

Surapala Vrikshayurveda: A treatise on agricultural technologies

Ranjana Mishra

Department of History, Shri M D Shah Mahila College, Malad (W), Mumbai

Email Id: ranjanamishra10@gmail.com

Abstract: For almost last seventy years' Indian agriculture has mainly concentrated on increasing yield and to achieve this goal all sorts of fertilizers and pesticides has been used Their negative impact on nutritional quality of plants as well as the environment is becoming evident with time. The science of farming and harvesting is not the legacy of contemporary science in India. Ancient India recognized the importance of conservation, developed cultivation, collection methods of plant, bio-resources and their rational use for health promotion and therapeutic purpose. Furthermore, the primordial classics of India laid emphasis on comprehension of plant taxonomy, classification of soil, relevant practices of cultivation viz. selection of soil, plant propagation techniques (through seeds, roots, cuttings apical portions etc.), plant nourishment, plant diseases and their management. Ayurveda is based on principles of nature and Vrikshayurveda is based on principles of Ayurveda and nature. As the aim of Ayurveda is to achieve happy, healthy and peaceful life and that of Vrikshayurveda is to provide the same to plants. The historians aver that documentation of plant in ancient India must have started around 2570 BCE to 2000 BCE. The experiences of various people from different parts of India facilitated the author in deriving to the conclusion that the practice of recommendations of Vrikshayurveda at present time would be profoundly beneficial for present economy.

Key words: Vrikshayurveda, treatise, Agricultural technologies, holistic approach

“Traditional knowledge in India is handed down through generations and manifested in different ways in the form of living folk practices, religious practices, art, economy culture and can also be found in many of our ancient manuscripts. If I were asked under what sky the human mind has most fully developed some of its choicest gifts, has most deeply pondered on the greatest problems of life, and has found solutions, I should point to India.”

-Max Mueller, German scholarⁱ

Introduction

For almost last seventy years' Indian agriculture has mainly concentrated on increasing yield and to achieve this goal all sorts of fertilizers and pesticides has been used.ⁱⁱ This has led to dawn of a new concept of organic farming. Although the use of chemical inputs in various stages

of nursery growth result in visibly more robust plants, their negative impact on nutritional quality of plants as well as the environment is becoming evident with time. This in turn has created many environmental problems which include ground water problems and barren soil.

The science of farming and harvesting is not the legacy of contemporary science in India. Ancient India recognized the importance of conservation, developed cultivation, collection methods of plant, bio-resources and their rational use for health promotion and therapeutic purpose. Furthermore, the primordial classics of India laid emphasis on comprehension of plant taxonomy, classification of soil, relevant practices of cultivation viz. selection of soil, plant propagation techniques (through seeds, roots, cuttings apical portions etc.), plant nourishment, plant diseases and their management. In ancient India, the people were aware of importance of the conservation and advancement of the plant kingdom for the benefit of the mankind. India is a nation having rich knowledge regarding its ethnic methods of farming, agriculture, horticulture. Vrikshayurveda means the science of plant life, mainly dealing with various species of trees and their healthy growth and productivity.ⁱⁱⁱ Ayurveda is based on principles of nature and Vrikshayurveda is based on principles of Ayurveda and nature. Hence, they go hand in hand with same basic principles. As the aim of Ayurveda is to achieve happy, healthy and peaceful life and that of Vrikshayurveda is to provide the same to plants.

Atharvaveda has mention about conservation and utilization of nature.^{iv} It says, that first and foremost in the process of harvest is that no damage should be done to the earth and secondly all humans can use nature for survival but not to be overuse or abuse.^v People in antiquity had profound knowledge regarding ethnic methods of farming, agriculture, horticulture etc. Being totally dependent on rains, they knew the art of rain harvesting for their personal and agricultural needs. The ancient sages had proper understanding of preservation of plant life and in-depth knowledge of the relationship of plants with other plants, animals, soil moisture, temperature and another geological phenomenon. India was blessed with a vast forest area.^{vi} Forest was the second greatest economy in ancient India after agriculture. Approximately about ten thousand different plant species were found in India out of which about 5000 were having medicinal properties and about 2500 different plants had been used as food.^{vii} The forest in India is the principal repository of large number of medicinal and aromatic plants, which are largely collected as raw materials for manufacture of drugs and perfumery products. The ancient

Indian scriptures have mentioned the number of trees. The Rigveda (5000 BCE) has recorded 67 medicinal plants, Yajurveda 81 species, Atharvaveda (4500-2500 BCE) 290 species, Charak Samhita (700 BCE) and Sushrut Samhita (200 BCE) had described properties and uses of 1100 and 1270 species respectively.^{viii}The proper documentation for the plant started around 2570 BCE to 2000 BCE.

