

EFFECT OF DIFFERENT NURSERY TECHNIQUES ON SURVIVAL AND GROWTH OF SEEDLINGS OF *AZADIRACHTA INDICA*

Muhammad Tahir Laeeq¹ and Muhammad Asif Aziz²

ABSTRACT

Azadirachta indica (L) A. Juss. (Neem) is native of Indo-Pak sub-continent and Burma. It is a multipurpose tree species, especially having medicinal and pesticidal value. Neem is propagated primarily through seed, but seeds are having viability for short period of time. To get healthy and good quality planting stock appropriate nursery techniques are imperative.

The study was initiated to assess the effect of various nursery techniques on the growth improvement of neem seedlings for obtaining healthy planting stock. The study comprised of four experiments including (i) application of fertilizer (urea) @ 0.2 gm/seedling at 2, 4, 6 and 8 days intervals. (ii) application of a hydroabsorbant polymer having a blend of fertilizer and growth stimulants. (iii) use of four mixtures of soil, sand and farmyard manure in the ratios of 3:2:1, 2:2:1, 4:3:2 and 3:2:2. (iv) use of four sizes of polythene bags (17.8 x 10.6 cm, 17.8 x 8.9 cm, 16.5 x 10.6 cm and 20.3 x 10.2 cm).

The result of fertilizer experiment revealed that control seedlings and those treated at intervals of 4,6 and 8 days with urea gave significantly better survival as compared to those seedlings treated at an intervals 2 days. However, height growth of control seedlings was found significantly better than those of seedlings treated at intervals of 2, 4 and 6 days. In Terracottem study, the chemical did not show any positive effect on survival as well as height growth of the seedlings. In the experiment of four different soil mixtures, no difference in seedlings survival was found among all the treatments. However, soil, sand and farm yard manure mixtures (4:3:2) showed significantly better height growth than mixtures, of 3:2:2 and 2:2:1. No significant difference among four sizes of polythene tubes regarding survival of neem seedlings was observed. However, the tube size of 20.3 x 10.2 cm produced the highest height growth (18.9 cm) which was significantly better than the height growth in tube size of 17.8 x 10.6 cm and 16.5 x 10.6 cm. As statistically, no significant difference in height growth of seedlings in two tube sizes i.e. 20.3 x 10.2 cm and 17.8 x 8.9 cm was found thus tube size of 17.8 x 8.9 cm is recommended for raising neem seedlings on the basis of better height growth and cost effectiveness of this tube size.

INTRODUCTION

Neem tree (*Azadirachta indica*) is a medium to large, usually evergreen tree, 12 to 25 m tall with a diameter of 0.57 to 0.86 m. The crown is broad, dense, spreading and rounded. It is a moderately tolerant tree that withstands some shade at an early age. It grows on soils which vary from rich loams to nutrient deficient sites and requires a precipitation zone of 300 to 1150 mm/yr and a temperature range of 1 to 45°C. (Sheikh, 1993)

Neem tree is native to dry areas of Indo-Pakistan sub-continent. It is also found in Bangladesh, China, Myanmar (Burma), Srilanka and Malaysia. It is

¹ Director, Forest Research Division, Pakistan Forest Institute, Peshawar

² District Manager, Welcome Chemical (Pvt) Ltd.

cultivated as well as naturalized in Thailand and Indonesia. It has been planted successfully in Sudan, Saudi Arabia and Sahelian zones of Africa. It has also been successfully introduced in Philippines and Haiti (Abdullah, 1972). Probably the world's largest and nearly pure stand of neem trees exists in Saudi Arabia in which fifty thousand plants have been planted in the plain's of Arafat near Mecca.

In Pakistan it is cultivated throughout Sindh, Southern Punjab, lower Balochistan and in some parts of Southern Khyber Pakhtoonkhwa. However, neither natural stand nor compact plantations of neem are found in the country. Although scattered planted trees are found near habitation, railway stations, in schools in playgrounds in courtyards of old office buildings, along canal and road sides. Anon (1980) reported its use as windbreak and a source of soil improvement.

Presently neem tree is receiving considerable recognition for its multiple use. It is one of the most valuable multipurpose tree species, least exploited amongst tropical trees. Neem tree produces timber, fire wood, fodder and other products to meet basic needs in the rural household, like medicines, pesticides, mosquito repellent, fertilizer, diabetic food, soap, lubricants, gums, agricultural implements. The neem based pesticides are safe, non toxic and non residual to agriculture produce. Neem is an important multipurpose tree species of medicinal, pesticidal and insecticidal properties (Mughal, 1992). Neem products for plant protection also help in reducing the atmospheric pollution and prevailing food poisoning. The tree has answer for several environmental problems such as rehabilitation of degraded lands. Controlled use of agro-chemicals and pesticides. Therefore, neem is regarded as tree for global problems having great potential to help the small farmers and save the environment of tropics.

