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Native Plant Propagation Guide
for *Acacia pachyceras*

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Food Security Program
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Designed by Oudah Orabi

Acacia pachyceras/*Vachellia pachyceras*
(Al Talha, الطلحة)

Family: Fabaceae

Kuwait's arid desert climate, characterized by extreme and unpredictable temperatures and rainfall, supports a limited variety of vegetation. The native flora, typically drought tolerant and adapted to these harsh conditions, includes a single native tree species, locally known as "Talha", and 34 species of shrubs, along with various herbaceous perennials and annuals (Omar et al., 2007).

The lone specimen of Kuwait's native tree species, *Acacia pachyceras* (synonym: *Vachellia pachyceras*), which is commonly referred to as "the Lonely Tree", is preserved in the Sabah Al-Ahmed Nature Reserve, Kuwait (Figure 1). Ongoing conservation efforts focus on the propagation and revegetation of this unique tree to prevent its extinction and ensure the continuation of local biodiversity. In view of these facts, it is significant to disseminate the knowledge on the aspects of propagation and optimal cultural practices for the efficient production of these seedlings. This information can serve as a valuable resource for nurseries and emerging research professionals, facilitating the mass propagation and production of this species.

The most effective propagation method for *A. pachyceras* is either through seeds or by transplanting the seedlings.

Distribution: Kuwait, Saudi Arabia, and Oman (Abdullah and Al-Dosari, 2022)



Figure 1. Lonely tree of Kuwait: *Acacia pachyceras*.

Seeds

Acacia pachyceras seeds can be procured commercially from Saudi Arabia. Previous experience has shown that these seeds can be stored for a long period of 10-15 years at 4^{o}C without significant loss in viability.

Acacia pachyceras seeds have a hard seed coat, exhibiting physical dormancy, which prevents water absorption and subsequent germination. To overcome this dormancy, either mechanical or chemical scarification methods can be used (Figure 2).



Figure 2. *Acacia pachyceras* seeds.

Scarification (Pre-treatment)

Mechanical Scarification

In mechanical scarification, the broader side of the *Acacia pachyceras* seed is gently scarified (rubbed) on sandpaper until the hard seed coat is broken, exposing the white inner portion. Care should be taken to protect the pointed side of the seed, which contains the micropyle, from any damage during the process.

Chemical Scarification

The physical dormancy of Acacia can also be broken through chemical scarification using concentrated sulphuric acid (H_2SO_4). To do this, seeds should be soaked in concentrated sulphuric acid in a glass beaker for 15- 20 minutes. A metal sieve should be kept under running water (in the sink) and the acid should be decanted from the glass beaker by slowly pouring it into the sieve. Extreme care should be taken while handling acid as fumes might be generated when the concentrated acid is added to water. Hence, protective measures, including wearing protective clothing, gloves, and a mask, are essential while doing this procedure. The treated seeds should then be washed thoroughly with running water and dried with tissue paper (Suleiman et al., 2018).

When comparing the two procedures, mechanical scarification is generally more effective than chemical scarification due to its higher success rate. However, when we deal with large quantities of seeds, mechanical scarification can be labour-intensive and time-consuming. Similarly, chemical scarification requires careful handling.

It is advisable to scarify the seeds irrespective of the planting technique, whether sowing seeds directly or transplanting seedlings.

Propagation through Seeds

Seed Rate

Based on previous experience, a seed rate of 71 g/ha, which is approximately 825 seeds, is recommended to obtain 400 seedlings/ha at 5 m x 5 m spacing for revegetation projects. The seed rate can be reduced based on the availability of the seeds. Depending on the objective, the spacing can also be increased. However, increased spacing will result in the increased initial costs and effort, as these plants require additional irrigation during the early stages.

Once germinated, the mortality rate in Acacia is typically very low. The suggested seed rate was calculated based on the following assumptions:

i) Seed lot viability of 90%,

ii) Germination percentage of 70%, and

iii) Survival percentage of 70%.

Direct Sowing in Field

After scarification, the seeds should be either sown directly in the field or used to produce seedlings in a greenhouse, which should be hardened for 3-4 months and transplanted in the field. If seeds are sown directly in the field, the topsoil should be loosened with a shovel or rake, and the seeds should be sown at a depth of ½ inch in rows. It is recommended to use a spacing of 5 m x 5 m (Figure 3).



Figure 3. *Acacia pachyceras* seedling germinated from seed sown directly in the field.

