



Review Article

VRIKSHAYURVED PLANTATION TECHNIQUES: A REVIEW

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ABSTRACT

Use of chemicals for plant growth and its management has led to soil and water pollution. It has ultimately affected the quality of medicinal plants. In the other hand *Vrikshayurved* (science of plant life) have fully organic and time tested methods to deal with entire plant life. It mostly emphasizes on the selection of land, seed collection, seed treatment, different plant propagation methods, irrigation, manure, plant protection, plant disease management, crop harvesting and storage of produce. Thus, *Vrikshayurved* encompasses both agriculture and forestry.

Materials and method- Collection and compilation of useful information has been done from concerned articles and texts of Ayurved and *Vrikshayurved* texts such as *Surpala's Vrikshayurved*, *Upavan Vinod*, *Varahamihir's Brihat Samhita*, *Charak Samhita* and *Sushruta Samhita*.

Discussion and Conclusion- This article represents concise information of *Vrikshayurved* plantation techniques for seed propagation, grafting, stem propagation, tuber propagation and plant transplantation. All these methods are affordable, natural, and chemical free. All substances used by *Vrikshayurved* methodology have its Ayurvedic significance. Thus, *Vrikshayurved* and *Manushya Ayurved* are interdependent. Use of *Vrikshayurved* in modern agriculture and forestry can result in better agriculture system and sustainable forestry. Hence formation of standard guidelines for *Vrikshayurved* methodologies through research work is mandatory for better tomorrow.

INTRODUCTION

Ayurved is the science of life which means it deals with life of every living substance that is animals & plants. Conventionally Ayurved is concerned with human life. The Ayurveda is divided into three branches *Manushya Ayurved* for treating humans, *Pashu Ayurved* for treatment of animals and *Vrikshayurved* for management of plant life. Plants science (*Vrikshayurved*) has given equal and important weightage just like human science and animal science in *Vedas*.

Global focus on Ayurved has tremendously increased demand for raw plant materials worldwide, on other hand the increasing population and ongoing development in India is a cause of the rapid destruction of forests and agriculture lands. To fulfill the need of today's time, it is very important to focus on the forestry, agriculture system and plantation of medicinal plants.

Modern science focuses on the use of chemical compounds in agriculture which may result in increased final yield, but it also damages soil and water quality and can also damage the nutritional quality of the plants in a longer perception, in other hand *Vrikshayurved* methodology are natural, organic and causes nourishment of soil hence helps in *Prashasta bhumi nirman* (construction of good quality of soil).

MATERIALS AND METHODS

Materials: *Surpala's Vrikshayurved*, *Upavan Vinod*, *Varahamihir's Brihat Samhita*, *Sushruta Samhita*, *Charak Samhita* with their commentaries and other

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texts, published articles regarding *Vrikshayurved* and Ayurved.

Methods: Collection of various information of plantation from different texts and articles and compilation of the information related to *Vrikshayurved* plantation techniques.

Methods of Plant Propagation

Various methods of propagation such as by seeds (*Bijaruha*), by roots (*Moolaja*), by cutting (*Skandhaja*), by grafting (*Skandhas ropaniya*), by apical portions (*Agravija*), by leaves (*Parnayoni*), are mentioned in ancient treatise.^[1]

Plants for different methods of plant propagation mentioned in Surpala's *Vrikshayurved* and Upavan Vinod^[2,3]

