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Walnut Nursery Raising Made Easy: From Seed Stratification to Successful Tongue Grafting

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Walnut is an important high-value nut crop of the North-Western Himalayas, where its expansion is constrained by limited availability of quality, true-to-type planting material. An integrated nursery protocol involving 8-week seed stratification, cocopeat + FYM (1:1) growing medium, selection of healthy rootstocks, and tongue grafting in the first week of February can facilitate efficient multiplication of elite walnut plants for farmers.

Introduction

Juglans regia L., commonly known as English, Persian, white, or common walnut, is one of the most widely cultivated nut crops in the world and belongs to the family Juglandaceae (McGranahan and Leslie 2012). Walnut is valued not only for its economic importance but also for its excellent nutritional properties. The kernel contains about 64.50% fat, 15.20% protein and 13.70% carbohydrates, providing approximately 654 kcal of energy per 100 g, also an important source of omega-3 fatty acids and antioxidant compounds, making walnut a highly nutritious component of a healthy diet (FDC 2019). Walnut is naturally adapted to cool temperate climates and performs best in areas where trees are protected from severe spring frosts and summer temperatures generally remain below 30 °C. In India, walnut cultivation is predominantly concentrated in the Himalayan region, with commercial production mainly restricted to Jammu and Kashmir, Himachal Pradesh and Uttarakhand. The crop currently occupies about 96,680 hectares in the country, producing approximately 3.22 lakh metric tonnes annually (Anonymous 2024). Despite its considerable potential, walnut production in India is constrained by low productivity and variable nut quality. One of the major challenges is the limited availability of true-to-type, vegetatively propagated plants of elite clones and suitable rootstocks, coupled with inadequate nursery and orchard management practices. Traditionally, walnuts have been propagated predominantly through seed, which leads to considerable variability among seedlings and has resulted in the establishment of a large number of seedling-based orchards (Regmi et al. 2023). Therefore, the development of efficient nursery propagation techniques for producing uniform and high-quality walnut plants is essential for the establishment of productive and commercially sustainable orchards.

Importance of quality planting materials in walnut

Walnut can be propagated either through seeds (sexual propagation) or by vegetative methods such as grafting (Vahdati et al. 2021). Although seed propagation is simple and widely practiced, it has several inherent limitations. Walnut seeds exhibit dormancy, which can delay

and reduce germination and subsequently affect early seedling establishment. Moreover, seedlings are genetically variable and generally do not retain the desirable characteristics of the parent tree. This variability may result in excessive and inconsistent tree vigour, irregular productivity, poor orchard uniformity and a prolonged juvenile period, with seedling trees often requiring 8–10 years to reach commercial bearing (Chalise et al. 2021). Successful nursery production also depends greatly on the selection of an appropriate growing medium. An unsuitable or poorly managed medium can adversely affect seed germination, root development and subsequent seedling growth. Vegetative propagation, particularly grafting, offers the advantage of producing plants that retain the desirable characteristics of selected genotypes; however, walnut is considered relatively difficult to graft compared with many other temperate fruit crops (Sadeghi et al. 2019). Low and inconsistent graft-take percentages remain one of the major constraints to the rapid multiplication of elite walnut cultivars. The difficulty of walnut grafting is associated with the interaction of several factors rather than with grafting technique alone. Graft success may be affected by the type and precision of grafting method, temperature and relative humidity during healing, the physiological and nutritional status of the scion, hormonal balance, phenolic compound concentration, and the maturity and timing of scion collection (Davies et al. 2018). Consequently, successful walnut nursery production requires careful management of both pre-grafting and post-grafting conditions, along with the use of appropriate propagation techniques.

Methodology of raising true to type elite walnut nursery plants

The production of true-to-type, elite walnut nursery plants involve a systematic sequence of nursery operations, beginning with the careful selection of healthy and viable seeds. The selected seeds are subjected to appropriate pre-sowing treatments to overcome dormancy and ensure uniform germination. The resulting seedlings are then raised under suitable nursery conditions to develop healthy and vigorous rootstocks. These rootstocks are subsequently used for vegetative propagation through suitable grafting techniques to multiply elite walnut genotypes. Following successful graft union formation, the grafted plants are carefully nurtured and hardened before being supplied to farmers for orchard establishment. Thus, the entire process—from seed selection and germination to rootstock development, grafting and production of field-ready plants—forms an integrated technical pathway for producing quality, genetically uniform walnut planting material (Figure 1).

Seed selection and stratification: Since walnuts are a temperate fruit, their seeds need to undergo a low temperature exposure process known as stratification for a period of 8-weeks, to break their dormancy, which further results in resulting in germination of 87.99 %, better seedling growth, and no morphological deformation (Panwar et al. 2026). For stratification, walnut seeds of uniform size (11.00- 134.00 g dry weight basis) are selected from the fruits that are harvested from wild walnut trees (kathu) in the month of August-September. Before stratification, the selected seeds are soaked for 24 hours in a tub of water (with water having approximately temperature of 22-24 °C). For stratification, the seeds that landed to the tub's bottom are gathered. The soaked seeds are placed in alternating layers of damp sand in a pit measuring 6-7 feet in length, 2 feet in width and 3 feet in depth with a suitable water drainage source in the last week of December. To provide adequate moisture, grass (hay) was placed over the top layer (Figure 1a-1c).