Vrikshayurveda is a dedicated text signifying the importance of agricultural science. Vrikshayurveda means the science of plant life, mainly dealing with various species of trees and their healthy growth and productivity.^{ix} It suggests that planting of trees is a means to attain the four components of life i.e. Dharma, Artha, Kama and Moksha. This holistic approach of the science enabled the proper cultivation and care needed for the growth of plant kingdom. In Vrikshayurveda, the cultivation of about 170 plant species are described including water management, soil conservation, fertilizers to cultivate the plants, the various diseases affecting the plants and their treatment.

Methodology

The Asian Agri-History Foundation (AAF) of Andhra Pradesh helped the author in getting authentic translations of ancient text. The translation was done by Nalini Sadhale, on the request of Y L Nene, Chairman, Asian Agri-History Foundation, who procured it from the Bodleian Library, Oxford, UK. The translation of Vrikshayurveda, by various authors like Gyanendra Pandey, C.K.Ramchacharan Jugnu with different perspectives and various history books related to plants and agriculture, helped the author in preparing this research monologue. The experiences of various people from different parts of India facilitated the author in deriving to the conclusion that the practice of recommendations of Vrikshayurveda at present time would be profoundly beneficial for present economy.

Ancient Scriptures on Indian Agricultural Technology

There are innumerable literary sources that provide information about ancient Indian economy that can be traced back from aboriginal classics of India viz. Rigveda,^xAtharvaveda, Agnipurana, Satapatha Brahmana, ^{xi}Ramayana and so on. This topic has been compiled, composed and written by the different ancient authors.^{xii}Kautilalya's Arthashastra enlists the functions of the officer in charge of agriculture and his assistants and various agricultural output.^{xiii}Among the various texts describing about Vrikshayurveda are Upavanavinoda.^{xiv} An

anthological compilation of Sarngadhara paddhati by Sarngadhara of thirteenth century, is another ancient text which deals with an allied subject, viz., arbori-horticulture.^{xv} It deals with wonder of tree, selection of soils, classification of plants and rules for the nourishment of plants. Sarngadhara is so modest as to confess that this wisdom earned and stored up on his book Vrkhস্যurveda should not be considered an achievement exclusively his own. Krishi Parasara composed by Parasara is repertoire of all agricultural techniques. Krishi Sangraha by anonymous author gives details about agricultural methods and classification of soils. Kashyapikrishi shukti by Kashyapa is another book that gives in depth information about agriculture. Vishwavallabha by Chakrapani Mishra is another book of repute in history.^{xvi} The Brihat Samhita compiled by Varahamihira between 505–581 BCE. It discusses the topics like clouds, indication of yield of crop right from the blooming of flowers to harvesting, ascertaining of water in dry region. Chavundaraya composed Vrikshayurveda chapter in Lokopakara in 1025. Upvanvinod by Sarangdhar gives in details the various kinds of soils and water conservation.

Amarakosha,^{xvii} a Sanskrit lexicon of 6th century CE compiled by Pandit Amarasimha named bhūvargādi-khāṇḍa's second chapter, gives a comprehensive glimpse of the art of classification of soil, land, various agricultural implements etc.^{xviii} Krishi Parasara by Parasara saint explains about agriculture depending on rainfall, seed collection, preservation and sowing.^{xix} Various texts like Dhanwanthri Nighantu, Raja Nighantu, Bhavaprakasha Nighantu also describe some aspects of Vrikshayurveda.^{xx} The another rbook KrishiSukthi, is a text on agriculture narrated by sage Kashyapa in 8th to 9th century. It contains the description of eatable and uneatable substances, methodology of paddy cultivation. Vatsayana and Kashyapa both authors in their respective books had given details of gardening and also has mentioned that in order to make people nature friendly and ecological conscious in all ancient books gods were associated to plants, trees and flowers.^{xxi} In 12th century C.E, Chalukya King, Someshvardeva compiled an encyclopedia “Abhilashitarthachitamani” or “Manasollasa” in which a full chapter on Vrikshayurveda was included. Ghag Bhandari's poems of 18th century translated by Devnarayan Diwedi gives immense information about various facts related to agriculture and farming techniques.

