(ISSN 2395 - 468X)

Year - 2023 Vol. 10, No. 1 Issue: January 2023

Van Sangyan

A monthly open access e-magazine

Impact Factor

SJIF: 2021-6.54

Indexed in:

COSMOS Foundation (Germany)

International Inst. of Org. Res. (Australia)

IIJIF

Tropical Forest Research Institute

(Indian Council of Forestry Research and Education)

Ministry of Environment, Forests and Climate Change (MoEFCC)

PO RFRC, Mandla Road, Jabalpur – 482021, India

Van Sangyan

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Note to Authors:

We welcome the readers of Van Sangyan to write to us about their views and issues in forestry. Those who wish to share their knowledge and experiences can send them:

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The articles can be in English, Hindi, Marathi, Chhattisgarhi and Oriya, and should contain the writers name, designation and full postal address, including e-mail id and contact number. TFRI, Jabalpur houses experts from all fields of forestry who would be happy to answer reader's queries on various scientific issues. Your queries may be sent to The Editor, and the expert's reply to the same will be published in the next issue of Van Sangyan.

Cover Photo: Panoramic view of Achanakmar-Amarkantak Biosphere Reserve

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From the Editor's desk

A large amount of artificial fertilizers are used toreplenish soil N and P, resulting in high cost and increased environmental pollution. This indiscriminate use of chemical fertilizers can be reduced by applying eco-friendly biofertilizers such as plant growth-promoting rhizobacteria (PGPR).

Bacteria that colonize plant roots and promote plant growth are referred to as plant growth-promoting rhizobacteria. Acinetobacter, Aeromonas, Agrobacterium, Allorhizobium, Arthrobacter, Azoarcus, Azorhizobium, Azospirillum, Azotobacter, Bacillus, Bradyrhizobium, Burkholderia, Caulobacter, Chromobacterium, Delftia, Enterobacter, Flavobacterium, Frankia, Gluconacetobacter, Klebsiella, Mesorhizobium, Micrococcus, Paenibacillus, Pantoea, Pseudomonas, Rhizobium, Serratia, Streptomyces, and Thiobacillus are the most reported bacteria genera that have been applied as PGPR-based biofertilizer

The mechanism by which PGPR exerts their beneficial effect on plants can be very diverse. Mostly, their effects can occur via local antagonism to soil-borne pathogens or by induction of systemic resistance against pathogens throughout the entire plant. Both types of induced resistance render uninfected plant parts more resistant to pathogens in several plant species. Resistance-inducing and antagonistic rhizobacteria might be useful in formulating new inoculants with combinations of different mechanisms of action, leading to a more efficient use for biocontrol strategies to improve cropping systems

In line with the above this issue of Van Sangyan containsanarticle onPlant growth promoting rhizobacteria - A safer alternative to chemical fertilizers.There are also useful articles viz.Agroforestry systems of West Bengal, Silviculture strategies- An evolving tool in forest stands, An insight into the major multipurpose trees of northwestern Himalaya, An overview of blue gold - Indigofera tinctoria, करंज: कृषिवानिकी केअंतर्गत बहुपयोगी वृक्ष, and शीशम एक बहुउपयोगी वन्यप्रजाति.

I hope that readers would find maximum information in this issue relevant and valuable to the sustainable management of forests. Van Sangyan welcomes articles, views and queries on various such issues in the field of forest science.

Looking forward to meet you all through forthcoming issues

Dr. Naseer Mohammad

Chief Editor

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Plant growth promoting rhizobacteria - A safer alternative to chemical fertilizers

Vipula Vyas*, Varsha Giri, Tanmaya Kumar Bhoi and Sangeeta Singh

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Abstract

Plant growth-promoting rhizobacteria (PGPR) are rhizosphere microorganisms that can improve plant growth through a number of different mechanisms, including phosphate solubilization, siderophore production, biological nitrogen fixation, rhizosphere engineering, production of 1-Aminocyclopropane-1-carboxylate deaminase (ACC), interference with quorum sensing (QS) signalling and inhibition of biofilm formation. A fundamental problem today is meeting the rising demand for crop output while significantly reducing the usage of synthetic chemical fertilisers and pesticides. By promoting plant development, the usage of PGPR has been shown to be an environmentally responsible way to increase agricultural yields. Since the use of pesticides and fertilisers in agricultural fields has reduced soil fertility and quality, it is nearly impossible to expand agricultural land with rich soil, so researchers and scientists have focused their attention on more productive and safe agricultural techniques. Rhizobacteria that promote plant growth (PGPR) have been acting as a co-evolution of microbes and plants, displaying antagonistic and cooperative relationships with soil microbes.

