

Vrikshayurveda: Sustainable Farming and Herbal Health Care

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Abstract

India is an agriculture-based country where population mainly depends upon agricultural practices for their survival. The indiscriminate use of chemicals as fertilizers and controlling agents over last few decades has resulted in multifarious ecological and health problems. Vrikshayurveda, the ancient Indian science which advocates use of plants and their extracts for controlling the infection of soil and plants for obtaining better yield has been ignored with our greed in various ways. Surapala's Vrikshayurveda is the first full-fledged available text for arbori-horticulture which deals with various aspects of plant's life, including practices like seed selection, sowing, and manuring etc. Kunapjala suggested as manure in Vrikshayurveda is a direction towards the use of organic manure. Results of some organic practices have suggested that traditional and biological methods of farming can be very useful in improving the soil quality and plant yield. Vrikshayurveda can also help to resolve the current problem of malnutrition and deteriorated soil quality by soil remediation and improving nutrient availability to plants. Thus to utilize the traditional knowledge with blend of advanced scientific interventions and present-day practices are the urgent necessities of present time for environment management, increasing crop yield and to lead a health life.

Keywords: Vrikshayurveda, herbal formulations, sustainable farming, environment conservation, healthcare.

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INTRODUCTION

India is a treasure of traditional knowledge since ages which besides others also explains the wayouts for solving most of the present day problems. Harmful side-effects of synthetic medicines have resulted in resurgence of traditional medicine systems for healthcare through holistic approach and utilizing the natural products especially of plant origin. India is one of the richest countries not only from traditional knowledge point of view but also in

terms of world's richest flora. Apart from research efforts, proper documentation of findings is also one of the inimitable features of the ancient Indian medicine system. Out of 10,000 herbs globally, more than 2000 plant species find their mention in traditional Indian literature for their medicinal applications for curing several ailments. Such documentation (Table 1) was available during 3000 BC -1000 BC in the form of Atharvaveda in which upto 289 medicinal plants have been documented [1].

Table 1: Evolutionary Milestones for Indian Pharmacopoeia [1].

Time period	Plants involved	Proposed changes	Literatures referred
3000–1000 BC	289	Atharvaveda (Building of pharmacopoeia)	Vedic texts
1500 BD–500 AD	650	Incorporation/discarding drugs	Ayurvedic texts • Charaka Samhita • Sushrut Samhita • Astanga Samgraha
500 AD–1900 AD	2000	Incorporation/discarding drugs Varieties identified Substitutes identified Expansion in applications	16 major Nighantus (like Dhanvantari Bhavprakasha, Raja Nighantu upto Shaligram Nighantu)

Table 2: Literatures related to Vrikshayurveda.

Vrikshayurveda	Time period	Author	Language
Brhat Samhita	505–581 A.D.	Varahamihira	Sanskrit
Vrikshayurveda	1000 A.D.	Surapala	Sanskrit
Lokopakara	1025 A.D.	Chavundaraya	Kannad
Manasollasa	1131 A.D.	Someshverdeva	Sanskrit
Upavanavinoda	1283–1301 A.D.	Sarangadhara	Sanskrit
Vishvavallabha	1577 A.D.	Chakrapani Mishra	Sanskrit
Shivatatvaratnakara	1698–1725 A.D.	Basavaraja of Keladi (King)	Kannad

Generally, it is assumed that treatment in Ayurveda, is restricted to animals and human beings only but ancient literature also reported a branch of Ayurveda dealing with health and nurturing of plants i.e. Vrikshayurveda. Also known as “The Science of Plant Life”, Vrikshayurveda written by Surapala, a Royal Physician in the court of King Bhimapala during 10th century A.D. was also awarded as Vaidyavidyavarenya [2-3]. Vrikshayurveda has been mentioned by different writers in ancient literature with different names as Vishvavallabha, Upavanavinoda, Lokopakara and Shivatatvaratnakara (Table: 2).

Vrikshayurveda written by Surapala which focused on revival of traditional knowledge and its application in present situation was recorded as the first ever full-fledged text for arboriculture [4].

VRIKSHAYURVEDA

The Ayurveda of plant's life, not only covers different practices of planting and farming to obtain healthy plants but also explains meaningful utilization of natural resources. It also provides the guidelines for conservation of natural resources, estimation of groundwater, construction of water reservoirs, rainwater harvesting, soil selection and pre-planting preparations, planting pattern, distance among the plants, treatment of various plant diseases, selection, preparation and treatment of manure and use of knowledge of *Vastu* for plantation etc. for gardening and farming. *Vrikshayurveda* is like a giant forest of knowledge that summarizes different planting and agricultural practices. Few of the practices have been given below [5–6]:

Soil description (*Bhumi nirupana*): It gives a detailed description and classification of soil on the basis of soil fertility. On the basis of water

content and plantation supportive nature, soil has been categorized in following three classes:

- Arid land (*Jangla Desa*):** It comprises of thin dry and rough sand as well as gravels which give rises to mirages. This kind of soil is full of *Khejdi* (*Prosopis cineraria*) and *Palas* (*Butea monosperma*) etc.
- Marshy land (*Anupa Desa*):** (Marshy land): This kind of soil is found at the river banks and surrounded by dense forest of *Hintala*, *Kamal*, *Kadli* etc.
- Ordinary land (*Sadharan Desa*):** This kind of soil is good for all kind of trees and soil is suitable for the tree of both arid and marshy land.