Transplanting of Nursery Grown Seedlings

Nursery Techniques

- The scarified seeds (either mechanical or chemical) should be soaked in water for 24 hours and then placed in a Petri dish, either lined with moistened filter paper or without any medium. Once the radicle emerges, the seedling should be transferred to a jiffy pot (6 cm diameter x 6 cm height) or any other small pot (to save space), with agricultural soil used as the planting medium.
- The Acacia seeds grow faster in agricultural soil medium than in the planting mix. If a soil mix is used, it is recommended to maintain a ratio where sand predominates over potting soil and peat moss (2:1:1- sand: peatmoss: potting soil). Once the plant reaches the 3-4 leaf stage (2 leaves after the cotyledons), the seedlings should be transplanted into small gallon pots containing either soil or potting mix.
- The propagation is typically initiated during the months of October-November in Kuwait. Approximately after one month, the seedlings should be transplanted from 5 cm jiffy pots to 1-gallon pots, depending on availability and requirements (Figure 4).

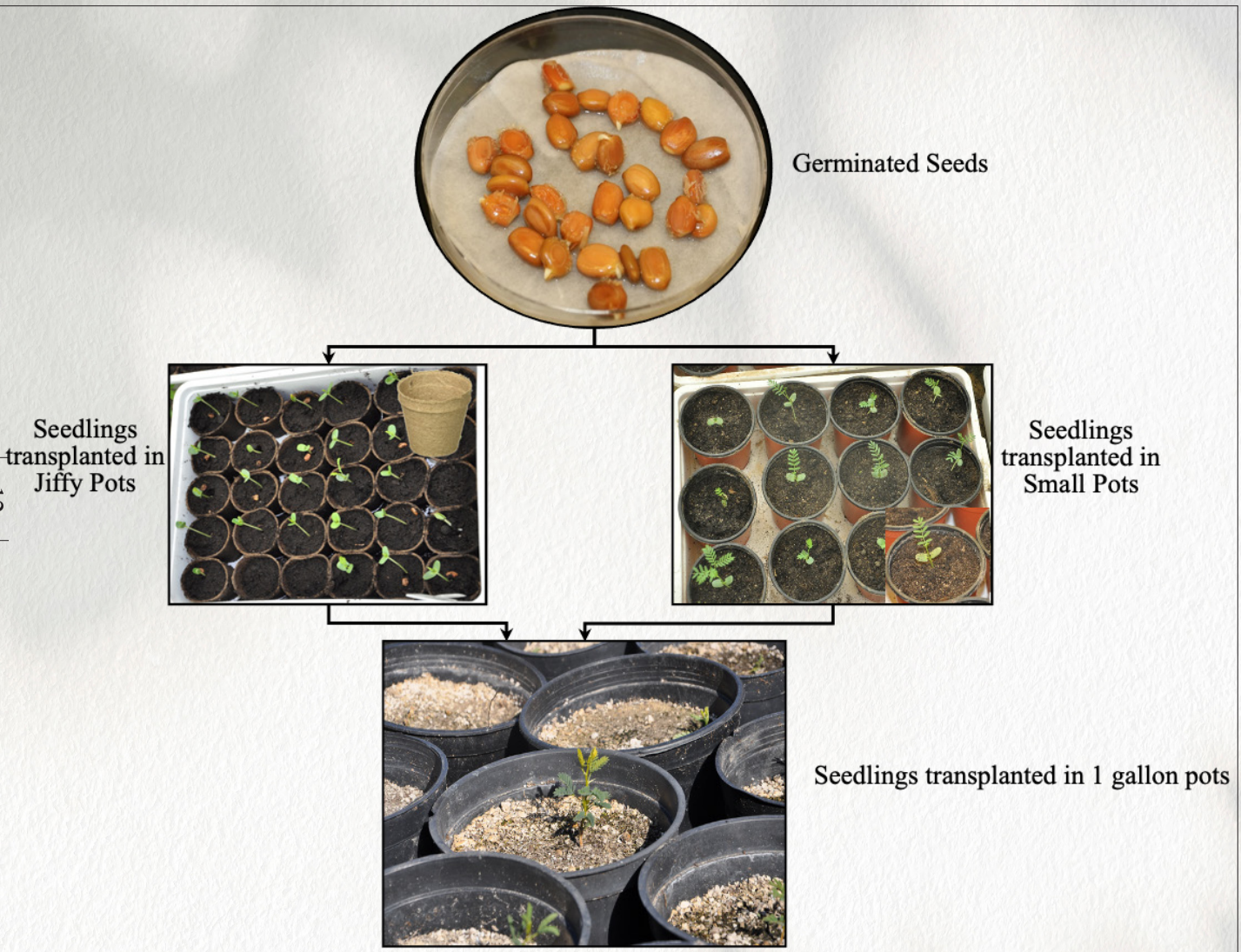


Figure 4. Transplantation of *Acacia pachyceras* germinated seeds.