Keywords: PGPR**,** Rhizobacteria, Biofertilizer

Introduction

The word “sustainable food production” has been an echoing phrase among policy makers, relevant national agencies and international organizations over the past decades. This has become ultimately one of the world most fundamental need to curb food insecurity amidst rising human population. Within the last century, man has gradually been faced with the greatest challenge of all time (food insecurity), which has potential of possible looming consequences on the entire human race. Overcoming this confront also will not be an easy task as there has been so much pressure on the natural ecosystem. The use of synthesized agro chemicals/fertilizer has been a point of discuss in public domain in the time past. Though their advantages tend to be immediate, they still present a lasting environmental and public health threat to man through possible entrance of heavy metals via the food chain, death of soil biotic life, environmental deterioration and degradation and alteration or damage of soil structure. Since the inception of microbiological research, only about 1% of

the estimated number of microorganisms has so far been identified. To combat food insecurity through agrobiology, there is need to pay stern attention on the engineering of beneficial microorganisms' resident in the soil that has been ascribed with potentials of mitigating associated difficulties in agricultural practices.

Rhizobacteria and microflora of soil

Bacteria fund over 95% of the soil microbial activities and are also dominant in abundant. This is as aresult of their fast proliferation and ability to utilize a range of nitrogen and carbon source as energy. Microbial structure of the bulk soil flora and rhizobacteria differs with the plant developmental stage, specie type and soil property. Some of the interactions that occur within therhizosphere and the rhizospheric bulk soil can be said tobe neutral, synergistic or antagonistic. The participating genera involved in harmful interaction tend to workagainst the plant growth, exerting effects in the form of phytopathogen while the beneficial once enhances growth with ability to support nutritional provision.

Plant growth promoting rhizobacteria (PGPR)

PGPR was first proposed by Kloepper*et al*. (1980). Recently, it has been used to include wide range ofrhizobacteria (Alcaligenes, Pseudomonas, Azospirillum, Bacillus, Klebsiella, Azotobacter, Enterobacter, Burkholderia, Arthrobacter and Serratia) that improves plant growth through different mechanisms. PGPR exhibit a special role by hindering plant infestation with disease, increase nutrient absorption, enhance root and shoot formation, improve seed germination and making the plant more to lerant to most environmental stress. Interestingly, these organisms have been accrued with fascinating roles ranging from enhanced nitrogen fixation through nodule formation, solubilization of phosphates, production of phytohormones such gibberellins, siderophores, indole acetic acid and serving as low molecular weight agents that modulate plantgrowth and development (Kenneth, 2017).

Role of plant growth promoting rhizobacteria for plant growth enhancement

PGPR plays an important role in enhancing plant growth through a wide variety of mechanisms. The mode of action of PGPR that promotes plant growth includes (i) abiotic stress tolerance in plants; (ii) nutrient fixation for easy uptake by plant; (iii) plant growth regulators; (iv) the production of siderophores; (v) the production of volatile organic compounds; and (vi) the production of protection enzyme such as chitinase, glucanase, and ACC-deaminase for the prevention of plant diseases. However, the mode of action of different PGPR varies depending on the type of host plants (Deyet al.2004).

Abiotic stress tolerance in plants

Abiotic stresses are considered to be the main sources of agricultural yield reduction. However, the intensity of abiotic stress varies depending on the type of soils (deficiency of hormonal and nutritional imbalances) and plant factors (physiological disorders such as being susceptible to diseases, abscission, ***etc.***).

Nutrient availability for plant uptake

PGPR has the ability to increase the availability of nutrient concentration in the rhizosphere by fixing nutrients, thus preventing them from leaching out. As an example, nitrogen, which is needed for the synthesis of amino acids and proteins, is the most limiting nutrient for plants. The mechanisms by which atmospheric nitrogen is added into organic forms that can be assimilated by plants are exclusive to prokaryotes. A rare example of a free-living nitrogen-fixing organism is ***Azospirillum***, often associated with cereals in temperate zones and also reported to be able to improve rice crop yields. Some PGPR have the ability to solubilize phosphate, resulting in an increased availability of phosphate ions in the soil, which can be easily taken up by the plants.

Plant growth regulators

These plant growth regulators, also termed plant exogenous hormones, are synthetic substances that are similar to natural plant hormones. They are used to regulate the growth of plants and are important measures for boosting agricultural production. One of the terms for the prominent modes of action for growth promotion by PGPR is phytostimulator, or plant growth regulator. This is defined as microorganisms that have the ability to produce or alter the concentration of growth regulators such as IAA, GA, cytokinins, and ethylene. The mechanism that is being projected is the production of phytohormones (plant hormones) such as auxins, cytokinins, and GA. Phytohormones are organic substances found in extremely low amounts that exert influence on the biochemical, physiological, and morphological processes in plants; their synthesis is smoothly regulated. Phytohormones that are not naturally synthesized by the plants but are synthesized exogenously by natural and synthetic means are known as plant growth regulators.

Production of siderophores

Siderophores are low molecular weight iron binding protein compounds involved in the process of chelating ferric iron (Fe (iii)) from the environment. When Fe is limited, microbial siderophores provide plants with Fe, enhancing their growth. Plants sequester iron by utilizing siderophores secreted by the mentioned PGPR.