Manner of seed sowing (*Bijoptivithi*)

It pertains to the knowledge regarding treatment of seeds for preservation and planting e.g. it has been suggested that seeds should be exposed to ashes and medicated smoke to obtain full growth of the plant.

Description of Plant's Life (*Padapavivaksa*)

Padapavivaksa signifies vitality and life in plants. It includes the complete biology of plant life and also explains that plants also have life and sense.

Plantation Methods (*Ropana Vidhana*)

This section of *Vrikshayurveda* contains the instructions and methods of the plantation. Methods of plantation depending upon the part used for plantation i.e.:

- Seeds:** *Jambu* (*Syzygium cumini*), *Champaka* (*Magnolia champaca*), *Nagakesar* (*Mesua ferrea*) etc.
- Stalks:** *Tambuli* (*Kali Musli- Curculigo orchoides*), *Tagara* (*Valeriana Wallichii*) etc.
- Bulbs:** *Kumkuma* (*Autumn Crocus*), *Sinduvara* (*Vitex negundo*), *Tagara* (*Valeriana Wallichii*) etc.

- d. **Seeds as well as stalks:** *Ela (Elettaria cardamomum)* etc.
- e. **Seeds as well as bulbs:** *Patala (Stereospermum suaveolens)*, *Dadima (Pomegranate-Punica granatum)*, *Plaksa (Ficus religiosa)* etc.

Methods of planting depends upon parts used for planting, which have to be followed for optimum growth of plants. Some of the planting instructions mentioned in *Vrikshayurveda* are:

- I. The number of seeds to be sown depends upon the size of the seed i.e. large seeds sowed singly while smaller seeds sown in multiples in slanting position.
- II. The length of stalk should be 18 angula long, with half of it smeared with cow dung and sown in as $\frac{3}{4}$ part is under the soil.
- III. The bulb should be sown in a pit of one forearm (width, breadth, and depth) filled with mud mixed with thick sand.
- IV. The distance between two bushes should be atleast 4–5 forearms length.

Irrigation Methods (*Niscana Vidhi*)

It explains the methods of irrigation and fertilization which signifies the amount of water to be given to various plants in different stages of plant life.

Nourishment Method (*Posana Vidhi*)

This section of *Vrikshayurveda* deals with the use of fertilizers and manures as nutrient supplements. *Vrikshayurveda* has a description of the special class of liquid manure. Mostly liquid manure such as “*Kunapajala*” prepared from biological materials in full or semi-fermented form has been prescribed for use. Apart from it milk, dung, honey brick dust have also been mentioned to be used as nutritive substances.

Kunapajala

Also known as *kunap water* it is mainly prepared from animal waste including cattle dung, horns, bones and flesh (Table 3). *Kunapajala* is liquid manure used and dispensed mainly by sprinkling on plant or dipping seeds before sowing. No specific/standard formulation for preparation of *kunap water*. This is rich in amino acids, sugars, fatty acids and other nutrients [7].

Kunapajala is a good source of macro and micro nutrients that not only support the growth of plants but also protect plants from infections and disease (Table 3). These components are mustard, honey, neem bark, viagra, hair, nails and horns etc [6].