Field Planting and Aftercare

After transplanting, the seedlings should be maintained inside the greenhouse for a month or until they reach a height of 20-30 cm (Figure 5). Acacia plants respond positively to sunlight, which promotes growth. Hence, when the climatic conditions are favorable, the seedlings should be kept outside the greenhouse for a month to undergo further hardening.



Figure 5. Transplanted *Acacia pachyceras* seedlings maintained outside greenhouse.

The optimal time to transplant seedlings in the field is between February and March, which coincides with the peak growing season in Kuwait. In contrast, it has been observed that the mortality rate of seedlings transplanted during the peak summer is still low, provided they are properly irrigated. However, February to March remains the ideal period. The planting pit should have dimensions of 30 cm width and 30 cm depth. The planting hole should be filled with one gallon organic manure and ½ gallon of potting soil. After mixing these, the plant should be transplanted into the hole. In addition, two tablespoons of hydrophilic polymer (e.g., Agrihope) can be mixed (not mandatory) with the topsoil prior to the first irrigation, to improve water use efficiency. The recommended spacing for Acacia in the field is 5 m x 5 m (Figures 6 and 7).

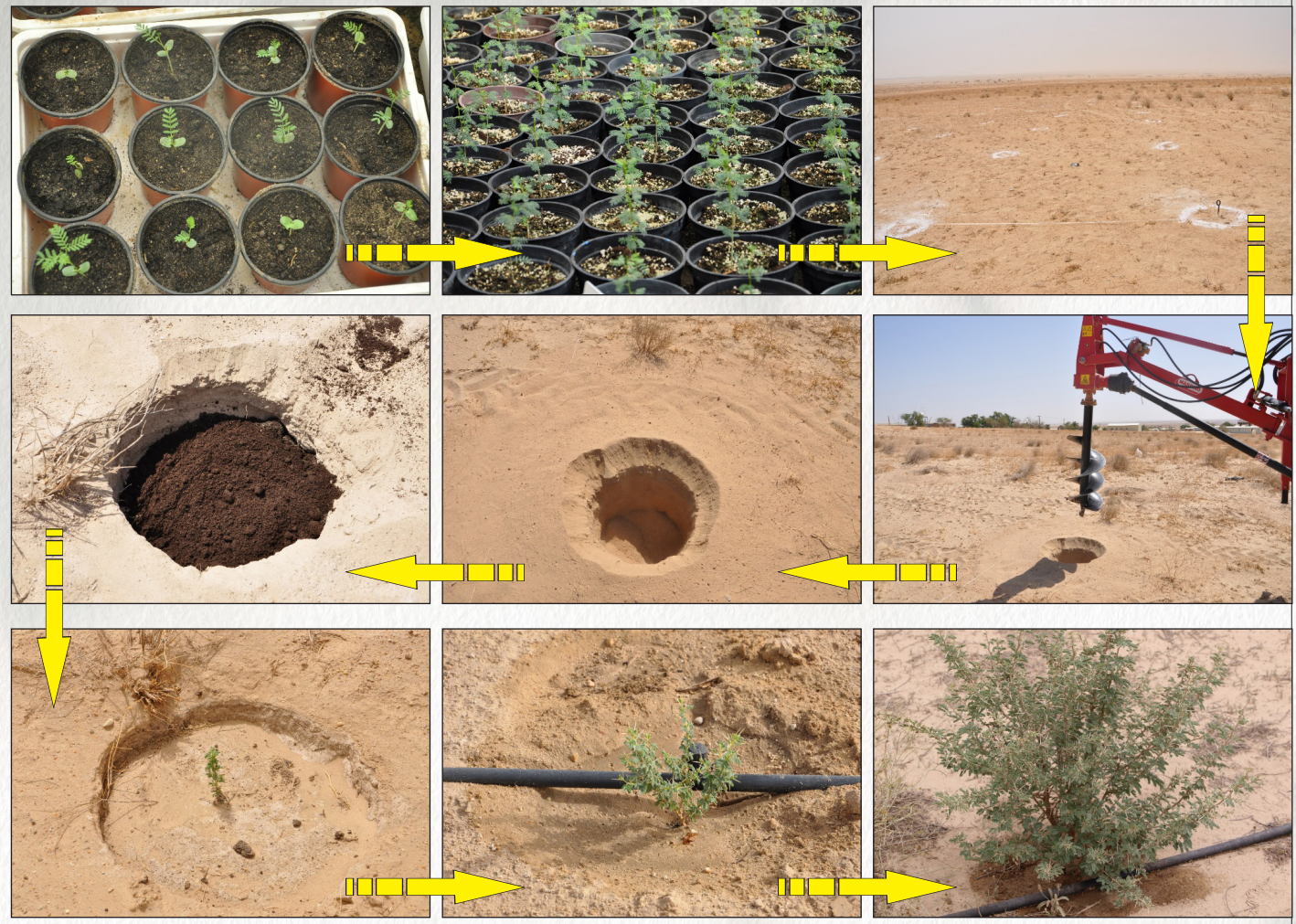


Figure 6. Transplantation of *Acacia pachyceras* seedlings in the field.