Production of volatile organic compound

Volatile organic compounds (VOCs) produced by plant growth promoting rhizobacteria (PGPR) are heavily involved in improving plant growth and induce systemic resistance (ISR) towards pathogens. Several bacterial species, from diverse genera including *Bacillus, Pseudomonas, Serratia, Arthrobacter***,** and *Stenotrophomonas***,** produce VOCs that influence plant growth. Acetoin and 2,3-butanediol synthesized by *Bacillus* are the best known of these compounds and are responsible for significant improvements in plant growth.

Production of enzymes

In terms of PGPR producing protection enzymes, the mode of action could be labeled that of biopesticides: PGPR promote plant growth through the control of phytopathogenic agents, primarily for the production of metabolites contributing to the antibiosis and antifungal properties used as defense systems. The mechanism would

involve the production of hydrolytic enzymes, of which two examples are chitinase and glucanase. Major fungal cell wall components are made up of chitin and beta-glucan, thus chitinases and beta-glucanases producing bacteria would inhibit fungal growth.

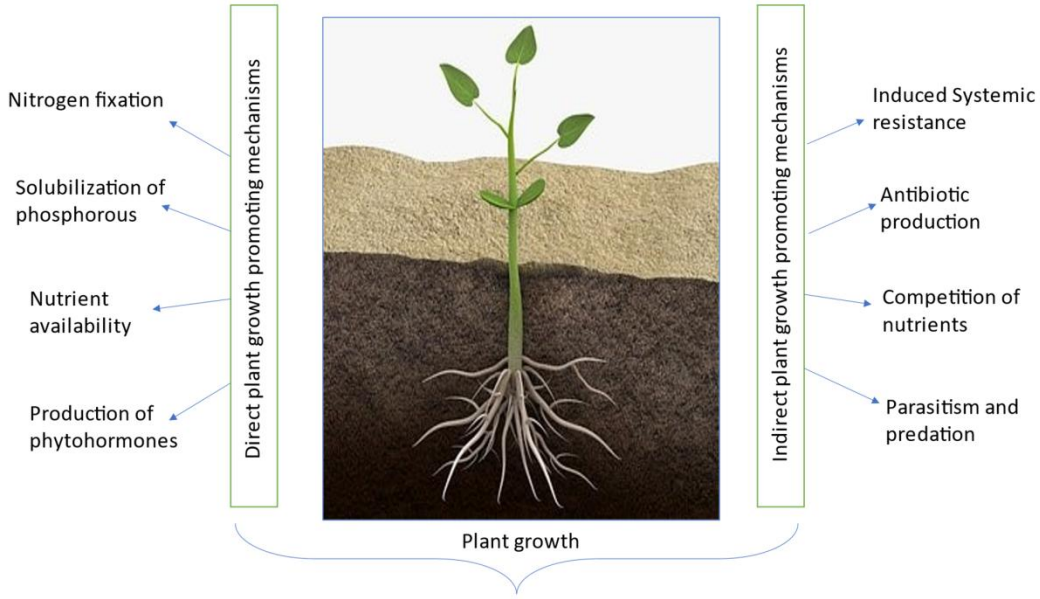

Fig.1: Mechanisms of Action of PGPRs

Conclusion

Biofertilizer is becoming a crucial aspect of organic farming and a major player for the economy and for general agricultural production on a global scale. Biofertilizers can be defined as products that contain living microorganisms; when applied to seeds, plant surfaces, or soil, they colonize the rhizosphere or interior of the plant, and promote plant growth by increasing the supply or availability of primary nutrients to the host plant. PGPR can be classified as biofertilizers when they act as a plant nourishment and enrichment source that would replenish or reconstruct the nutrient cycle between the soil, plant roots, and microorganisms present. The catch here is whether the "living" biofertilizers used could be self-sustaining or would need to be re-applied to soil on a continual basis, and also whether excessive usage would destabilize the microorganism interaction in the soil.

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Agroforestry systems of West Bengal

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The agroforestry concept is evolving by highlighting its potential in the concurrent period where scientists, policymakers, and people strive to find solutions for food security concerns without causing land degradation, climate change, and biodiversity loss. Agroforestry lies close to forests in sustainability and ecosystem services without affecting the economic output much. Concomitantly, traditional monoculture practises focus on production despite the threats to the ecosystem. Even though agroforestry increases the complexity of the farm unit by incorporating multiple components (trees, crops, livestock), it also provides economic, social, and ecological benefits.

Agroforestry, well recognised in the agricultural research field for the past two and a half decades, is promoted as a sustainability-enhancing practise worldwide. The scope of agroforestry practises is not only limited to agricultural lands but also extends to degraded lands. Trees, one of the main components of agroforestry, nourish the soil and adapt the areas cultivable. Conserving natural resources is one of the main objectives of agroforestry (Figure1).

Trees selected for an agroforestry system should possess multiple benefits and encourage the surrounding intercrops (Figure 2). Hence, agroforestry uplifts the socio-economic profile of farmers by doubling their income. In addition, the agroforestry systems sequester biomass and soil carbon with carbon stock values comparable to those of natural forests and plantations. Therefore, agroforestry can be recommended as an apt land use and land management strategy at the local, regional and national levels to reduce carbon dioxide emissions combined with nutritious food provision.