Historical Background of Vrikshayurveda

Vrikshayurveda deals with various tree and plant species and ensure the healthy growth and productivity. It consists of about 170 different plant species including herbs, shrubs and trees. The different chapters of Vrikshayurveda deal with agro -horticulture, home gardening, intercropping and storage etc. The book emphasizes on plant procurement and preservation along with soil treatment, ground water management and fertilizers.^{xxii} Two ancient books are completely dedicated to Vrikshayurveda.

Vrikshayurveda wrote by Salihotra around 400 B.C.E^{xxiii} consists of twelve vast chapters namely Bhumi nirupana (Graphical representation of Soil classification according to Bhumi nirupana), Bijoptivithi (illustrate about the process of seed germination), Padapavivaksa (exposed to the medicated smoke which can serve as an antimicrobial agent), Ropana vidhana (method of cultivation), Nise canavidhi (the life of plant), Posana (nurture), vidhi (method), Drumaraksa (protect trees from weather), Taru Cikitsa (methods of curing), Upavanakriya, Nivasa sanna taru Subhasubha Laksana (perfect dwelling), Taru Mahima (a little away from roof and window) and Citrikarana (make it blossom throughout the year).^{xxiv}

In the 1st chapter of the book, various types of land and soil are described. The first category of land is known as Anupa Desha. This land is fertile in nature with abundant water, green trees, climate suitable for the growth of plants and soil rich in natural nutrients. The second category is Jangala Desha where the land is dry and barren. The third category of land is Sadharana Desha where the water content in the soil is less. The book gives in details the preservation, care of seeds and its germination also. The methods used for the irrigation of the plants, amount of water needed for the proper growth of plant is mentioned in depth. The book states about fertilizer called as 'kunapajala' (The dictionary meaning of the Sanskrit word kunapa is "smelling like a dead body, stinking).^{xxv} The manure kunapambu or kunapajala was appropriately named because it involved fermentation of the animal remains, such as flesh, marrow, etc. which was used for the cultivation of the plants. There are mention of innumerable methods as how to protect the plants and trees from extreme weather conditions, treatment of branches and roots if affected by diseases. The book contains the names of diverse plants which should be planted around dwelling place. This book also describes about the techniques used to

help plants and trees bloom flowers and bear fruits throughout the year irrespective of the season, climatic conditions etc.^{xxvi}

The other book on Vrikshayurveda was written 1400 years after Salihotra by Surapala (1000 CE). Surapala lived and worked in Bundelkhand in central India, under the royal patronage of King Bhimapala.^{xxvii} He carried out his various experiments in horticulture and botany. His text was forgotten and fell into oblivion for several centuries. It was translated from Sanskrit into English by Dr. Nalini Sadhale in 1996 and in Hindi by Dr. S.L. Choudhary in 2003. Surapala's book deals with various subjects such as planting a garden, importance of various trees, collection, examination and treatment of seeds, selection of suitable land, soil characteristics, digging of planting pits, different methods of irrigation, plant nutrition, fertilizers, diseases of trees and their treatment, the wonders of horticulture, plant conservation, underground water resources etc. He wrote about all these basic information, a millennium ago when chemical fertilizers and pesticides were unknown. In those days' plant diseases and pests were dealt with by natural means available to the farmers who were using the locally available materials. The basic techniques of agriculture enunciated by him yielded magnificent results in the past decade. This manuscript on horticulture gives methods to prepare various kinds of manures for more yield and preparation for various solutions to treat plant diseases.^{xxviii} Acharya Surapala is referred to be a prominent physician of his time (Vaidya vidyavarenya). On the foundation of the soil types, plants, and environments discussed in the work, historians surmise Surapala lived in the Gangetic plain i.e. the present day U.P / Bihar region between 7 to 10th century C.E. Like several other Sanskrit texts, the manuscript gives no clue to the date or place of the author.^{xxix} Interestingly, it is in Ubandhu's Vasavadatta, a Sanskrit prose romance of the seventh century that one comes across the name Surapala. This might be a reference to some Surapala who through his writings or commentary could throw light on the plant. At least, there is a reasonable ground to accept such a proposition. Surpala has expressed indebtedness to the earlier scholars but claims that in writing the text he was guided by his own reason. Even though it is a reasonable conjecture, Sdhale Nalini in his book, Dear to the World: The Science of Plant Life, avers that the reference must have been to some other Surapala of the seventh century, the author of Vrikshayurveda must be in 10th Century C.E. He also claims that an ancient work on plants Ganikarika was there before Surpala and which must have guided him to write the book.^{xxx}