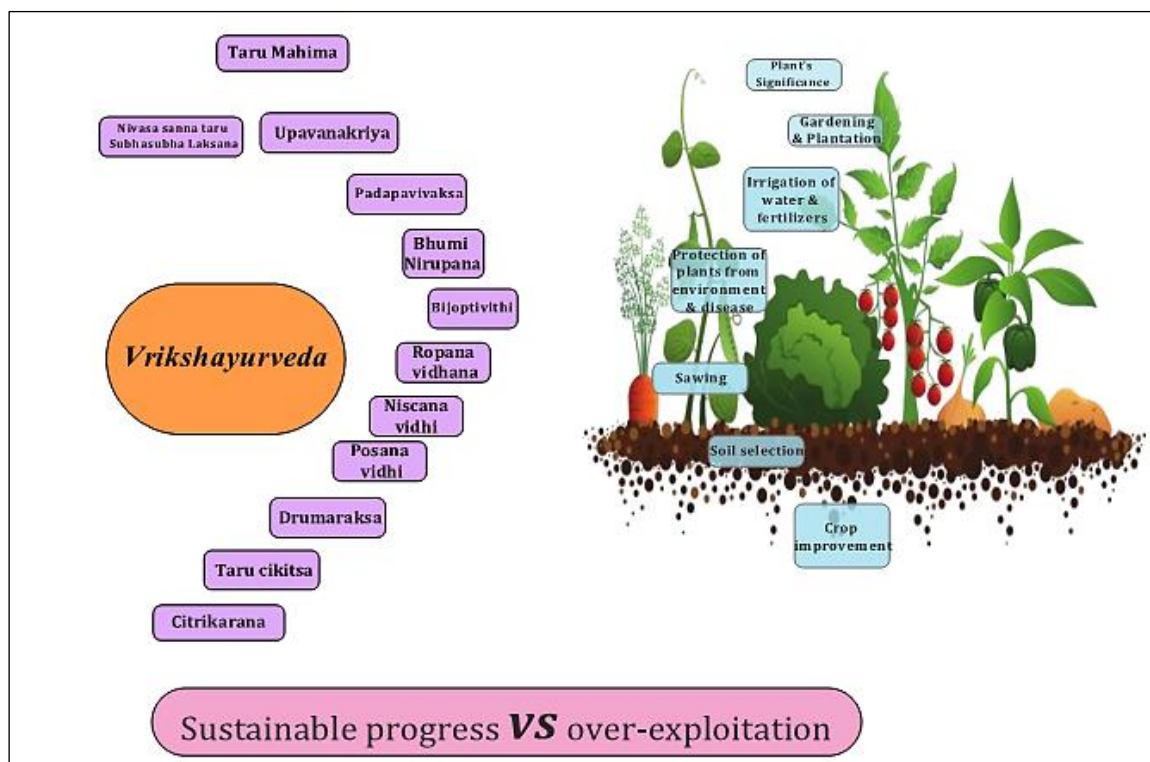


Fig. 1: *Vrikshayurveda* representing the various aspects of plating and farming.

Table 3: Main Components of Kunapjala and Their Source.

Components	Source	Description
Mustard	Plant	Sinablin have insecticidal, pesticidal, antifungal, antibiosis, nematicidal and acaricidal properties.
Honey	Animal	Proline shows antimicrobial activity, induces systemic resistance in plants, increases cytokinins levels. It also has bound healing properties.
Milk	Animal	Lactoferrin proteins showing antiviral, antimicrobial and antinematode activities.
Vidanga (banana)	Plants	Fruits of <i>Vidanga</i> have antihelminthic activity.
Neem	Plants	Triterpenoids i.e., azardion, namberin, azadirachtin and salanin etc showing antimicrobial activity.
Hair, nail/horns	Animal	Contain high amount of sulfur-containing amino acids. Smoke of sulfur control pest and diseases.
Panchamula	Plants	A mixture of five plants' roots i.e., <i>Aegel marmeloës</i> , <i>Clerodendrum phlomidis</i> , <i>Gmelina arborea</i> , <i>Oroxylum indicum</i> , <i>Stereospermum suaveolens</i> . Plants having antimicrobial activity.

Protection of Trees (Drumaraksa)

It contains the detailed knowledge for saving the plants from harsh and destructive environmental conditions to save whole plants from drying or wilting. It also reports the use of herbs for wound healing.

Treatment of Plants (Taru Cikitsa)

In *Vrikshayurveda* plant diseases have been classified into two categories [7]:

- a. **Internal Diseases:** Like *Ayurveda*, *Vrikshayurveda* also depends upon three important factors—Vataj, Pittaj, Kaphaj—and imbalance in any one of these will lead to disease in animals, humans and plants as well.
 - i. **Vataj:** These diseases are due to dry land, a disease diagnosed by thin, weak, zigzag stem, hard fruits, and tumors etc. These diseases are treated with liquid manure called *Kunap water*. Fumigation of burning animal fat can also be used in case of *Vataj* imbalance.
 - ii. **Pitaj:** When plants are treated with acidic and salty water, yellow leaves with unhealthy flowers and fruits are the resultant symptoms. Infected plants are treated with cold and sweet substances like honey, fruit decoction.
 - iii. **Kaphaj:** If plants are treated with sweet and cold water for prolong time then disease occur which are diagnosed with late flowering and fruiting with small pale leaves. Infected plants are treated with bitter and strong decoction to cure *Kaphaj* imbalance. Sometimes roots are coated with mustard paste.
- b. **External Diseases:** These diseases are mostly due to external factors e.g. worms, insects and unfavorable conditions and are diagnosed in the form of weakness of infected part. In case of external infection, insects and worms have been prescribed to be removed manually. For the treatment of

external diseases most commonly ash and brick dust are preferred to sprinkle on infected part.

Gardening (Upavanakriya)

This section contains instructions how to make and maintain the gardens e.g. use of Latagrha, Kridaparvata, and Kadaligrha. It also suggests other ways to further beautify the garden.

Benefic and Malefic Responses from Plantation (Nivasa sanna taru Subhasubha Laksana)

This section illustrate in detail about various proposals based on the Vastu knowledge. It symbolizes the planting of various plants in different directions as Pearls-East, Athi-South, Arayal-East, and Either-North, but not near the house. It also suggests that people about positive and negative effects of trees e.g. one shouldn't spend the night in shade of trees.

Plant's Significance (Taru Mahima)

It details the importance of natural resources like water bodies and plants in human life and the conservation of water/water bodies. It also explains the importance of planting for life in a mythological way.