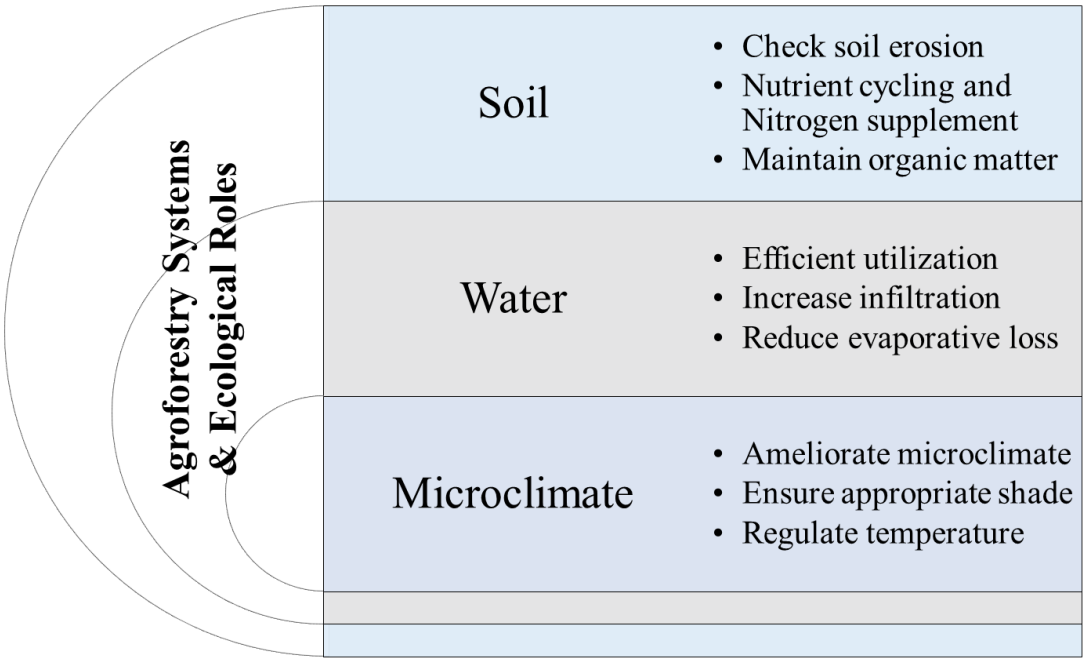

Fig. 1: Ecological role of Agroforestry Systems

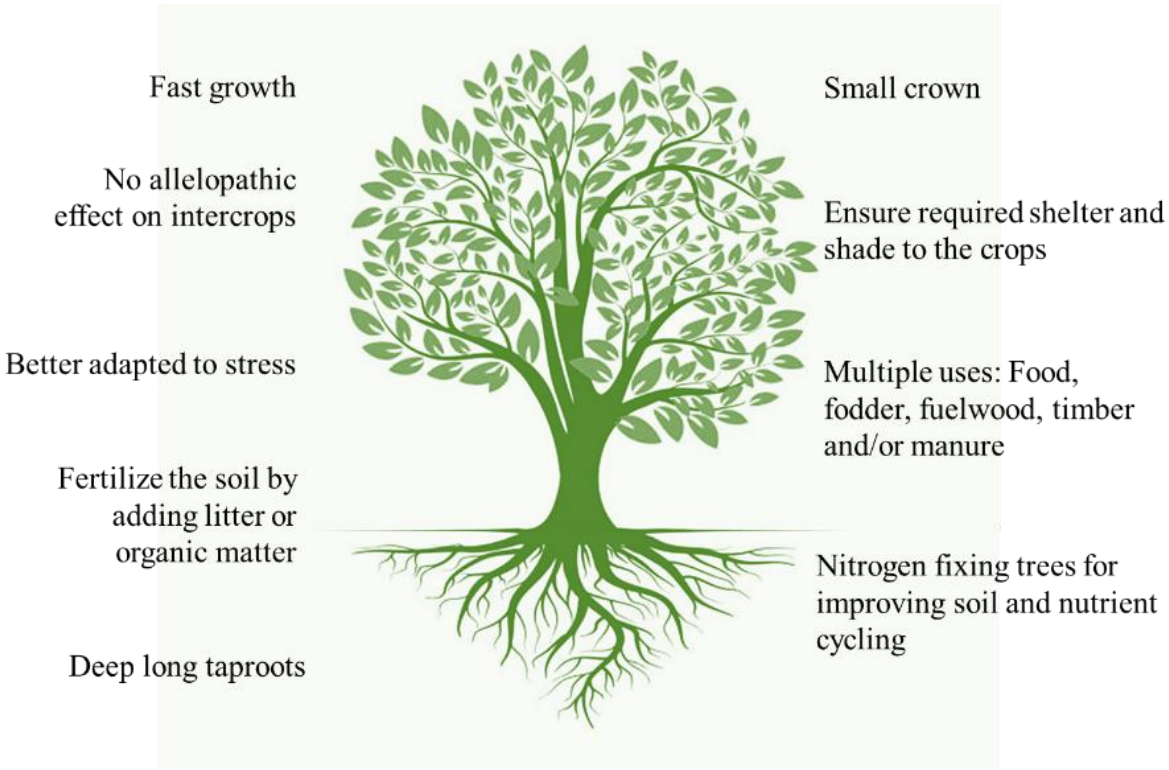

Fig. 2: Essential qualities of trees required in agroforestry systems (Selvan and Kumar, 2017; Saha et al., 2021)