Surapal's Vrikshayurveda is a systematic composition starting with the glorification of trees and tree planting.^{xxxii} It then proceeds to discuss various topics connected with the science of plant life such as procuring, preserving, and treating of seeds before planting; preparing pits for planting saplings, selection of soil, method of watering, nourishments and fertilizers; plant diseases and plant protection from internal and external diseases, layout of a garden, agricultural and horticultural wonders, groundwater resources, etc.^{xxxiii} The topics are aptly divided into different sections and are internally correlated. This exclusive book dedicated to the science of plants is divided into 13 chapters.^{xxxiii} In the book the whole plant kingdom is divided into 4 types based upon their morphology.^{xxxiv} First plant is Vanaspati- Plants which bear fruits but flowers cannot be seen. The second plant is Druma in which both fruit and flowers can be seen. The third plant is Lata which is Creepers and the fourth is Gulma i.e. Shrubs and Herbs. In this book a special method of preparing the manure is mentioned. It is prepared from the combination of the flesh and fat of boar mixed with water and milk. The ingredients used for preparation of the manure was Meat-1 Kg, Sesame- 250 gms, Black gram- 250 gms and Cow milk- 1000 ml. The method to prepare was like cooking meat with 5 liters of water till the water was reduced to half and after that the water was filtered. In the filtered water sesame and black gram was mixed before again put to boil. The milk is added when the boiled mixture was cool. After that the liquid was transferred into a mud pot and then it was buried in the ground. After 10 days, the filtrate was transferred into another pot till it fermented. The filtrate could be applied near the roots or used as spray. The solid was mixed with the soil of agricultural field and the water was sprinkled on newly germinated seeds and this helped in quicker growth of plants. Even today Scientific studies have proved that if Kunapa Jal which is 50 ml of the filtrate could be mixed with 10 liters of water and spray on the plants the yield is much more than usual production. The book writes about methods of sowing seeds. It says that seeds should be smeared with cow dung and sprinkled with milk. After getting dried they should be once again smeared repeatedly with powder of Vidanga (embelia ribes burm plant) mixed with honey and then sown for germination.^{xxxv}

The book also deals with process of planting trees. It says that a proper pit should be made and each pit should be about 1 'hasta' (about 18 inches) or 2 'hasta' (about 36 inches) in depth and one has a width should be prepared. Before planting the pit should be properly dried, filled with cow bones, cow dung and burnt. Then the ash is removed after it is cooled. 'Kunapa'

(special manure) water should be sprinkled and fill the pit with good mud before transferring the sapling to the pit. The bulbs should be planted in pits measuring one hastha (hand) length, breadth and depth and filled with mud mixed with thick sand.^{xxxvi}The Kadali (Banana plant) should be planted after smearing the root with cow dung and should be watered well. The book gives in details the methods of planting big and the small trees. It says that small trees should be transplanted by day time after smearing the root with honey, lotus fiber, and ghee and the big trees should be transplanted during the evening with their roots covered.

The fruits yielding trees should be planted with a gap of 6-9 meters for better yield^{xxxvii}.Depth of pits and spacing between trees was almost the same as we follow today. Pits were dug and soil was allowed to dry. These were then filled with crushed bones and cattle dung and burnt in the pits themselves. Only after the ash became cool, kunapajala (described later) was liberally sprinkled on all sides of the pits. Pits were then filled with good soil. Saplings were placed in the pits.