A. Seed- Propagated Plants		
<i>Jambu (Syzygium cumini L.)</i>	<i>Champaka (Magnolia champaca L.)</i>	<i>Punnaga (Calophyllum inophyllum L.)</i>
<i>Nagakesara (Mesua ferrea L.)</i>	<i>Chimchika (Tamarindus indica L.)</i>	<i>Kapittha (Feronia limonia (L.) Swingle)</i>
<i>Badara (Ziziphus mauritiana)</i>	<i>Bilva (Aegle marmelos L.)</i>	<i>Kumbhakari (Dolichos biflorus L.)</i> ^[7]
<i>Priyangu (Callicarpa macrophylla Vahl.)</i>	<i>Panasa (Artocarpus heterophyllus Lam)</i>	<i>Madhuka (Madhuca longifolia)</i>
<i>Karamarda (Carissa carandas)</i>	<i>Amra (Mangifera indica)</i>	
B. Kandaj (portion of stem-cutting method)		
<i>Tambula (Piper betle)</i>	<i>Sinduvara (Vitex Negundo Linn.)</i>	<i>Tagara Valeriana wallichii DC</i>
C. Beeja kanda udbhava = Seeds and Stem Propagated Plants		
<i>Patala (Stereospermum sauealens DC)</i>	<i>Dadima (Punica granatam Linn)</i>	<i>Plaksa (Ficus lacor Buch)</i>
<i>Karavira (Nerium indicum)</i>	<i>Vata Ficus benghalensis Linn</i>	<i>Mallika (Jasminum sambac)</i>
<i>Udumbara (Ficus racemosa. L.)</i>	<i>Kunda Jasminum multiflorum</i>	
D. Kanda = Tuber-bulb Propagated Plants		
<i>Kumkuma (Crocus sativus)</i>	<i>Kakubha Terminalia arjuna (Roxb)</i>	<i>Ardra (ardraka) Zingiber officinale</i>
<i>Aluka (Dioscorea species)</i>	<i>Rason (allium sativum L.)</i>	
E. Seed- Tuber Propagated Plants		
<i>Ela (Elettaria cardamomum Maton)</i>	<i>Padma (Nelumbo nucifera)</i>	<i>Utpala (Nymphaea alba Linn)</i>

Plant Propagation by Seeds

Kautilya considered seed as the most important component of agriculture and therefore gave much emphasis on the procurement of quality seeds, their preservation, production, and distribution.^[4]

Seed selection criteria of *Vrikshayurved*^[5,6]

1. Seeds from well matured fruits
2. Seeds from fruits grown in fruiting season.

Common Seed treatment by *Upavan Vinod* and *Surpala's Vrikshayurved*^[8,9]

1. Ripened and matured fruits are collected and dried then seeds are removed from fruits. *Godugdha* (cow milk) is sprinkled (*Nishikta*) on seeds and dried again. Same procedure is repeated for next 5 days- (*Panchdinani*). Then seeds are fumigated (*Dhupitam*) by *Go-ghruta* (cow ghee) & *Vidanga churna*.
2. Seeds should be treated by sprinkling milk, then the seeds should be pasted (*Liptam*) with the paste (*Kalka*) of *Brihati (Solanum indicum L.)*, *Tila*

(*Sesamum indicum L.*), *Bhasma* (of cow dung ash) and *Sarshapa (Brassica nigra Koch.)*. Subsequently, the seeds should be rubbed (*Mardita*) with *Gomaya* (cow-dung) and clay soil (*Mrida*). Further, seeds material should be fumigated with fat.

3. The seeds should be sprinkled/dipped (*Nishikta*) in milk and then *Gomaya* should be rubbed/pasted (*Purimardita*) on it. Then this seed material should be rubbed thoroughly (*Bahusho mruditam*) with *Madhu* (honey) and *Vidanga Churna*.

A. Seed treatment by *Surpala's Vrikshayurved*^[10]

1. Seeds should be soaked in milk (*Kshiren bhavitam*) and allowed for drying up. Then fine powder consisting of *Sarshap*, *Brihati*, *Tila*, *Nala (Kamal danda)* should be dusted.

Surpala's Vrikshayurved mentions that *Makanda (Mangifera indica L.)*, *Jambu* and *Panasa* seeds are better germinated by the above processes.

2. Seed treatment of *Rajadan* (*Mimusops hexandra* Roxb.) and *Bakul* (*Mimusops elengi* L.) - the seeds of *Rajadan* and *Bakul*, after above common procedures, are further dried then their heads are cut. This process results in better viability.
3. Seed treatment of *Ervaru* (*Cucumis melo* L.)- The seeds of *Ervaru* are wrapped and tied with a platter (*Patraputi*) and jaggery solution (*Guda* dissolved in water) is sprayed (*Sikta*). Then they are heated up (*Tapta*) for three days and taken out. In this way, such seeds become viable with their better results of sowing and growth (*Vapana yoga*).
4. Seed sowing according to seed size and shape- *Surpala's Vrikshayurved* also emphasizes on different methods of sowing of seeds according to seed sizes.

