتصادي كبير وذلك لفوائدها المتنوعة في التشجير الزراعي وأهميتها الطبية والغذائية . ورغم كل ذلك لم تجد الشجرة الاهتمام الكافي لاكثارها . أجريت هذه الدراسة لإنتاج الشتلات في مرحلة المشتل لمعرفة أفضل أنواع التربة ومعدلات الري لعمليات الانتاج . كما تعرضت الدراسة للتكاثر الخضري عن طريق العقل الساقية المعاملة بهرموني اندول حمض البيوتريك (IBA) ونافثلين حمض النافثليك (NAA) مقارنة بالعقل غير المعاملة كيميائياً .

تم قياس المتغيرات فوق وتحت التربة في إنتاج الشتلات إذ تم قياس إرتفاع وقطر الشتلات ووزن أغصانها وطول وعدد الجذور بالاضافة إلى نسبة التجذير في الانتاج الخضري .

وجد أن أكثر الظروف ملائمة لإنتاج الشتلات هي استخدام التربة الطميية مع الري اليومي لمدة ستة أسابيع في المرحلة الأولى ثم الري كل أربعة أيام مع التظليل الجزئي .

أما بالنسبة للعقل الساقية فقد وجد أن نسبة التجذير كانت ضعيفة في العقل غير المعاملة كيميائياً ولم تحدث الهرمونات المستخدمة أي تحسن معنوي لهذه النسبة .