The book talks about different types of soil. The earth containing the black colored soil is the most fertile land for cultivation. The book mentions about the time for watering the plants according to the season. The newly planted trees should be watered both in the morning and evening. The watering method varies during all seasons as for example in Hemantha, Sisira i.e. winter on every alternate day, in vasanthai.e. spring, it should be daily. In Grishmai.e. Summer it should be twice once in the morning and once in the afternoon. In Sharat i.e. autumn when there is no rain fall then a ditch should be made around the tree and everyday it should be filled with water. The crops and the vegetables should be cultivated on the quality of the soil and different seasons.^{xxxviii}To increase the size of vegetables, fruits like orange, mango, pomegranate etc. milk mixed with fertilizer of sesame, remnants of meat and fish should be poured around the plant after the flowering is seen. In case of worm in plant one should irrigate the plant with cold water for seven days and apply cow dung mixed with water, milk and kunapajala.^{xxxix} Every alternate day one should apply mixture of white mustard, Vacha (acorus calamus), Kusta (Saussurea lappa) to the affected part of the plant. It is written in the book that in case the plant dries then one should replace the soil and mix milk and water in the changed soil. One can also use water used for cleaning fish and rice for irrigation of plants and which can save them from various diseases.The book also mentions that Jambu(Acmella oleracea) champaka, punnaga,

nagakesara, tamarind, kapittha, badari, bilva, kumbhakari, priyangu, panasa, amra, madhuka, karamarda, etc. grow from seeds but tambul, sindhuvara, tagara, etc. grow from stalks but Patala, dadimi, plaksa, karavira, vata, mallika, udumbara kunda, etc. grow from seeds as well as from stalks. It is specifically mentioned that large seeds should be sown singly but smaller ones should be sown in multiples. The seed of naranga (orange) should be sown in a slanting position with hand. The stalk should be eighteen angula (finger's breadth) not too tender nor too hard. The half of the plant should be smeared with plenty of cow dung and then it should be planted with three-fourth part in the pit and should be sprinkled with water mixed with soft sandy mud. When they are covered with leaves they should be uprooted and transplanted wherever desired in the month of Asadha (beginning of rains). The other chapters of the book depict Achaya Surapala's observation and efficacy in treating the diseased plants, viz., when watered by the decoction of milk, honey, yastimadhu, and madhuka, trees suffering from pitta type of diseases get cured. The worms accumulated on trees can be treated quickly by smoking the tree with the mixture of white mustard, ramatha, vidanga, vaca, usana, and water mixed with beef, horn of a buffalo, flesh of a pigeon, and the powder of bhillata (bhallataka). If Creepers are eaten away by insects, they should be sprinkled with water mixed with oil cake. The insects on the leaves can be destroyed by sprinkling the powder of ashes and brick-dust.^{200-201.}^{xl} The broken trees should be smeared with the paste of the bark of plaksa and udumbara mixed with ghee, honey, wine, and milk and the broken parts should be firmly tied together with the rope of a rice stalk.^{xli} Fresh soil should then be filled in the basin around the trees, sprinkled immediately with the milk of buffalo and flooded with water. This will help them to recover. The white flowers of a tree turn into a golden colour if the tree is watered with the mixture of turmeric powder, kimsuka, cotton seed, manjista, and lodhra.

Survey of literature available on Vrikshayurveda reveals that it is entirely based on analytical methods with minimum disturbance to nature and harmonious living as guiding principle. Topics related to soil, water, irrigation, farm implements, land preparation, propagation, plant nutrients, plant protection from diseases, harvesting and storage etc. practices are eco-friendly.^{xliii} This book regains its importance till date as the book describes in detail about the cultivation and preservation of the plant from its seed till its maturity.

Positive outcome of Methods of Vrikshayurveda in present times

In recent years there has been a great deal of interest, experiments and innovations on the use of animal products in traditional agriculture. ^{xliii}The first person who experimented with kunapajala was Valmiki Sreenivasa Ayangarya, a mathematician by training, who renounced materialistic life about 20 years ago and dedicated himself to the tribal welfare activities. ^{xliv} He first published a short note "Herbal kunapa" in the journal Asian Agri-History in 2004. Valmiki reported excellent results when kunapajalawas applied to mango and coconut. He further tried a "herbal kunapa" on various fruits and plants and got excellent results. Valmiki published a report on "manujala" in which he used vegetable organic wastes and fermented those in human urine. He again observed excellent effects on the growth of several fruit and vegetable plants. ^{xlv}