Large size seed- sown singly

Small and minute seeds- spread by dispersal (*Vikisna*), in multiple or numerous quantities.

The shape of seeds is also considered for sowing. *Naranga* (*Citrus reticulata* Blanco) seeds are curved (*tiryak*) so should be sown in the same (standing) position.^[11]

B. Seed treatment by *Varahamihir's- Brihat Samhita*^[12]

1. General practice of sowing seeds- It involves soaking them in *Dugdha* (milk) for ten days, taking out daily with hand, smearing with ghee, rolling many times in cow dung, and fumigating with the flesh of deer or hog. Then the seeds were sown in a soil which was already treated with sesamum crushed together with flesh and hog's marrow.
2. Instant sprouting and fruiting - soak the seeds hundred times in a fruit paste of *Ankola* (*Alangium salvifolium* L.) or *Sleshmataka* (*Cordia dichotoma* Forst.F) or in its oil and sow in a soil mixed with hail (frozen rainwater).
3. Hard cover seeds - Hard seeds like tamarind are better sprouted when they are sprinkled with a mixture of the flour of rice, black gram and *Tila* and wheat particles along with stale meat and fumigated it repeatedly with turmeric powder.
4. *Sleshmantaka* - For *Sleshmantaka*, the shell of the seeds should be removed, then soaked in water, mixed with the paste of *Ankola* fruits and dried in the shade seven times, rubbed with buffalo dung and stored in the dry dung. The seeds were then sown in a soil soaked with hail water.

Stem (cuttings) Propagation - *Kanda pratiropana*^[13]

Surpala's Vrikshayurved by mentions stem propagation techniques as follow-

1. Selection criteria of stem for propagation - *Kanda* or *Vrunta* (stem or twig/cutting) of a plant to be

propagated should be 18 *angula* long, neither it should be very soft (tender) nor very hard.

2. Stem propagation methods -

- The stem should be pasted half with an adequate quantity of *Gomaya* (cow dung). This (stem cutting) should be planted (*Sanropana*) in the pit by inserting underground up to 3/4 part (*Tribhaga*). Then, the irrigation (*Sinchana*) by water mixed with fine sand and clay (*Mruttika*) should be done.

- Any stem or branch (twig) should be pasted with ripe fruit-pulp of naturally matured *Kadali* (banana) then kept under sunlight till it gets fully dry. The rope, (cord) made of *Shashti* rice (rice variety that matures in sixty days), is tied on that. Then the same stem or twig should be planted in the pit. Subsequently it should be followed by droplet irrigation or irrigation with a little bit of water gradually (*Stoka jala parisikta*) during the summer season.

- Stem cutting for *Shatapatrika* (*Rosa centifolia*) plant - The lower part (*Adhobhaga*) of stem or branch (twig) should be semi-matured (*Ardhapaka*). It should be propagated during month *Kartika* (time after rains/ post- monsoon season). After this, it should be irrigated constantly for two months (*Daruplavayet salile*), so that the propagated plant-material should remain almost submerged in water during this period.

- Cow dung (*Gomaya*) is considered as best material for *Kanda ropana* in plants whose branches get easily bent down (*Anamya*) like *Karavira* (*Nerium indicum*) and *Dadima* (*Punica granatam* Linn).

3. Irrigation - The irrigation of water (*Salila*) to the propagated stem twig should be continued for two months (*Māsadvaya*) regularly (*Nityam*).

4. Further transplantation of stem -

When propagated stem or twig bears leaves or covered with leaves (*Pallavita*) within the period of two months, the same should be taken out and transfer to the appropriate place (beds). Transplantation is favorably followed up during the month of *Ashadha* (beginning of rains), the *Bhumi* and *Disha* (lands and direction) need to be examined for their appropriates and accordingly.

Grafting^[14,15]

Varahamihira's Brihat Samhita has recorded two methods of grafting. They are: (i) inserting the cutting of a plant into the root of another, cut off from its trunk, and (ii) inserting the cutting of a tree into the stem of another. The junction of the two in both the cases was covered with a coating of mud and *Gomaya* (cow dung).