Variagation (Citrikarana)

This section of *Vrikshayurveda* can be compared with the scientific techniques for development of new character in plants e.g. evolution of fragrance in non-fragrant flowers to make a plant bloom throughout the year, pre-maturity of plants and fruits.

All the practices described in the *Vrikshayurveda* are the means to communicate with the environment to obtain higher yield and additional support of natural organic manure to protect from infection (Table 4).

Table 4: Agricultural Practices Included in Vrikshayurveda.

Sr. No.	Planting practices		Description
1.	Soil	Jangle Desa (Arid land)	Thin, dry and sough sand.
		Anupa Desa (Marshy land)	Generally at the bank of rivers.
		Sadharan Desa (Ordinary land)	Good for all kind of trees.
2.	Selection of soil for planting	Suitable	Rich in nutrient.
		Unsuitable	Soil with poisonous elements, stones, anthills etc.
3.	Type of planting	Grows from seed	Nagakesar
		Grows from stalks	Tambuli
		Grows from bulbs	Kumkuma
		Grows from seeds as wells as bulbs	Padama
		Grows from seeds as wells as stalks	Plaksa
4.	Method of planting	Describe methods used for planting of different plant parts.	
5.	Plant diseases	Internal diseases	Vataj: Due to dry land.
			Pittaj: Due to acidic and salty water.
		Kaphaj: Due to sweet and cold water.	
External diseases	Due to insects and worms.		
6.	Treatment of diseases	Internal	Vataj
			Pittaj
			Kaphaj
		External	Removal of worms and insects, use of ash, brick dust and mustard-like material
7.	Nourishment and fertilizer	Use of <i>kunapajala</i> , ash, brick dust, cattle dung and milk etc. as fertilizer.	
8.	Vastu principle for plantation	Discuss the planting of different plants within or outside house vicinity as per the <i>Vastu</i> principles.	

SIGNIFICANCE OF VRIKSHAYURVEDA Ayurveda

Plants and herbs have been the strength of traditional medicines since the time immemorial. These herbal medicines are safer alternatives due to wide applicability and lesser side effects. Ayurveda, one of the oldest traditional treatment systems originated in India. Charak Samhita, Sushruta Samhita and Ashtanga Hridaya of Vagbhata and Madhav Nidan are some of the important literature of Ayurveda which provide detailed description of more than 500 diagnostic symptoms more than 700 herbs and 6000 formulations dealing with various ailments [8].

Ayurvedic medicines are based on the plant/herbal extracts and good agricultural practices. Vrikshayurveda has become much more significant in the present time where deteriorating environment and other anthropogenic activities have posed several threats for even the survival on mankind on earth.

Good agricultural practices involve the management of each and every aspect of soil, irrigation, nourishment etc. *Vrikshayurveda* can help in the cultivation of medicinal plants in pots or gardens by setting up the appropriate

environment. The knowledge of Vrikshayurveda to grow plants, extract good quality extract and use efficiently for various ailments is of paramount significance.

Manure production (i.e. *Kunapjala* and *Matsya pani*)

Traditional literature of *Vrikshayurveda* has the description of unique liquid manure known as *Kunapjala*. The uniqueness of this manure is that it is rich in both macro and micronutrients to support plant's growth and to prevent damage to plants from harsh environment and pathogens as it is made up of waste material such as animal flesh and bones as major component along with other organic waste. Industries are generating a huge amount of organic waste, which can be used for the production of biofertilizers. Thus *Vrikshayurveda* can be useful in reducing the available organic wastes along with reducing the use of chemical fertilizers.

Herbal Garden

Garden is a separate space constructed for the cultivation of ornamental or some other kind of plants such as vegetables or herbs. Herbal gardens used for the cultivation of medicinal

plants and herbs are of special interest in terms of healthcare and Ayurveda. The main purpose of the herbal garden is to enhance ex-situ conservation of medicinal plants and improve the quality of herbs.

Pollution Control and Environment Management

Vrikshayurveda is not only the collection of information of plant's life but it can also help to find out ways to rescue them from different environment problems. Chemicals have been used indiscriminately for enhancing the agriculture yield but this has resulted in bio-accumulation of these chemicals in our food chain. Shivatatvaratnakara was the last reported literature of Vrikshayurveda. Traditional knowledge is diminishing with the passage of time and chemicals have become prime choice as fertilizers and disease controlling agents. However in last few decades, these chemicals have become matter of concern due to their multifarious hazardous side effects. The rapid industrialization has also raised the issue of huge wastes generated, which is responsible for proliferation of pathogens in soil and water which not only affect crop yield but are also a major concern for the human health.