Figure 7. Performance of *Acacia pachyceras* in the field.

Irrigation

In Nursery

Acacia plants are highly drought-tolerant and can survive with minimal water. During the first month, the optimal water quantity is sufficient to maintain the soil in a slightly moist condition. Though the Acacia plant can withstand waterlogging, its growth is optimum when the soil remains slightly moist. If the planting medium is agricultural soil, care should be taken to avoid extreme soil dryness that may lead to plant wilting.

After transplanting into a 1-gallon pot, 1 liter of water per pot every 4-5 days is sufficient. The thumb rule is to ensure that the soil remains moist (neither too dry nor waterlogged) during the initial growth periods.

In Field

Once the seedlings are in the field, the plants should be drip irrigated with a drip flow equivalent to 1.5 lit/day/plant approximately, twice a week during winter, from November to May. During the peak summer months (June- October), irrigation should be provided on alternate days for the first five years. Once the plants are established, they can survive with one irrigation per week during winter (November-May) and two irrigations per week during summer (June-October).

Additionally, if the initial planting occurs during drier periods, the application of polymers (two tablespoons approximately 5 g per seedling-) will help conserve moisture in the soil, facilitating plant survival and growth. Polymer can be mixed in the soil around the plant within a 15 to 20 cm diameter. Even after establishment, the application of hydrophilic polymers (e.g., Agrihope) during the summer months will continue to benefit plant growth by improving water retention.

Fertilizer Application

After transplanting in the field (up to 7 years), each year, during the months of September-November and February-April, 3-5 g of 15:15: 15 NPK mix or 18:18:18

NPK should be applied per tree, placed 25 cm from the base in a circular pattern after loosening the soil. It is important to ensure that irrigation is provided after each fertilizer application, to facilitate easy release and absorption of nutrients. If monthly fertilizer application is not feasible during September-November and February to April, at least one application during these periods is sufficient. Organic manure can also be applied at the rate of 1 gallon per tree during February-March. However, a two-week gap should be maintained between the application of organic manure and synthetic inorganic fertilizers to avoid any adverse interactions.

After 7-8 years of plantation, super phosphate fertilizer should be applied at a rate of 2-3 g/tree during October-November to enhance flowering. This should be followed by the application of potassium nitrate fertilizer at 2-3 g/tree during December-January, placed 30 cm away from the base, to promote fruit setting. Potassium fertilizers can also be applied through fertigation by mixing 1 kg of potassium nitrate in 1000 gallons of water.

Additionally, a bacterial mix (Pseudomonas putida in liquid form + *Bacillus subtillis* in liquid form + Phyto EM in powdered form) can also be applied as a soil stimulant. Four hundred milliliters of each of the above-mentioned items, along with 200 ml of date syrup, should be mixed in 1 liter of water and allowed to ferment for three hours. This mixture is then diluted with 40 liters of water and applied at a rate of 2 liters per tree at the base of each tree.

It is important to maintain at least a one-month gap between chemical fertilizer application and the bacterial mix application. For example, if the bacterial mix is applied in October, the chemical fertilizer should be applied one month later. In addition, it is advisable not to use the bacterial mix as a soil stimulant during the summer to ensure optimal benefits.

Pruning

Occasional mild pruning of branches is recommended for plants with a thick canopy, especially near the basal area, during October-November, prior to fertilizer application (Figure 8).

Flowering

Flowering in *Acacia pachyceras* typically occurs during January-February, while seed set is observed during March-April. Flowering and fruit setting may be delayed due to variations in climate, rainfall, and other external factors.



Figure 8. Pruning performed on *Acacia pachyceras.*

With regular irrigation and fertilization during November–January, flowering and seed setting can be expected once the *Acacia pachyceras* tree reaches 7-8 years of age. The details in this booklet are initial observations of the authors and can be revised or updated based on insights gained from continuous monitoring of the performance of Acacia trees under the harsh and variable climatic conditions of Kuwait. As the *Acacia pachyceras* tree is an integral part of Kuwait's heritage, its conservation through commercial propagation and planting in revegetated areas is of critical importance to the State of Kuwait.

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