Neem tree has wide climatic adoptability and can be established in dry regions receiving low annual rainfall of 500mm or less. It has good coppicing power and regenerates well through coppice and root suckers. Neem is propagated primarily through seed. The seeds are recalcitrant which have short viability. Another option for establishment of neem plantation is through stump planting, however, the most popular and economic method of propagation is through seeds.

Direct sowing in the field results in weak plant growth and higher failure percentage of seedlings. To avoid these problems the healthy and good quality planting stock can be raised in the nursery through intensive management and appropriate nursery techniques.

This study was conducted with the objective to determine the suitability of a nursery technique for obtaining healthy and vigorous neem seedlings in a comparatively short period of time. For this purpose the followings four nursery techniques were studied for raising neem seedlings.

- i. Application of fertilizer in different doses

- ii. Application of hydroabsorbent containing a blend of fertilizer and growth stimulator
- iii. Use of various soil mixtures
- iv. Use of different sizes of polythene tubes

MATERIAL AND METHODS

Four nursery techniques, including (i) use of fertilizer (Urea) at different intervals. (ii) application of a hydroabsorbant with growth stimulant namely, Terracottem. (iii) different sizes of polythene bags, and different soil mixtures, were tested in the Silviculture Nursery at Pakistan Forest Institute, Peshawar.

i) Effect of different doses of fertilizer on seedlings

Fresh and depulped seed of neem were sown in the month of August 1996 in polythene tubes of 17.8 x 10.6 cm size filled with a soil mixture in 3:2:1 (soil:sand:manure) ratio. When the seedlings were about 2 weeks old, 500 seedling of equal size were selected and arranged in a randomized complete block design with 5 treatments including control in 4 replications. In each replication there were 25 seedlings per treatment. The dose of urea fertilizer was given at the rate of 0.2 gm per seedling at 2,4,6 and 8 days of intervals. Soon after the layout of experiment, the treatments were started and continued during the whole experimental period. Consequently, each seedlings treated after 2, 4, 6 and 8 days interval got in total 5.8gm, 3.0gm, 2.0gm and 1.6gm of urea respectively. The seedlings were irrigated equally in all treatments.

ii) Effect of Terracottem on seedlings

To test the efficacy of a hydroabsorbant polymer (Terracottem) blended with fertilizer (4-1-2 NPK) and growth stimulators was used. The neem seeds were sown in polythene bags of 17.8 x 10.6cm size filled with loamy soil, sand and manure in a ratio of 3:2:1 and treated with terracottem @ 1.5gm/tube. Seeds were also sown in untreated soil mixture as control.

After 2 weeks of germination, 200 seedlings each from treated and untreated stock and having the same height were selected and arranged in a randomized complete block design experiment with four replications; every replication comprising 50 seedlings of each treated and untreated.

iii) Effect of four different soil mixtures as growing media on seedlings

Four soil mixtures of soil, sand and manure in different ratios i.e. 3:2:1, 2:2:1, 4:3:2 and 3:2:2 were prepared and filled in polythene bags of 17.5 x 7.5 cm size followed by sowing with neem seeds. Neem seedlings raised in each of four soil mixtures, 2 weeks old 100 seedlings of equal size were selected and used in the experiment arranged in a randomized complete block design having four replications

and each replication containing 4 treatments. All seedlings were irrigated equally and normally.

iv) Effect of different sizes of polythene bags on seedlings

Polythene bags of four different sizes, i.e. 17.8 x 10.6 cm, 17.8 x 8.9 cm, 16.5 x 10.6 cm and 20.3 x 10.2 cm (in unfilled and flat condition) were filled with soil mixture of soil, sand and manure in a ratio of 3:2:1. Two weeks old 400 seedlings of equal height were selected and used for the experiment. The experiment was laid out in a randomized complete block design with four replications and with same number of treatments. Each polythene bag size was considered as a treatment. In each treatment of a replication, there were 25 seedlings. All the seedlings were irrigated normally.

v) Data collection and analysis

In all the experiments height and survival data of all seedlings was recorded at the age of 10 weeks. The data on seedlings height and survival were tabulated and analysed statistically.

RESULTS AND DISCUSSION

a) Effect of different doses of fertilizer on seedlings

Effect on survival

The data on survival of *Azadirachta indica* seedlings treated with urea fertilizer were recorded as follows:

Survival of neem seedlings under different fertilizer treatments

Treatment	Survival% *
T ₁	46
T ₂	77
T ₃	80
T ₄	93
T ₅	95

* Survival out of 25 seedlings in a treatment of each replication

Where

- T₁ = Application of urea fertilizer @ 0.2 gm/seedling after two days.
 T₂ = Application of urea fertilizer @ 0.2 gm/seedling after four days.
 T₃ = Application of urea fertilizer @ 0.2 gm/seedling after six days.
 T₄ = Application of urea fertilizer @ 0.2 gm/seedling after eight days.
 T₅ = No treatment (control)

The data indicated maximum survival of 95% in the seedlings where no fertilizer was applied (control), while the lowest survival of 46% was observed in treatment T₁ where the fertilizer was given after two days interval. Similarly 77%, 80% and 93% survival of the seedlings was registered in treatments of 4 days, 6 days and 8 days intervals respectively. As the frequency of fertilizer increased, it affected the survival of seedlings adversely.