Agriculture

Conventional agricultural practices are the pioneer for providing food to growing human population but in order to fulfill the food requirement of growing population, indiscriminate use of hazardous chemicals and pesticides has posed serious threat for human health [9]. Chemical fertilizers are relatively cheaper and can provide high nutrient to plants in a shorter duration but then excess use has resulted in air and ground water pollution by eutrophication. However organic manure has low nutrient content, slow decomposition rate but they provide balanced nutrient supply to increase soil nutrient availability and soil microbial activity [10-11]. Recent efforts are needed to use environment friendly practices to ensure bio-safety for the production of 'nutrient rich high quality food'. This innovative approach attracts the demand of biological organic fertilizers as an alternative to agro-chemicals [12]. Organic farming and biofertilizers ensure food safety by improving nutrient supply, conserving the soil biodiversity

with least adverse effect to ecosystem [13-15]. Generally 60-90% of applied fertilizers are lost and only 10-40% are utilized by the plants which multiply and participate in nutrient cycling and remain in soil for long time [16-17]. The ancient traditional literature Vrikshayurveda already has the description of preparation and applications of biofertilizers i.e. Kunapjala, which is prepared by using different compositions of biological materials such as cow dung, honey, ghee, oil cakes etc. Literature also signifies the beneficial impact of Kunapjala application on crop yield. Moreover soil texture and its demography is an important part of agricultural practices has also been discussed in Vrikshayurveda.

ROLE OF TECHNOLOGICAL INTERVENTIONS IN CURRENT SCENARIO AND FUTURE POSSIBILITIES

Vrikshayurveda has the valuable description of various agricultural practices including plants and crops. Application of scientific knowledge can be helpful in efficient modifications and applications in present situation for dealing with problems of pollution and crop yield. Without having the proper information of soil texture, getting the optimum yield is not possible. Since same composition may not be suitable for all the crops in different climatic conditions hence scientific analysis of biofertilizers and using suitable composition with respect to environment can be helpful for enhancing the crop yield. Kunapjala in *Vrikshayurveda* is mainly focused on the use of residual material while addition of biological controlling agents may enhance its' efficacy.

Scientific techniques also help in developing the improved and stress resistant crops as suggested in chitrikarana in Vrikshayurveda. However conventional methods are laborious and time consuming which can be complemented by advanced genetic modification and hybridization techniques. Reduced quality and crop yield are the major concerns to fulfill the food demand. Biotic and abiotic stresses such as harsh environment, scarcity of water, lower crop yield can be overcome by altering the physiological and metabolic system in plants. Hence there is need of active system to control/balance generated

reactive oxygen species (ROS) by scavenging through antioxidative enzymes such as catalase (CAT), superoxide dismutase (SOD), and guaiacol peroxidase (GPX) and also the enzymes of ascorbate-glutathione (AsA-GSH) cycle, i.e., ascorbate peroxidase (APX), dehydroascorbate reductase (DHAR), monodehydroascorbate reductase (MDHAR), and glutathione reductase (GR) and proteins/non-enzymatic components include ascorbate (AsA) and glutathione (GSH) along with carotenoids and tocopherols along with other phenolic compounds.

GM crops can help fight malnutrition due to enhanced yield, nutritional quality and increased resistance to various biotic and abiotic stresses. Genetic modification/editing of crop for the over-expression of antioxidative stress pathway components and other redox proteins help the plant to survive under adverse conditions. This suggests that the development of transgenic plants, over-expressing enzymes and redox-sensitive proteins associated with oxidative stress and anti-oxidative stress pathways will surely provide an important link to reduce oxidative damage in crops [18]. Biosafety, public concerns and other ethical issues associated with GM crops have initiated debate about the safe consumption and their effects. Cis-genesis, intra-genesis, recombinant DNA technology, site-specific integration, and gene editing can be very helpful in overcoming the limitations of traditional genetic engineering methods. Besides using foreign gene, mutation and modification without involving foreign DNA might consider safer and non-transgenic genetically altered plants. It would also invite new approaches for the development and commercialization of transgenic plants with superior phenotypes [19]. Scientific approaches including tissue culture, micro propagation and fermentation processes can be very helpful in generating and conserving important plants and increasing the metabolite yield.

VRIKSHAYURVEDA AND HEALTHCARE IN 21ST CENTURY

Synthetic medicines have been used for rapid cure of ailments. But these medicines have their own side effects on living systems. To counter

or to reduce the side effects, momentum has shifted towards safer alternatives. Herbal therapies, one of the holistic approaches using medicinal plants is generally considered safer. Although use of herbs does not show any adverse effects like synthetic drugs however they can potentially be toxic sometimes due to wrong identification of plants among different forms available in nature. Hence proper identification of herbs and adequate preparation are necessary. Exact mechanism of action of herbs is not fully understood. However in most of the cases, medicinal herbs possess an antioxidant activity which is very effective in combating the ill effects of toxic agents or compounds. Some plants have also been used to cure cancer, memory deficit and several diseases like alzheimer, atherosclerosis, diabetes and cardiovascular diseases [20].

Medicinal use of plants is inherited heritage and inseparable part of healthcare system in India and also elsewhere. On the basis of climatic conditions, India can be divided into 16 different Agro climatic zones hosting more than 45,000 diverse plant species comprising of more than 15,000 medicinal plants. The Indian traditional medicinal systems such as Ayurveda, Siddha, Unani, and Homoeopathy medicine are mainly based on plants and plant based products for drug formulation for treating various ailments (Table 5).