Agroforestry in West Bengal

Agroforestry systems and practices vary in structure, composition, economic worth and dependency between places and cultures. West Bengal, a state in the eastern part of India, is divided into Gangetic or alluvial zones, terai, northern hills and red and laterite regions, with peculiar agroforestry systems in each zone.

In the Gangetic areas of West Bengal, people widely accepted the potential of agroforestry for its provisional services and protective uses. Trees were plantedto demarcateboundaries in agricultural fields of these areas. The dominant agroforestry systems of this zone are documented by Dhara et al. (2016) as follows:

- Agri-silviculture (Trees+ Crops)
- Agri-horticulture (Fruit trees+ Crops)
- Agri-horti-silviculture (Trees+ Fruit trees+ Crops)
- Horti-agriculture (Fruit trees+ Vegetables)
- Boundary plantation (Trees on boundary+ Crops)
- Silvi-apiculture (Trees+ Honeybee)
- Horti-apiculture (Fruit trees+ Honeybee)
- Aqua-forestry (Fish+ Tree)
- Homestead gardens (Combination of trees, fruit trees, vegetables etc.)

The list of species encountered during the survey of agroforestry systems by Dhara et al. (2016) is represented in Figure 3. Mango, Guava, Ber and Litchi are the main fruit trees preferred by people, but lack of knowledge and technology hinders the proper maintenance of agroforestry systems in these regions. More research should be encouraged regarding species selection and management aspects.

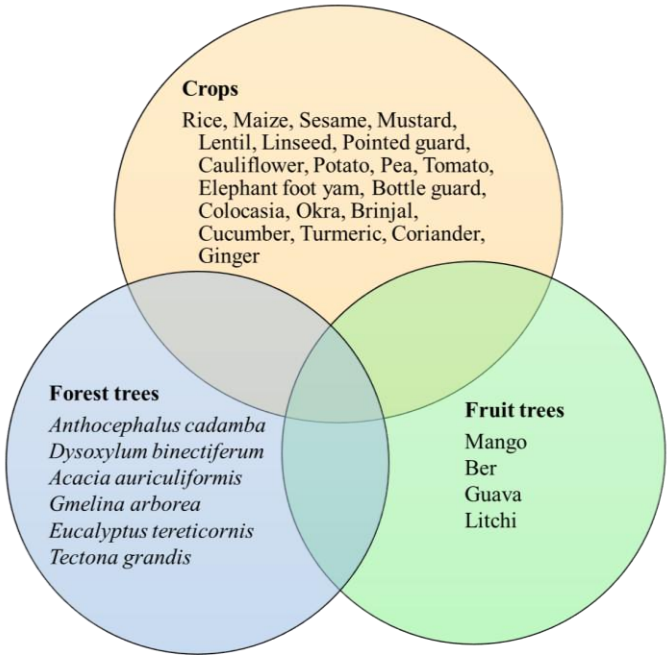

Fig. 3: Components of various agroforestry systems in the Gangetic region of West Bengal

Red and laterite zones of West Bengal face severe water scarcity. For efficient water use, the Agri-Silvi-Horti agroforestry models proved beneficial. In such systems, multifunctional trees (such as *Gmelina arborea* and Eucalyptus species), fruit trees (such as *Mangifera indica*), and arable crops are all included (Ground nut and Maize). In terms of economic returns, Sharma et al. (2017)'s study showed that mango-based agroforestry systems were preferable to mono-cropping systems, especially in rainfed environments. However, there is an indirect proportionality between the age of trees and the yield of arable crops. Hence, in fruit-based agroforestry systems, short-rotation arable crops are more suitable. Mango-based agroforestry systems with *Dysoxylum binectariferum* and pigeon pea showed enhanced production and soil improvement without compromising mango yields (Murmu et al., 2017). Agroforestry systems based on Eucalyptus were also documented in West Bengal, with *Eucalyptus tereticornis* serving as the main species (Saha et al., 2021).

Multi-tier crop models with nitrogen-fixing Acacia sp. (mostly Acacia auriculiformis-which grows in degraded areas) and guava (Psidium guajava) or sweet orange (Citrus sinensis) are also preferred in the red and laterite zones (Banerjee and Dhara, 2011). The wider spacing also allows farmers to grow intercrops, especially black gram, ground nut, cowpea and bottle guard. The Agri-Horti-Silvicultural system delivers multiple benefits such as timber, fuelwood, food, manure and fodder.