The ANOVA and LSD test indicated the treatment T₁ (application of fertilizer after two days) significantly different from the treatments T₂, T₃, T₄ and T₅. However, treatments T₂, T₃, T₄ and T₅ were not found significantly different from each other. The fertilizer used most frequently i.e. at 2 days interval for 29 times affected the survival of seedlings negatively and most of the seedlings were died in this treatment. It seems that either the application of urea was too frequent or too much as a whole, therefore, low doses at greater interval and for less number of times may be tried before concluding the impact of urea fertilizer on survival of seedlings.

Effect on height growth

Data on height growth of seedlings of *A. indica* under treatments of urea fertilizer applications at different intervals were recorded as follows:

Height growth of neem seedlings (cm) under different fertilizer treatments

Treatment	Height (cm)
T ₁	18.4
T ₂	18.8
T ₃	18.9
T ₄	19.2
T ₅	20.2

The height growth data indicated that seedlings gained maximum height of 20.2 cm in the treatment T₅ where no fertilizer was applied, while the lowest height of 18.4 cm was attained by the seedlings in treatment T₁, where the fertilizer was applied after two days interval. Similarly the seedlings gained the height of 18.8 cm, 18.9 cm and 19.2 cm in the treatments T₂, T₃ and T₄ respectively.

The ANOVA and LSD test indicated significant difference among the treatments that the treatment T₅ (control) is significantly different from T₁, T₂ and T₃ but not significantly different from T₄ treatment. She, et al (1986) also conducted studies on effect of fertilizer treatment on *A. indica* seedlings and reported that growth was not enhanced by fertilizer treatment.

b) Effect of Terracottem on seedlings**Effect on survival**

To compare the survival of neem seedlings treated with terracottem with the seedlings grown in the normal growing media i.e. soil: sand: farmyard manure (3:2:1), the data on survival of seedlings were recorded as follows:

Survival of neem seedlings under Terracottem and control treatments

Treatment	Survival % *
Treated	89
Untreated	91

* Survival out of 50 seedlings in a treatment of each replication

The analysis of variance indicated no significant difference between the two treatments with respect to survival of seedlings.

Terracottem is a hydroabsorbant polymer and is claimed (by the manufacturer) to be capable of absorbing water 100 times of its weight and retain it for a long time for subsequent supply to plant. However, the neem seedlings watered once in a day did not show any significant positive response to application of terracottem as far as survival of seedlings is concerned. Neem is a species having the characteristics of growing in dry climates with low soil moisture (Siddiqui 1995). Thus neem seedlings did not show significantly positive response to Terracottem mixed soil media which was rich in soil moisture.

Effect on height growth

Data on height of neem seedling treated with terracottem and without treatment were recorded as follows:

Height growth (cm) of neem seedlings raised in soil mixture treated with Terracottem and un-treated soil mixture

Treatment	Av. Height (cm)
Treated with Terracottem	19.8
Untreated	19.3

The height growth data indicated that seedlings treated with the Terracottem gained slightly more height (19.8 cm) than height of seedlings in control (19.3 cm). The analysis of variance indicated that there was no significant difference between the two treatments.

c) Effect of four different soil mixtures as growing media on seedlings

Effect on survival

The survival of neem seedlings raised in four different soil mixtures were recorded after 8 weeks of layout of experiment as follows:

Survival of neem seedlings under different soil mixture treatments

Treatment	Survival %*
T ₁	99
T ₂	99
T ₃	99
T ₄	98

* Survival out of 25 seedlings in a treatment of each replication

T ₁	=	3:2:1 (soil : sand : farmyard manure)
T ₂	=	2:2:1 (soil : sand : farmyard manure)
T ₃	=	4:3:2 (soil : sand : farmyard manure)
T ₄	=	3:2:2 (soil : sand : farmyard manure)

The above data indicated that highest survival of 99% was obtained in treatments T₁, T₂ and T₃ while 98% survival was given by the seedlings in treatment T₄.

The ANOVA indicated no significant difference among the treatments, which means that all the above four soil mixtures are equally good as regards the survival of neem seedlings is concerned.