Valmiki continued his experimentation with kunapajala in Arunachal Pradesh in Northeast India (Ayangarya, 2005). He developed "herbal kunapa" and called it Sasyagavya. He prepared 5,000 to 10,000 liters Sasyagavya every day and applied it to the soil. Tea plants started looking healthy. He prepared kunapajala by fermenting aerobically safari fish (mentioned in Vrikshayurveda) in cow urine and sprayed tea bushes at 1 % concentration of the ferment, which he named Indsafari, to most effectively control the attack by tea mosquito helopeltis with 10-day interval schedule. Foliar sprays with Indsafari at 1% concentration also controlled the loopers on shade trees commonly grown in tea gardens. Valmiki found Indsafari both insecticide and growth promoter. In addition, Valmiki prepared kunapajala from poultry (chicken) bird flesh and called it kukkutakunapa and used it very effectively in increasing kiwifruit yield from 120 kg per tree. Around the same time Narayanan (2006), farmer in Tamil Nadu, Dindigal District prepared "rat Kunapa" or "mushika kunapa. This experiment not only increased the growth of the plants but also the rats disappeared from sprayed fields.

Arijit Bhuyan and Babul Lahkar of Golaghat, small tea growers, learnt how to make kunapa jal applied it to their gardens and fields in 2009. They obtained glorious results within a short period of time. These farmers today produce full-bodied loose leaf green teas and have received appreciations from foreign buyers for their unique natural flavors.

Dr. Padmeswar Gogoi a retired botanist has also praised these vrikshayurveda manures when he saw their wonderful field results. He is totally convinced about the efficacy of sasyagavya which uses green weeds and cowdung as raw materials. He has now become a

champion of vrikshayurveda in Assam. Even Sir Albert Howard in his book an Agricultural Testament has admitted the superiority of traditional Indian methods of agriculture over European methods.^{xlvi} He avers that usage of chemical fertilizers have resulted into disaster and farmer suicides in Vidarbha, Andhra Pradesh and north India are a direct outcome of this system of agriculture.

Indian agriculture and horticulture stands at the crossroads today. Chemical fertilizers and pesticides are petroleum derivatives. But with the depletion of oil reserves all over this planet within the next 20-25 years this system of agriculture cannot last. Anjali Pathak is a naturopath, writer and organic farming consultant. She uses indigenous methods including those of vrikshayurveda in her work. She advises growers and conducts practical workshops on vrikshayurveda methods all over India upon invitation.

It is most relevant to point out here a recent study by the scientists at the University of Lancaster and Britain's Institute of Grassland and Environmental Research, Professor Richard Bardgett and his team have found that not only can organic nitrogen be directly taken up by plants, but also it is used differently by different species, enabling nitrogen sharing and biodiversity.^{xlvii}

Relevance of Vrikshayurveda

The ignorance of our ancient texts is responsible for the degeneration of the agriculture practices. With the help of ancient texts and model methods of agriculture we can not only scientifically prove the sayings of the text but we could also establish some novel modified methods for the agricultural systems. Traditional storage treatment that is using cow's milk, cow dung, honey and Vidanga powder methodology adopted from Surapala's Vrikshayurveda is effective for storing seeds. Even Cow dung slurry is effective in increasing germination percentage and rate of growth speed. The Panchagavyam is better than Urea as nutrition supplement for seedlings. The proper interpretation and availability of Vrikshayurveda can also play an important role in the field of intercropping and put forward for the use of organic fertilizers and can play a crucial role to build the eco friendly environment. The scientific community should validate the sayings of Vrikshayurveda and the development of the agriculture as well as the production of various medicinal plants used in various systems of medicine. Y.L. Nene avows that the methods described in Vrikshayurvedahas potential of more

crop yield and can control crop mites.^{xlvi} Apart from agricultural scientists the personnel from Ayurveda, Forestry, Ecology and Pharmacognosy should emphasize to the respective ancient science of Vrikhsayurveda and correlate with the modern science and the thorough validation is required.

