

Techniques for Successful Propagation of Walnut

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Walnut (*Juglans sp.*) is one of the temperate nut fruit belongs to the family Juglandaceae. They are commonly known as 'Akhrot'. In India, commercial farming of walnut is limited and mainly cultivated in Jammu & Kashmir, Uttarakhand and Himachal Pradesh. Other states are also slowly picking up in commercial walnut farming. Jammu Kashmir is the major production state of walnut in India. Different methods are used for the production of transplants in controlled temperature, relative humidity, method and time of grafting (Nedev *et al.*, 1976). Most of the production in India comes from the seedling trees scattered in the temperate region of the northwestern Himalayas from 1200 m to about 3500 m above sea level. Few indigenous selections made as Hamdan and Sulaiman from Jammu and Kashmir, Govind and Partap from Himachal Pradesh and Chakrata seedling 13 from Uttarakhand. *Juglans* species are generally propagated by seeds. Seedling plants usually have a long juvenile period of 12-15 years. It requires chilling temperature to break the dormancy. Dormancy can be broken down by pre chilling of seeds at 3-5°C for 3-4 months but still results in a low percentage of seed germination. Therefore, efforts are being made to propagate such plants by vegetative propagation as to commence early bearing within 4-5 years and is considered to be the fastest technique for propagation.

Soil and climatic requirement

It grows well in cool climatic condition. Most walnut varieties have a winter chilling requirement of 800-1000 hours below 7°C to break dormancy and require a growing season of at least 200 frost-free days. Frost condition during spring may not be suitable for its growth. It grows well in well-drained deep silt loamy or sandy loam soil which is rich in humus with soil pH of 6.0 to 7.5. Water-logged soils should be avoided for its root growth and development. The tree usually begin to produce in the fourth or fifth year after planting.

Principle of grafting and budding

Its principle is based on the matching of scion and stock cambiums (meristematic tissue, the cells of which are undifferentiated and capable of frequent cell division) (Steele and Torrie, 1980).

Purpose of propagation

- Optimize cross-pollination and pollination
- Take advantage of particular rootstocks
- Perpetuate clones
- Repair damaged plants
- Increase the growth rate of seedlings
- Major purpose is to create finished propagated trees for orchard planting.

Different Techniques in Propagation of Walnut

Various types of sexual and vegetative propagation techniques are used in walnut with varying degree of success under different climatic conditions (Solar *et al.*, 2001).

- a) **Sexual propagation:** It is the reproduction of plants by seeds. The genetic material of two parents is combined by pollination and fertilization to create offspring that are different from each parent. Rootstocks are generally prepared by this method. The nuts are commonly allowed to air dry in the hull. If nuts are planted in the spring, they needed to be cold stratified for at least two months to ensure germination.
- b) **Vegetative propagation:** It is also known as vegetative multiplication or cloning. In this method new plant can be prepared from a fragment or cutting of the parent plant or specialized reproductive structures, which are sometimes called vegetative propagules. Different types of techniques are involved in this such as micropropagation, cutting, budding and grafting.

Micropropagation

In this technique individual stem segments containing one bud (no leaves) are surface-sterilize and then its basal portion is placed into an agar medium containing a mixture of plant hormones, nutrients and sugars to promote bud growth. Many clonal microshoots can be produced from a single bud and for rooting it can be treated with Potassium Indolebutyric Acid (KIBA) in vitro for 5 to 7 days. In the spring, hardened plantlets can be transferred to the nursery field (Vahdati *et al.* 2004). It has great advantage of rapidly generating a large number of

genetically identical plants in a much shorter time as compared to conventional techniques of propagation.

Cutting

Hardwood and semi-hardwood cuttings can also be used for rootstock propagation. They generally have low success rate. The bases of cuttings are treated with KIBA at 8-12,000 PPM before sticking.

Budding

In general, Mid-May to Mid-June is considered as the best period for budding. Buds can be collected during the winter dormant period of the tree. The percentage of successful budding is influenced by both the age of the rootstock as well as the time of pruning after budding.

Patch & T-budding

It is generally practiced during mid-June to end of June. In patch budding a square piece of bark is cut from the rootstock which is replaced with the same size patch from the bud stick containing a well-developed bud. In T-budding a slit in the rootstock bark is made in the shape of a T and a shield shaped piece of stem including a bud from the bud stick is cut and placed into the opening. After placement, the bud should be covered with budding tape which is removed after a few weeks as soon as the bud is healed.