Our ancient texts have documented medicinal properties of a large number of plants. Indian medicinal system has already identified 1500 medicinal plants comprises of 500 species used in drug formulation. However demand of medicinal plants/products from other countries is on rise. Kala Zeera, Amaltas, Indian mustard, Karela, Brinjal, Neem, Gudmar etc. are some of the important medicinal plants which have already been patented. India possess rich heritage of valuable flora and fauna due to presence of 'treasure house' of valuable medicinal and aromatic plant species which has been in use by traditional practitioners and households ladies in tribal areas. However India is lagging behind at global platform than other countries in filing patents [28-29]. Government of India has listed 116 important medicinal plants in 3 subsidy categories on the basis their importance (Table 6).

Table 5: Some of the Herbal Plants Commonly Used in Medicinal Formulations.

Plant	Use	References
<i>Centella asiatica</i>	Wound healing, leprosy, lupus, varicose ulcers, eczema, psoriasis, diarrhoea, fever, amenorrhoea, diseases of the female genitourinary tract.	21
Marigold	Anti-inflammatory, analgesic, anti-edematous, dermatological and cosmetic applications	22
<i>Trigonella foenum-graecum</i>	Carminative, gastric stimulant, antidiabetic, and galactagogue effects, hypocholesterolemic, antilipidemia, antioxidant, hepatoprotective, anti-inflammatory, antibacterial, antifungal, antiulcer, antilithogenic, anticarcinogenic.	23
<i>Mentha piperita</i>	Aromatherapy, bath preparations, mouthwashes, toothpastes, and topical preparations for calming pruritus and relieve irritation and inflammation.	24
<i>Achyranthes bidentata</i>	Anticoagulative activity, anti-osteoporosis, neurotrophic and neuroprotective effects, inhibition of myocardial ischemic/reperfusion-induced injury, antitumor and immunomodulatory activities.	25
<i>Asparagus adscendens</i>	Spermatogenetic, spermatorrhoea and chronic leucorrhoea, prevents the risk of nervous disorders.	26
<i>Withania somnifera</i>	Stimulates the immune system, combats inflammation, increases memory, to increase the production of bone marrow, semen, and acts anti-aging, anti-tumor and anti-inflammatory agents.	27

Table 6: Prioritized plants and provided subsidy for their cultivation [30]

List of Prioritized Medicinal Plants for Development and Cultivation Under Scheme of Centrally Sponsored Scheme on National Mission on Medicinal Plants			
S.No.	Crop Name	Botanical name	Subsidy in %
1.	<i>Acorus calamus</i>	Vach/Bach	20
2.	<i>Aloe vera</i>	Ghritkumari	20
3.	<i>Andrographis paniculata</i>	Kalmegh	20
4.	<i>Artemisia annua</i>	Artemisia	20
5.	<i>Asparagus racemosus</i>	Shatavari	20
6.	<i>Azadirachta indica</i>	Neem	20
7.	<i>Bacopa monnieri</i>	Brahmi	20
8.	<i>Boerhaavia diffusa</i>	Punarnava	20
9.	<i>Cassia angustifolia</i>	Senna	20
10.	<i>Caesalpinia sappan</i>	Patang	20
11.	<i>Centella asiatica</i>	Mandookparni	20
12.	<i>Chlorophytum borivillianum</i>	Shwet Musali	20
13.	<i>Cinnamomum verum</i>	Dalchini	20
14.	<i>Cinnamomum tamala</i>	Tejpat	20
15.	<i>Cinnamomum camphora</i>	Kapoor	20
16.	<i>Coleus barbatus</i>	Pather Chur	20
17.	<i>Coleus vettiveroides</i>	Hrivera	20
18.	<i>Convolvulus microphyllus</i>	Shankhpushpi	20
19.	<i>Cryptolepis bunchanani</i>	Krisna Sariva	20
20.	<i>Digitalis purpurea</i>	Foxglove	20
21.	<i>Dioscorea bulbifera</i>	Rotalu, Gethi	20
22.	<i>Embelia ribes</i>	Vai Vidang	20
23.	<i>Garcinia indica</i>	Kokum	20
24.	<i>Ginkgo biloba</i>	Ginkgo	20
25.	<i>Gymnema sylvestre</i>	Gudmar	20
26.	<i>Hedychium spicatum</i>	Kapur Kachari	20
27.	<i>Hemidesmus indicus</i>	Anantamool, Indian Sarsaparilla	20
28.	<i>Holarrhena antidysenterica</i>	Kurchi/Kutaj	20
29.	<i>Ipomoea petaloidea</i>	Vrddhadaruka	20
30.	<i>Ipomoea turpenthum</i>	Trivrit	20
31.	<i>Litsea glutinosa</i>	Listea	20