Bamboo-based agroforestry systems were also found effective in the red and laterite zones (western part) of West Bengal which comprises bamboos, fast-growing species with high mean annual increment and cultural utility, and agricultural crops. Bambusa balcooa and Bambusa tulda are integrated with other agricultural crops: lady's finger, elephant foot yam, bottle gourd, groundnut, pigeon pea, cowpea, colocasia, turmeric and even paddy in upland areas (Banerjee et al., 2009). In such integrated systems, bamboo produces more than just plantations. Along with creating jobs, it guarantees livelihoods and food security. Moreover, the role of bamboo in purifying air through supplementing oxygen and improving soil is well accepted by the scientific community. Bamboos are recommended over other tree species in agroforestry because of their shorterharvest time, high growth rate and high demand as raw materials and building accessories.

Another characteristic agroforestry system in West Bengal is homegardens (agrosilvopastoral agroforestry practice) managed by indigenous and rural people and is acknowledged forits high species diversity, stratification and carbon sequestration potential. In homegardens, trees, shrubs, herbs, palms, bamboo, climbers and creepers are integrated into limited space and provide maximum year-round economic and ecological provisions. The hilly and terai regions of West Bengal have traditional homegardens, especially in the Darjeeling and Kalimpong areas. Homegarden agroforestry systems inthese areas play a crucial role in preventing soil

erosion and utilising the undulating terrain for cultivating valuable species.

Along with homegardens, in the terai regions of West Bengal, the silvi-horticultural system shows dominance with Bischofia javanica, Elaeocarpus floribundus, Swietenia macrophylla and Cinnamomum zeylanicum as principal species (Dey and Panda, 2020). In northern West Bengal, the mahogany (Swietenia mahagoni)- based horti-silviculture system was successfully practised with chillies (Capsicum annuum) (Datta and Dey, 2009).

Tea gardens with scattered trees for shade purposes are another typical example of an agroforestry system in the northern part of West Bengal. The abundant shade trees in sub-Himalayan tea gardens are Albizia chinensis, Albizia lebbeck, Albizia procera, Senna siamea, Cassia fistula, Dalbergia sericea, Dalbergia sissoo, Melia azedarach and Trema orientalis (Chowdhury et al., 2015).

Drier zones of West Bengal, where chances of massive crop failure are high due to erratic rainfall, have high practical utility for agroforestry. However, the lack of formation of suitable models particular to the location hinders the agroforestry systems from expanding. On the other hand, while choosing agroforestry components of a region, market demand, cultural utility, adaptability and importance of the species should be taken into consideration. Therefore, to increase the yield and stability of such agroforestry systems, thorough research with location-specific analyses is required.

Conclusion

Agroforestry practices have extensive utility among people because of their sustainable benefits. In West Bengal, agriculture and forestry are combined by aligning trees and crops in such a way that gives maximum economic and ecological output. Several agroforestry systems have become well established in West Bengal, which include Agri-Horti-silviculture, boundary plantations, homegardens, bamboo-based systems and tea gardens. But still, there are regions where well-adapted technology and models haven't reached. Identifying and documenting agroforestry systems where studies are rare should be incorporated into future research. Even though agroforestry has national acceptance, in West Bengal, policy-level implementation activities are still lacking. Hence, better awareness and people's participation will further enhance the scope and opportunities of agroforestry in West Bengal.

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Silviculture strategies- An evolving tool in forest stands

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The growth of human civilization has been significantly influenced by forests. They have given us food, wood, shelter, and fuel. The burden on forest resources has grown as human populations have increased, which has resulted in overexploitation and degradation of forests all over the world. However, as the amount of forest resources decreased management strategies emerged that made it possible to use the resources more sustainably. The most efficient of these techniques were developed and improved through silvicultural strategies that are often used.Silviculture is the art and science of controlling the harvest, establishment, growth, composition, and quality of forest vegetation for the full range of forest resource objectives. Successful silviculture depends on clearly defined management objectives. However, silviculture is often confused with managing stands and forests purely for timber. Remember that silviculture is also used to manage forests for wildlife, water, recreation, aesthetics, or any combination of these or other forest uses.

Silvicultural planning must include managing forests for adaptation to new conditions by encouraging a forest's resistance to change, resilience in the face of change and response options that ease a forest's transition to new circumstances. It can require taking steps to maintain or restore the compositional, structural, and functional variety of stands. It accounts variables such as ecosystem structure, current and potential range of variation in stand composition, history of disturbance or suppression of disturbance, and stand development dynamics over time that could affect a forest stand's potential response to manipulation. It considers the habitat compatibility for alien invasive species, which must be controlled, as well as threatened or endangered species, which must be safeguarded.