Conclusion

Some critiques opine that Surapala gave a number of impractical suggestions, untested methods, fanciful ideas that do not make sense. There is no doubt that caution, discretion, further study and research should go along with the enthusiasm to accept the book but the present report of various case studies gives positive aspects of Vrikshayurveda. The use of synthetic manure in agricultural field is a very serious problem in present era of modern agricultural system both economically and environmentally. The case of Punjab with over exploitation of land through overdose of fertilizers is a worrisome phenomenon. It is urgent to introduce organic manure in agricultural field to protect agricultural ecosystem. Therefore, a balanced fertilization strategy that combines the use of chemical, organic or bio-fertilizers must be developed and evaluated. There is a growing recognition, nationally and internationally, of the need for incorporating the contributions of these systems.^{xlix}

The Vrikshayurveda has mentioned every possible measure to maintain ecological balance to maintain nature's harmony. There is increased demand towards the natural and traditional holistic systems of healing in recent times. At this juncture there is need to develop appropriate methodology of cultivation by integrating the knowledge of traditional and contemporary sciences which consecutively aid in sustainable agriculture and their conservation. The ignorance of our ancient texts is responsible for the degeneration of the agriculture practices. With the help of ancient texts and model methods of agriculture we can not only scientifically prove the sayings of the text but we could also establish some novel modified methods for the agricultural systems. Present scenario is very suitable for the development of the ancient sciences as there is a huge demand of the conservation and sustainable utilization of the wood and non-wood forest products as well as the medicinal plant sciences. The proper interpretation and availability of Vrikshayurveda can also play an important role in the field of intercropping and put forward for the use of organic fertilizers and can play a crucial role to build the eco friendly environment. Greater incorporation of suitable traditional techniques during development of

nursery protocol, along with currently available practices, will definitely result in production of quality planting material better suited for large scale plantation programs aligned to nature and better productivity.

ⁱ https://en.wikipedia.org/wiki/Max_Müller

ⁱⁱ https://en.wikipedia.org/wiki/Organic_farming

ⁱⁱⁱ Surapalas Vrikshayurveda: ancient treatise on plant life edited by Dr Shrikrishana jugnu,Chaukhamba Sanskrit Series office, Varanasi. 2004, pp.34-67.

^{iv} Ralph Griffith, The Hymns of the Atharva Veda, Volume 1, EJ Lazarus, p. v.

^v Ibid.,p.vi.

^{vi} Nalini Sadhale, (Tr.) Surapala's Vrikshayurveda the Science of Plant Life by Surapala, Agri-History Bulletin No. 1, Asian Agri-History Foundation, Secunderabad India,2005, pp.55-85

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^{viii} Vrksayurveda of Parasara:A Treatise on plant Science, Sri Satguru Publication,1996,pp.45-55.

^{ix} Srikanth, Devesh Tewari and A. K. Mangal,THE SCIENCE OF PLANT LIFE (VRIKSHA AYURVEDA) IN ARCHAIC LITERATURE: AN INSIGHT ON BOTANICAL, AGRICULTURAL AND HORTICULTURAL ASPECTS OF ANCIENT INDIA Central Council for Research in Ayurvedic Sciences, Ministry of Government of India, New Delhi, India.Vol 4, Issue 06, 2015,pp.388-404.

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^{xi} . Satapatha Bramana with hindi Trans, by Pt. Ganga Prasad Upadhyaya, in two volumes, The Research Institute of Ancient Scientific Studies, Delhi. Vol. I-1967; Vol.II-1969, pp.56-85.

^{xii} Central Council for Research in Ayurvedic Sciences, Ministry of AYUSH, Government of India, New Delhi, India.Vol 4, Issue 06, 2015, pp.388-404.

^{xiii} Arthashastra of Kautilya, critical Edn., and English transl. by R.P. Kangle in 2 vols., University of Bombay, 1960, ed. R.Sharma Sastri, Mysore, 1963.

^{xiv} G.P. Majumdar, Upavana-Vinoda, A Sanskrit Treatise on Arbori-Horticulture, Indian Research Institute, Calcutta, 1935, pp.126-128.

^{xv} Sarngadhara Samhita,Ancient Science of Life, Vol. IV, No.2 October 1984, Page110-111.

^{xvi} Upavana Vinoda with Eng. Transl. by G.P. Majumdar, The Indian Research Centre,Calcutta, 1935,pp.45-89.

^{xvii} Amarakosa with the comm. of Lingayasurin and Mallinatha, in 3 vols., Adyar Library,1900,pp.123-167.

^{xviii} <https://en.wikipedia.org/wiki/Amarakosha>

^{xix} <https://lugigupag.files.wordpress.com/2015/06/parashara-smriti-pdf.pdf>

^{xx} easyayurveda.com/2016/05/11/vriksha-ayurveda-to-improve-plant-health/

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