32.	<i>Lepidum sativum</i>	Chandrasur	20
33.	<i>Mucuna prurita</i>	Konch	20
34.	<i>Ocimum sanctum</i>	Tulsi	20
35.	<i>Phyllanthus amarus</i>	Bhumi amlaki	20
36.	<i>Phyllanthus emblica</i>	Amla	20
37.	<i>Piper longum</i>	Pippali	20
38.	<i>Pluchea lanceolata</i>	Rasna	20
39.	<i>Solanum nigrum</i>	Makoy	20
40.	<i>Stevia rebaudiana</i>	Madhukari	20
41.	<i>Terminalia arjuna</i>	Arjuna	20
42.	<i>Terminalia bellerica</i>	Behera	20
43.	<i>Terminalia chebula</i>	Harad	20
44.	<i>Tinospora cordifolia</i>	Giloe	20
45.	<i>Vitex nigundo</i>	Nirgundi	20
46.	<i>Withania somnifera</i>	Ashwagandha	20
47.	<i>Woodfordia fruticosa</i>	Dhataki	20
48.	<i>Kaempferia galangal</i>	Kacholam/Indian crocus	20
49.	<i>Vetiveria zizanioides</i>	Ramacham/Khas-khas grass	20
50.	<i>Plumbago rosea</i>	Chethi koduveli/Leadwort	20
51.	<i>Oryza sativa</i>	Njavara/Scented rice	20
52.	<i>Alpinia calcarata</i>	Smaller Galangal	20
53.	<i>Alpinia galangal</i>	Greater Galangal	20
54.	<i>Ipomoea maruittiana</i>	Giant potato	20
55.	<i>Ipomoea digitata</i>	Giant potato	20
56.	<i>Decalepis hamiltonii</i>	Makali ber	20
57.	<i>Catharanthus roseus</i>	Sadabahar	20
58.	<i>Sida cordifolia</i>	Flannel weed/Bala	20
59.	<i>Bergenia ciliata Stern.</i>	Pashnabheda	20
60.	<i>Clitoria ternatea (blue & white variety)</i>	Aparajita	20
61.	<i>Hyoscyamus niger</i>	Khurasani ajwaine	20
62.	<i>Psoralea corylifolia</i>	Bakuchi	20
63.	<i>Aegle marmelos</i>	Bael	50
64.	<i>Albizia lebbek</i>	Shirish/Siris	50
65.	<i>Alstonia scholaris</i>	Satvin, Saptaparna	50
66.	<i>Altingia excels</i>	Silarasa	50
67.	<i>Anacyclus pyrethrum</i>	Akarkara	50
68.	<i>Atropa belledona</i>	Beladona/Atropa	50
69.	<i>Coscinum fenestraum</i>	Peela Chandan	50
70.	<i>Crataeva nurvala</i>	Varun	50
71.	<i>Dactylorhiza hatagirea</i>	Salampanja	50
72.	<i>Gloriosa superb</i>	Kalihari	50
73.	<i>Glycyrrhiza glabra</i>	Licorice Roots, Mulethi	50
74.	<i>Gmelina arborea</i>	Gambhari	50
75.	<i>Hippophae rhamnoides</i>	Seabuckthorn	50
76.	<i>Inula racemosa</i>	Pushkarmool	50
77.	<i>Leptadenia reticulata</i>	Jivanti	50
78.	<i>Mesua ferrea</i>	Nagakeshar	50
79.	<i>Panax pseudoginseng</i>	Ginseng	50
80.	<i>Parmelia perlata</i>	Salieya	50
81.	<i>Piper cubeba</i>	Kababchini	50

82.	<i>Plumbago zeylanica</i>	Chitrak	50
83.	<i>Pueraria tuberosa</i>	Vidarikand	50
84.	<i>Premna integrifolia</i>	Agnimanth	50
85.	<i>Petrocarpus marsupium</i>	Beejasar	50
86.	<i>Rauwolfia serpentine</i>	Sarp Gandha	50
87.	<i>Salacia reticulata, Salacia oblonga</i>	Saptachakra(Saptarangi)	50
88.	<i>Saraca asoca</i>	Ashok	50
89.	<i>Smilax china</i>	Hrddhatri(Madhu snuhi), Chob Chini Lokhandi	50
90.	<i>Stereospermum suaveolens</i>	Patala	50
91.	<i>Tecomella undulate</i>	Rohitak	50
92.	<i>Tylophora asthamatica</i>	Damabooti	50
93.	<i>Taxus Wallichiana</i>	Thuner, Talispatra	50
94.	<i>Urarea picta</i>	Prishnaparni	50
95.	<i>Tricopus zeylanicus</i>	Jeevani/Arogyapacha	50
96.	<i>Desmodium gangeticum</i>	Sarivan/Orila	50
97.	<i>Zanthoxylum alatum</i>	Timoor/Tejbal	50
98.	<i>Viola odorata</i>	Bunafsha	50
99.	<i>Valeriana wallichii</i>	Indian Valerian	50
100.	<i>Rheum spp.</i>	Adapalene	50
101.	<i>Aconitum ferox/A.balfouri</i>	Vatsnabh	75
102.	<i>Aconitum heterophyllum</i>	Atees	75
103.	<i>Aquilaria agallocha</i>	Agar	75
104.	<i>Bergenia aristata</i>	Daruhaldi	75
105.	<i>Commiphora wightii</i>	Guggal	75
106.	<i>Ferula foetida</i>	Hing	75
107.	<i>Gentiana kurrooa</i>	Trayamana	75
108.	<i>Nardostachys jatamansi</i>	Jatamansi	75
109.	<i>Oroxylum indicum</i>	Syonaka	75
110.	<i>Picrorhiza kurrooa</i>	Kutki	75
111.	<i>Podophyllum hexandrum</i>	Bankakri, Indian Podophyllum	75
112.	<i>Polygonatum cirrhifolium</i>	Mahameda	75
113.	<i>Pterocarpus santalinus</i>	Raktachandan	75
114.	<i>Santalum album</i>	Chandan	75
115.	<i>Saussurea costus</i>	Kuth, Kustha	75
116.	<i>Swertia chirata</i>	Chirata, Charayatah	75
117.	<i>Aconitum chasmanthum</i>	Vatsnabh	75
118.	<i>Coptis teeta</i>	Mamira	75
119.	<i>Mappia foetida</i>	Ghanera	75