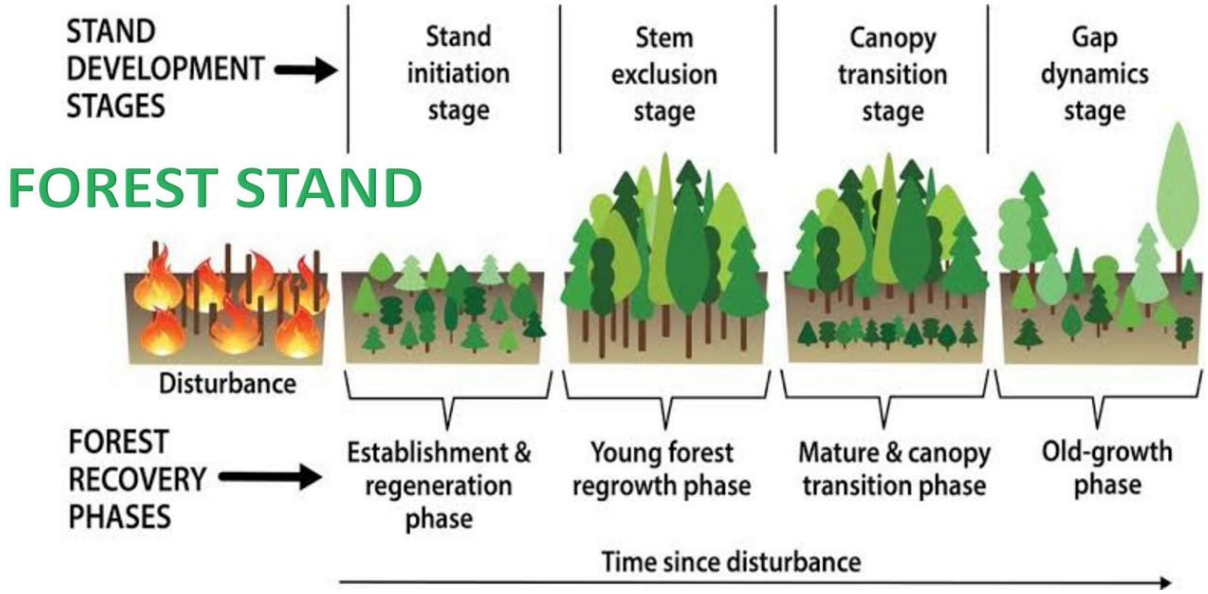

Fig 1: Stand Development stages showing forest recovery phases

Species components

The management of many dense forests and changes in disturbance regimes hasaltered the species composition, reducing certain species that were well adapted to the previous range of variation and increasing others those were poorly adapted. It could take decades for the effects of climate change to become apparent. The species and populations that developed on the area for the time being, make up those plant communities that are most adapted to transitional climate extremes. A plausible goal for silvicultural intervention is to restore species that have been eradicated as a result of changes in land use, management methods, or exclusion by invading species. It is best to restore community composition before significant climatic changes take place, while there is still a good match between the current site conditions and the species' potential for adaptation.A major issue is the degree to which current seasonal patterns of growth and development will remain synchronized in the face of rapidly changing and increasingly variable weather and climate patterns. For example, if pollen dispersal occurs out of synchrony with flower receptivity, then decreased seed production may limit natural regeneration for seed-regenerating species.

Density management

It may be possible to effectively reduce stressors connected to the climate by managing density based on traits specifically related to site resource demand. Silviculturists have long understood the benefits of thinning and other vegetation-manipulation techniques for preserving a balanced relationship between the availability and use of site resources. Traditional thinning frequently aims to increase stand productivity and concentrates on redistributing site resources from a high number of small, undesirable trees to a smaller number of larger, more desirable

trees. Silvicultural thinning is a powerful tool that can be used to influence stand development, stand stability, and the characteristics of the harvestable products. To keep stand densities at levels that support cumulative productivity and avoid times of low stand vigour, thinning's may be repeated over time.