Plants mentioned for grafting by *Brihat samhita* = *Panasa*, *Ashoka* (*Saraca asoca* (Roxb.)

Willd.), *Kadali*, *Jambu*, *Lakuch* (*Artocarpus lakoocha* Rox), *Dadima*, *draksha* (*Vitis vinifera* L.), *Bijapurak* (*Citrus medica*).

Graft Plantation According to Seasons

Plant condition	Grafting <i>Ritu</i> (season)
Plants without branch development	<i>Shishira</i> (Mid- January to Mid-March)
Plants with developed branches	<i>Hemant</i> (Mid-November to Mid-January)
Plants with large, developed branches	<i>Varsha</i> (Mid-July to Mid-September)

Irrigation= The grafted trees were to be watered both in the morning and evening every day in summer, on alternate days in the cold season and whenever the soil becomes dry in the rainy season.

Propagation of Tubers^[16]

Vrikshayurved by Surapal mentioned *Ela*, *Padma* and *Utpala* as suitable plant to be propagated by *Kanda* (tuber/ rhizome)

Pit preparation- Pit for (*Sarva kanda*) all tuber, rhizome propagation should be of 1 *Hasta* in length, breadth and depth in measurement and such pits to be filled with (*Paripurita*) with soil mixed with sand.

Plant Transplantation Techniques

1. *Surpala's* book of *Vrikshayurved* mentions plant transplantation method according to size of the plant, if the plant is a small herb or tiny seedlings (*Balataru*) then it should be propagated/transplanted during daytime, in definite direction. When they attain growth to certain (desired) proportion, then their roots should be pasted with a recipe consisting of *Madhu*, lotus-stalk (*Mrnāla*), *Ghrīta* and *Vidanga* (fruit/seeds powder). Finally, this plant-material should again be covered with soil and made underground in the pit. In case of the propagation for large plants (*Mahantaru*), the same procedure for transplantation (*Pratyaropana*) should be followed up except the timing is specifically evening for large plant.^[17]

2. Plant transplantation by *Upavan Vinod*^[18]

- Plant transplantation criteria - A sprouted plant when grows to about 1 cubit can be transplanted.
- Pit preparation - One should plant a tree (seedling) in a pit two cubits in depth, well-watered, filled with fine dusts of earth free from sands, and filled with *Gomaya* (cow dung).

Transplantation Procedure

- First sprinkle *Godugdha* to the plant then dig the plant few inches away from the stem, take out the plant carefully keeping the soil intact to the roots. Then apply paste of *Ushira* (*Vetiveria zizanioides* L.), *Vidanga* and *Ghrīta* to the exposed roots. Then replant it in a pit together with cow dung.

- Plantain sprouts and *Kshiri* (with milky sap) trees should be planted after applying only *Gomay* to their roots.

DISCUSSION

- *Sushruta Samhita*, while describing fertilization in humans, mentioned seed germination process^[19]. Good and matured seed (*Beeja*) germinates when proper *Ritu* (season), *Kshetra* (place), and *Ambu* (water), are available. *Sushruta* has not used term *mruda*. *Sushruta* might have pointed out that plants can be grown without soil. Modern science has developed different ways of growing plants without soil like hydroponics and aeroponics.

- Plant Reproduction methods- *Vrikshayurved* has covered both sexual and asexual methods of reproduction. The grafting technology of plantation is explained in detail by *Brihat Samhita* and *Surapala's Vrikshayurved* emphasize on cutting and seed sowing techniques.

- *Vrikshayurved* seed treatment methods

The verse 52-54 by *Surpala's Vrikshayurved* and verse 51-53 of *Varahamihir's Upavan vinod* are similar, but the commentators have translated the *Shlokas* differently. Also, the methodology, use of materials and duration of procedure is not fully explored yet. Hence standardization of *Vrikshayurved* techniques is must.

- Plantation materials- Use of several materials for plantation are mentioned in ancient texts from time to time, all the texts give special emphasis on *Gomaya* (cow dung), *Madhu* (honey), *Go-ghrita* (clarified butter) and herbs like *Vidang*, *Ushira*, *Kamal*. All these materials are easily available, natural, and biodegradable.