Other countries have also joined the league for exploring the medicinal herbs. At global level, African traditional healthcare system which can be considered as the oldest and an assorted therapeutic system is still the most easily accessible and affordable health resource in many rural and tribal areas of Africa. *Aloe ferox*, *Artemisia herba-alba*, *Aspalathus linearis*, *Centella asiatica*, *Catharanthus roseus*, *Cyclopia genistoides*, *Harpagophytum procumbens*, *Momordica charantia*, and *Pelargonium sidoides* are some commonly

used and more prevalent medicinal plants in Africa [31].

Kangzhuan is one of the common traditional formulations also known as Tibetan tea used as an essential beverage. Aqueous extract of Tibetan tea (LATT) was reported to have anti-oxidant effect. HPLC analysis of the extract showed the presence of at least five phenolic components, including gallic acid, and four catechins (i.e., (+)-catechin, (-)-catechin gallate (CG), (-)-epicatechin gallate (ECG), and (-)-

epigallocatechin gallate) [32]. Chinese herbal medicines are also one of the ancient traditional systems. Danggui Liuhuang (DLH) decoction is well known traditional herbal preparation widely used in East Asia for recovering from menopausal symptoms [33]. Normally hormonal therapy is used for menopause but it may also increase the risk of Ischemia strokes. Evaluation study of Chinese herbal medicines and hormone therapy (HT) performed on total 32,441 menopausal women as subject for the occurrence of Ischemia strokes revealed that use of both CHM and HT have significant risk of IS while CHM have higher rate of IS. However combined use of HT and CHM showed significant reduction in IS than HT and CHM when used separately [34]. *Allium hookeri* and *Lycium chinense*—Chinese fruit—contains rutin which can be used to reduce the proliferation of human mast cells without exposing them to any cytotoxicity. Therapeutic rutin or HM0601 reduces the mast cell proliferation, impairs the interleukin (IL)-13 and Bcl2 expression, reinstates the Bax and phosphorylated-p53 protein levels, and impairs caspase-3 activities. Moreover, it also reduces the levels of inflammatory cytokine. The study suggested that rutin/HM0601 can be a potential therapeutic herbal drug for allergic inflammatory diseases [35]. Several other studies have also reported the usefulness of medicinal plants in various human diseases.

CONCLUSION

India is one of the countries like China and Africa which traditionally depends upon natural resources and traditional practices for curing ailments. Medicinal plants are important user friendly natural resource having less side effects, hence these prime focus of research for drug development against several pathogens and curing several ailments. Excessive harvesting of medicinal plants and continuous depleting resources has affected yield, quality of extracts and its efficacy to a greater extent. Disproportionate application of chemical fertilizers and controlling agents contaminate the natural resource and environment.

Vrikshayurveda is an historic sanskrit literature dealing with not only various aspect of growing and cultivating healthy plants but also for environment conservation. Apart from

traditional practices, it also describes some recent phenomena like crop improvement. It advocates the use of organic fertilizers like *kunapjala* made from waste materials to enhance the nutrient availability in soil. Thus Vrikshayurveda can also help in improving the crop yield which help to improve the extract quality for drug formulation.

The relevance of Vrikshayurveda for a country like India is much more for overall development and a means for providing better environment, food and healthcare to its citizens to an affordable cost. The rich traditional knowledge of Indian systems including Ayurveda and other field of agriculture, horticulture, healthcare etc. if blended with appropriate modern day technological interventions, can help the society in various ways. It can not only help to fight the ill effects due to implementations of modern day unplanned forced activities blindly but can provide better option which can be need based region specific and environment friendly as well. Therefore the need of the hour is to understand the root of the cause of any problem and use the traditional knowledge with blend of modern day scientific interventions and Vrikshayurveda is of the perfect answer for these including sustainable farming and herbal healthcare.

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