Seed germination: The stratified seeds for 8 weeks (Figure 1d) are further planted in nursery beds (2.5 m × 1.5 m) at a distance of 15 cm row to row and 10 cm seed to seed (2.5 cm deep) during the first week of March in an open field using various growing media in a mixture of cocopeat and FYM (1:1) (Figure 1e). Regular irrigation through mini sprinklers (flow rate of 20-110 litres per hour, operating pressure of 1.5 to 2.5 kg/cm² with 4 mm pipe diameter) (watering done for at least 2-3 hours during summer and 1-2 hours during other seasons in evening time) and regular weeding is done. The emergence of plumule signifies the germination of seed (Taiz and Zeiger 2010) (Figure 1f).

Selection of raised seedling rootstock: At the end of the growing season, preferably during the last week of December, healthy and vigorous walnut seedlings are carefully selected as

rootstocks for grafting. Seedlings should be free from diseases and pests, have a healthy and undamaged root system, and possess a uniform stem diameter of approximately 10–12 mm at the grafting point (Figure 1g). Care should be taken during lifting and handling to avoid injury to the roots. The selected seedlings are then maintained under suitable nursery conditions until whip-and-tongue (tongue) grafting is carried out during the first week of February. Selection of uniform and healthy rootstocks at this stage is essential for obtaining good graft union formation and successful establishment of grafted walnut plants.

Grafting in walnut: Tongue grafting should be done in 1st week of February, results in highest bud take success and proportion of saleable plants (75.00 - 78.00 %) (Panwar 2024). For performing tongue grafting, a slanting cut approximately 2 cm long is made on the rootstock, 15 cm above the soil level, and a corresponding cut of equal length was made on the basal end of the scion bearing 3–4 buds. A reverse cut, about 1.5 cm long, is then made on both the stock and the dormant scion wood containing three to four buds is prepared like a wedge by giving two slanting cuts 2-3 cm long opposite to each other at the basal end without injuring cambial tissues, forming an interlocking "tongues. The scion and stock are then joined, ensuring cambial alignment on at least one side, and the graft union is carefully wrapped with an grafting tape (polythene stripe of 100 µ thickness) (Figure 1h-1l).

Graft aftercare: Immediately after grafting, regular irrigation is to be maintained using a micro-sprinkler system (flow rate: 20–110 L/hr; pressure: 1.5–2.5 kg/cm²; 4 mm pipes). Weeding work is to be carried out throughout the study to ensure optimal growth conditions. De-shooting of any shoots emerging below the graft union should be regularly performed to prevent competition with the sprouted scion. Once the scion reached a height of 10–15 cm, the grafting tape should be removed to avoid girdling.

Selection of quality planting material of grafted walnut: At the end of the growing season, preferably during the last week of December, healthy grafted walnut plants are selected for further dissemination to farmers. The selected plants should be free from diseases, have an undamaged root system, a scion diameter of 10–15 mm, and a plant height above 30 cm. Such quality grafted plants are considered suitable for further planting and distribution to farmers.