- *Gomay* (cow dung) - Use of cow dung for dressing seeds, plastering cut ends of vegetative propagating units such as sugarcane setts, dressing wounds, sprinkling as a diluted suspension on plants and applying to soil has been indicated since the time of *Kautilya* (c.300 BC). When seeds are treated in various ways with cow dung, they get coated (pelleted) with cow dung residue. This residue contains cellulose, hemicelluloses, micronutrients, metabolic nitrogen, epithelial cells from the animal, bile salts and pigments, potash, sulphur, traces of phosphorus and a large number of bacteria, the majority of which are cellulose, hemicellulose and pectin fermenters. The cow dung residue has emulsifying properties. A thin dry layer of cow dung on a seed acts like blotting paper and readily absorbs moisture from the surrounding soil, which is to the advantage of the seed. The presence of bacteria in the residue may antagonize potential pathogens ready to attack the seeds.^[20]

- *Vidang- Vidanga* is explained as *Agyra* (the best) *Krimighna dravya*.^[21] *Embelia ribes* berries contain several chemical constituents like embelin, volatile oil, fixed oil, resin, tannin, christembine (alkaloid), phenolic acids like caffeic acid, vanillic acid, chorogenic acid, cinnamic acid, o-cumaric acid. 4.33% of the embelin content is observed in the berries of *Embelia ribes*. The major bioactive constituent of *Vidanga* is embelin, found to have antimicrobial activity.^[22]
- *Go-ghrita* – Many uses of *Ghrita* are mentioned in different texts of Ayurveda. It is useful for maintenance of *Jatharagni* (digestive fire), pacifies *Tridoshas* and indicated for *Rasayan karma* and *Snehan karma*. Ghee contains 8% lower saturated fatty acids which makes it easily digestible. Due to having 4-5% linoleic acid, an essential fatty acid, it promotes proper growth of human and plant body. Ghee also contains vitamin A, B, E and K. Vitamin A and E are antioxidant in nature and are helpful in preventing oxidative injury to the body.^[23]
- *Madhu- Sushruta Samhita* has mentioned *Madhu* as *Vranaropak*.^[24] proline peptide apidaecin present in honeybee saliva is antibacterial.^[25] Thus, it protects wounds in plants as it does in animals.
- *Jivo jeevasya jeevanam* (one living being is food for another living being)- Life of animals is totally dependent on plants. Plants provide nourishment, prevention and cure for the diseases in animals, in similar way animals provide nourishment, prevention and cure of diseases in plants. Use of animal body parts like bones, blood, flesh and excreta are well utilized in *Vrikshayurved*.
- Use of *Tantra yukti*
Indian ancient literature is written on the basis of *Trantra yukti* (tools for composing and understanding treatises). Application of *Tantra yukti* is necessary for understanding of Indian treatise then we can understand and gain precise knowledge from ancient Indian literature.
The *Vrikshayurved* texts mention different methods of plantations with some examples of plants. By using *Tantra yukti* and *Yukti Praman*, one can easily apply that knowledge to other plants.
- The plantation methodology *Ardrak* (*Zingiber officinale* Rose.) *Ela* (*Elettaria cardamomum* Maton) is described by *Vrikshayurved*. Both of them belong to Zingiberaceae family, as the family members possess similar structure and chemicals, we can apply the same knowledge for plantation of other family members from Zingiberaceae family.
- Seed treatment for hard cover seeds is mentioned for tamarind seed. We can use the same treatment for other hard cover seeds, e.g., *Fabaceae* family plants, to reduce seed dormancy.

CONCLUSION

Vrikshayurved mentions many affordable, natural, and chemical free plantation solutions which are easy to implement in today's time. Utilization of *Vrikshayurved* knowledge in the field of agriculture and forestry is important. *Vrikshayurved* methodologies preserves quality of soil and water hence maintains environmental balance. Application of basic principles of Ayurved explained by *Brihatrayi – Charak Samhita, Sushruta Samhita, and Ashtang sangraha* should be implemented not only for *Manushya Ayurved* but also for *Vrikshayurved* and *Pashu Ayurved*. Formation of standard guidelines for *Vrikshayurved* methodologies through research work is the necessity of contemporary world.

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