Effect on height growth

Data on height growth of neem seedlings raised in four different soil mixtures were recorded at the age of 10 weeks as given below:

Height growth of neem seedlings (cm) raised in four different soil mixtures

Treatment	Height (cm)
T ₁	18.2
T ₂	17.2
T ₃	19.0
T ₄	17.4

The data indicated that the maximum height (19.0 cm) of the seedlings was obtained in soil mixture of T₃ treatment (4:3:2), while the lowest height (17.2 cm) was obtained in the treatment T₂ (2:2:1). Similarly, the height of the seedlings observed in

T₁ and T₄ treatments were 18.2 cm and 17.4 cm respectively.

The ANOVA and LSD test for the height data of the seedlings indicated that there is significant difference among the treatments. The height data indicated that treatments T₃ and T₁ have no significant difference, however, treatment T₃ showed significant difference from the treatments T₄ and T₂. Treatments T₁ and T₄ have no significant difference between them. But T₁ treatment showed significant difference from T₂ treatment. However, no significant difference was found between treatments T₄ and T₂. These results indicated that soil mixture of treatment T₃ is the best among the four soil mixtures used for growing neem seedlings followed by treatment T₁.

d) Effect of four different sizes of polythene bags on seedlings

Effect on survival

Data on survival of seedlings raised in four different sizes of polythene tubes were recorded and given below:

Survival of neem seedlings raised in different sizes of polythene tubes

Treatment	Survival % *
T ₁	98
T ₂	99
T ₃	96
T ₄	99

* Survival out of 25 seedlings in a treatment of each replication

T ₁	=	size (17.8 x 10.6 cm)	T ₃	=	size 16.5 x 10.6 cm
T ₂	=	size (17.8 x 8.9 cm)	T ₄	=	size 20.3 x 10.2 cm

The data indicated that highest survival of 99% was obtained in treatments T₂ and T₄, whereas the treatment T₃ indicated the lowest survival of 96%. The analysis of variance indicated no significant difference between the four treatments of tube sizes, which means that all the four tube sizes are equally good for raising neem seedlings regarding their survival.

Effect on height growth

Observation on height growth of neem seedlings raised in four different sizes of polythene tubes at the age of 10 weeks were recorded and presented below:

Height growth (cm) of neem seedlings raised in four different tube sizes

Treatment	Av. Height (cm)
T ₁	17.4
T ₂	18.7
T ₃	16.6
T ₄	18.9

The data indicated that the maximum height (18.9 cm) of seedlings was obtained in tube size of T₄ treatment (20.3 x 10.2 cm), while the lowest height (16.6 cm) was observed in the treatment T₃ (16.5 x 10.6 cm). In treatment T₃ the tube size is small having less quantity of soil mixture, thus the seedlings got smaller space as well as less nutrients, due to which the height of the seedling was found minimum.

The ANOVA and LSD test of height data indicated significant difference among the treatments. The analysis indicated that T₄ and T₂ treatments are laid out in the same group, and are not significantly different from each other, but treatment T₄ is significantly different from other two treatments i.e. T₁ and T₃. Although the treatment T₂ is not significantly different from treatment T₁ but it is significantly different from treatment T₃. No significant difference between treatments T₁ and T₃ was observed. It is obvious that the polythene tubes in treatment T₄ having the maximum length provided more space for root growth, which also resulted in the highest shoot growth.

CONCLUSION

The study was carried out to observe the survival and growth response of neem seedlings under various nursery techniques, including application of fertilizer (urea) with different frequencies, hydroabsorbent polymer having a blend of fertilizer and growth stimulants (Terracottem), use of various soil mixtures and use of different sizes of polythene tubes. The following conclusions were made from the results.

- i. The neem seedlings without fertilizer treatments showed the highest survival and height growth. Thus no urea fertilizer is required for enhancing growth of neem seedlings raised in the soil mixture used in the nursery stage.
- ii. During the study period terracottem had no significant positive effect on survival and height growth of seedlings due to already available sufficient quantities of nutrient and moisture in the soil mixture. Perhaps it could produce some effect, if seedlings were kept for a longer time in the nursery.
- iii. Different soil mixtures did not produce any significant difference in survival of neem seedlings, indicating that all the above soil mixtures are equally good as regards the survival of neem seedlings is concerned.

- iv. The soil, sand, farmyard manure mixtures in ratio of 4:3:2 was found significantly better than other two mixtures i.e. 3:2:2 and 2:2:1 for height growth of neem seedlings.
- v. Among the four sizes of polythene tubes tested for raising neem seedlings, no significant difference in survival percent was found. However, tube size 20.3 x 10.2 cm produced better height growth than other sizes i.e. 17.8 x 10.6 cm and 16.5 x 10.6 cm. As statistically there is no significant difference in height growth of seedlings in two tube sizes i.e. 20.3 x 10.2 cm and 17.8 x 8.9 cm the later size is recommended for raising neem seedlings on the basis of cost effectiveness of this size.

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