Chip budding

The optimum period for chip budding for North-Western Himalayas mid hills is from mid-May to the first week of June. It is done on 1-year old rootstocks (*J. regia* L.) with buds taken in the current season. The percentage of survival increased when rootstock is in complete vegetation during the winter (Chandel *et al.*, 2005).



Fig 1: Different techniques of budding and grafting

Grafting

Grafting is also a horticultural technique that combines two plants, the scion and the rootstock, to create a plant with desirable features from both parents, so that they can grow together as a single composite plant. The bottom portion that contains a root system is called the rootstock. The top portion that contains the shoot system is labeled the scion. After grafting, better graft union takes place at temperature 27°C with relative humidity 80-90%. Generally, this

technique is practiced during the month of February and March under temperate North Indian conditions. The success of grafting depends not only on the grafting technique choice but also on the month as well. Maintaining sufficient humidity around the graft union at the wound site can play an important role in callus formation. Wrap the graft site with grafting tape. Using the right combination of grafting method and covering materials of the graft union can increase the grafting success.

Rootstocks: The seedlings raised from of one year old hard shelled local walnut (*Juglans regia* L.) of thickness 1-1.5 cm were generally used as rootstock. It is the bottom portion that contains root system is called the rootstock.

Scions: It is the top portion of the graft that contains the shoot system. Mother stock trees were severely pruned to stimulate vigorous one-year-old shoots. It's length should be around 10-15 cm and should be taken from the dormant shoots during December and February. It should atleast contain two buds and then soaked in Captan @0.3% fungicide for disinfection and then it can be used for grafting purpose.

Different types of grafting techniques include

- Cleft grafting
- Epicotyl grafting
- Whip grafting
- Bridge grafting
- Tongue grafting
- Wedge grafting
- Hot callusing grafting, and
- Hypocotyl grafting

Cleft grafting

In this method, first head back the rootstock and make a vertical split of about 5 cm down in the center of rootstock to be grafted. The scion should have 2-3 buds (10 to 20 cm long). Scion thickness corresponded to the thickness of the new shoot of the rootstock (Gandev, 2009). This method is very similar to wedge grafting. Cover the graft union tightly with grafting tape and should maintain a temperature of around 27°C for better callus formation. After 12-16 days it will start to develop new shoots (Suk-In *et al.*, 2006).

Tongue grafting

Make a matching tongue cut of equal depth in the scion wood. Line the cuts up, and slide them together, making sure to interlock the tongues. Check again that the cambium layer of each is in contact with the other. A slanting cut of 5-8 cm long is made both

on the rootstock as well as on the scion with grafting knife. Make the tongue with a cut into two sections of the rootstock. First cut about 1/3 of the distance from the tip and second cut about 2/3 of the length of the first rootstock cut. Wrap the graft area with grafting tape tightly.

Wedge grafting

Terminal portion of the stock is removed with a horizontal cut and is split vertically, few cm deep whereas base of scion is cut into a "V" shaped wedge. Carefully insert the wedge into the cut, matching the cambium layer. Wrapped firmly with grafting tape so that air cannot reach the graft. Within three to four weeks new shoots will appear on the graft.

Hot callusing grafting

In this method, the grafted plants are placed horizontally, the graft union being positioned on the heating cable. In it heating is done with an electric cable, placed in a plastic U-pipe full of peat. Proliferation occurs most readily during the late winter and at the time of the year just before or during "bud break" in the spring. (Gandev, 2009)

Hypocotyl grafting

In this method, grafting takes place during vegetation with growing tip of soft wood cutting on cleft. Grafted plants should be kept in about 80-90% relative humidity and temperature of 26-27°C. Grafted plants can be kept in a greenhouse under controlled temperature (Gandev, 2007b).

Best time for grafting

The best time for grafting is February-March and for budding is late August and mid-September (patch or T-bud), with the time current season scion buds develop to a condition suitable for use as budwood. Scion of length 10-15 cm should be grafted on one year old rootstock.

Conclusion

It can be concluded from the present article that for successful vegetative propagation of walnut clonal plant material both the time of propagation as well as technique used is very important. Therefore, before propagating the walnut plant material much consideration should be given to time, temperature and type of technique used because all of these may

vary from region to region and each technique requires specific skills.

Table 1: Walnut varieties cultivated in different parts of India

Jammu & Kashmir	Drainovsky, Lake English
Himachal Pradesh	Wilson, Gobind, Eureka and Franquette
Uttaranchal	Chakrata Selections

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