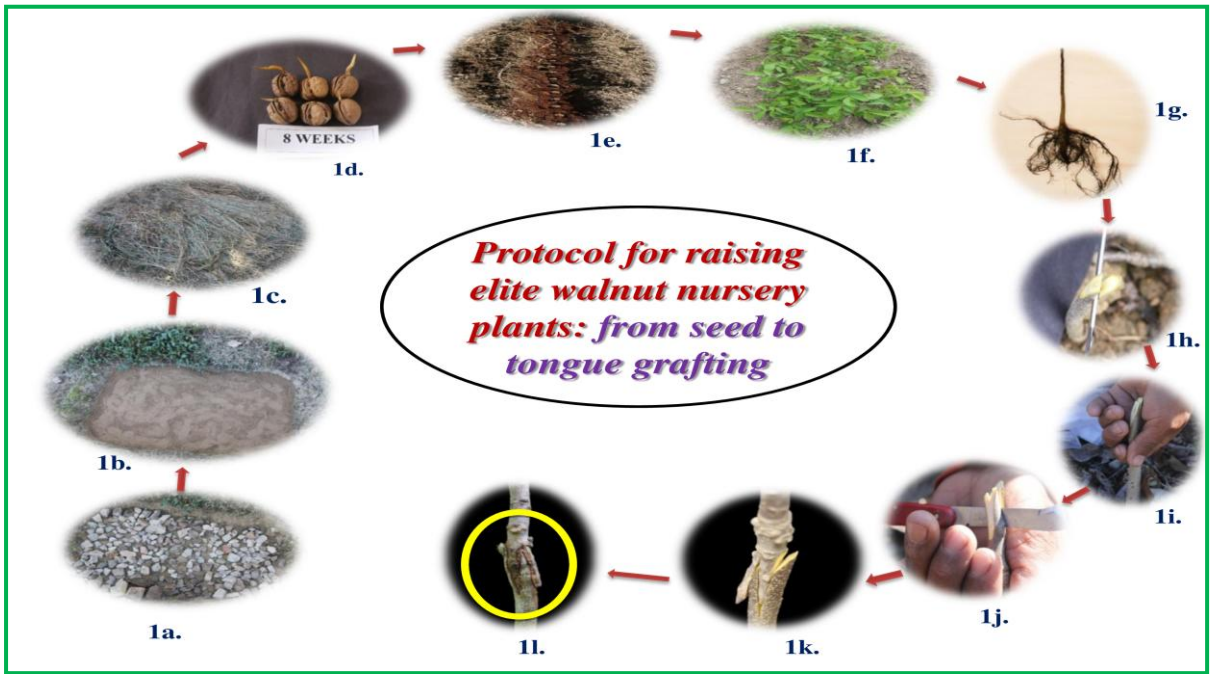

Figure 1. Protocol for raising elite walnut nursery plants: from seed to tongue grafting. 1a. First layer of pebble in pit; 1b. Last layer of sand in pit; 1c. Covering of stratification pit with hay mulch; 1d. Walnut stratified seeds after 8 weeks; 1e. Line sowing of stratified walnut seeds in growing mixture of cocopeat + FYM (1:1); 1f. Germinated walnut seeds; 1g. Selected walnut seedling for grafting; 1h, 1i and 1j. Preparation of cut (first whip cut and then slant cut) on scion; 1k. Insertion of scion on rootstock; 1l. Successful graft union formation.

Conclusion

Walnut is an important high-value nut crop of the North-Western Himalayas; however, the limited availability of healthy, true-to-type and high-quality planting material remains a major constraint to its expansion and productivity. Efficient nursery production of elite walnut plants can help overcome this limitation and ensure a reliable supply of quality planting material to growers. Based on the nursery practices described, 8 weeks of seed stratification, followed by sowing in a 1:1 mixture of cocopeat and farmyard manure (FYM), provides a suitable approach for raising healthy seedling rootstocks. The selected rootstocks can subsequently be multiplied through whip-and-tongue (tongue) grafting during the first week of February. Adoption of this integrated nursery production protocol can facilitate the large-scale multiplication of elite walnut planting material and help meet the growing demand of farmers in the North-Western Himalayan region.

References

1. Anonymous 2024. National Horticulture Board. Area and Production of Horticulture crops (2024-2025).
2. Chalise, B., Bhusal, R.Y., Kalauni, S., Giri, K.R. and Binod, L. (2021). Effect of grafting dates on graft take success and sapling growth of Persian walnut (*Juglans regia* L.) under open field condition of Jumla, Nepal. *Nepalese Horticulture*. **15**: 34–43.
3. Davies, F.T., Geneve, R.L., Wilson, S.B., Kester, D.E. and Hartmann, H.T. (2018). Hartmann and Kester's Plant propagation: Principles and practices. 9th ed.. Pearson Education Inc.pp. 880.
4. FDC. (2019). Food Data central: USDA (*U.S. Development of agricultural Research Service*).www.fdc.nal.usda.gov.
5. McGranahan, G. and Leslie, C. (2012). Walnut. In: Badenes M L and Byrne DH (Eds.), Fruit breeding. 8:827–846. Springer, Boston, MA.
6. Panwar, H. (2024). Studies on the propagation of walnut (*Juglans regia* L.). M. Sc. Thesis. Department of Fruit Science, College of Horticulture, Dr YSP UHF Nauni Solan (H.P.), India. 69p.
7. Panwar, H., Verma, P., Sharma, D.P., Sharma, N. and Kumari, M. (2026). Enhancing walnut seed germination and seedling growth through stratification and growing media in the North Western Himalayas. *New Zealand Journal of Crop and Horticultural Science* **54**:e70158.
8. Regmi, B., Thapa, R., Poudel, S.R., Dahal, S. and Khadka, T. (2023). Evaluation of grafting performances in Persian walnut affected by grafting methods and covering materials in Mugu district, Nepal. *Cogent Food and Agriculture*. **9**(1).
9. Sadeghi, M.R., Vahdati, K., Roozban, M.R. and Arab, M. (2019). Exploring combination of graft cover and grafting method in commercial walnut cultivars. *International Journal of Fruit Science*. **19**: 359-371.
10. Taiz, L. and Zeiger, E. (2010). Plant Physiology, 5th ed., 782. Sinauer Associates Inc.
11. Vahdati, K., Sarikhani, S., Arab, M.M., Leslie, C.A., Dandekar, A.M., Aleta, N., Bielsa, B., Gradziel, T.M., Montesinos, A., Rubio-Cabetas, M.J., Sideli, G.M., Serdar, U., Akyuz, B., Beccaro, G.L., Donno, D., Rovira, M., Ferguson, L., Akbari, M., Sheikhi, A. and Mehlenbacher SA. (2021). Advances in rootstock breeding of nut trees: objectives and strategies. *Plants*. **10**(11):2234.