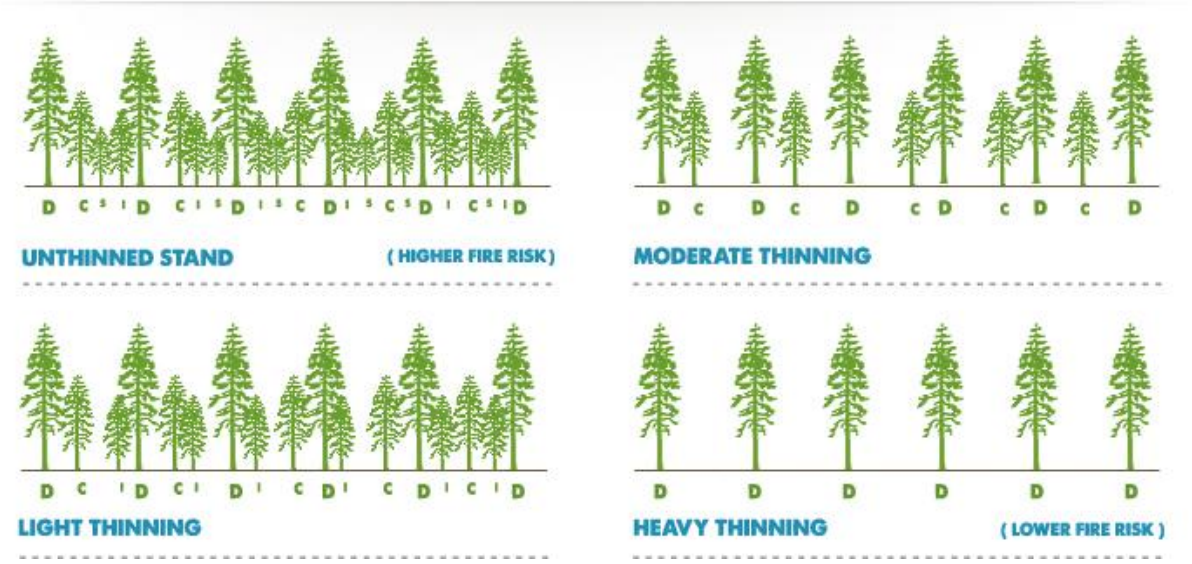

Fig 2: Density Management in Forests through Grades of Thinning

Pruning

Dead trees are frequently removed from stands that are maintained for the production of wood because they are primarily seen as issues that should be avoided or reduced. As a result, recommended spacing is determined by how many trees can reach a certain size before suffering severe competition-related mortality. If accessibility and economics allow, it is typical to promptly harvest trees that have been killed by pests, diseases, or fire. However, downed, dying, and vital elements of many forest ecosystems, and a diversity of creatures are linked to them. Prior to stand closure, pruning might be started to remove lower branches, which would allow lighter to reach the forest floor and encourage the growth of the woody and herbaceous understory. Altering the number of trees pruned and the amount of the crown removed are examples of other changes. Removal of certain trimmed trees during thinning could boost financial returns and possibly cover expenses of other silvicultural activities in regimes with repeated thinning's on reasonably lengthy rotations.Biological, mechanical, labor, and logistical components all play a part in silvicultural activities.

Implementation measures

The goals of management years ago were very different from those of today, and they will be different a few years from now.Forest managers must choose and implement silvicultural measures based on

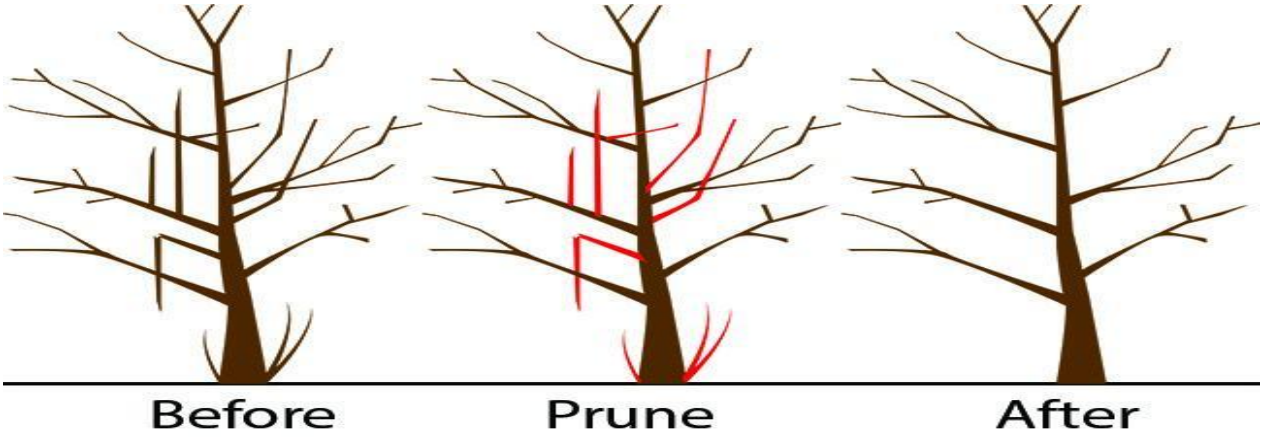

Fig 3: Intensity of Pruning

specific goals. Making decisions also necessitates considering possibilities in relation to their surroundings rather than individually. Will how the stand is treated have a significant impact on productivity for any of these values? Additionally, it must be acknowledged that there is a lot of uncertainty regarding the treatment's effects on values other than wood output, both in terms of objectives and present assessments.

An insight into the major multipurpose trees of north western Himalaya

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Agroforestry has prolonged tradition in the Himalayan regions of India. The North-Western Himalayan region comprised two states and two union territories of the Indian Republic i.e, Himanchal Pradesh, Uttarakhand, Jammu & Kashmir and Ladakh. This region is mainly comprised of many indigenous multipurpose trees based traditional land uses practices. So, this kind of ecofriendly and economically viable practices has a huge impact on the livelihood of the poor people in the hills by providing food, fodder and fuel. Now the socio-economic and environmental benefits of the tree-based agroforestry practices and systems have got more emphasis by different stakeholders. In this context, it is essential to know the basics of multipurpose trees in the traditional agroforestry systems of Himalayas are very much important for coping the climatic vagaries in today's uncertain world.

Alnus nepalensis (Common name- Utis, Family- Betulaceae)

Distribution

It occurs throughout the Himalaya at 500–3000 m of elevation from Pakistan through India, Nepal and Bhutan to Yunnan in Southwest China.

Silviculture characters

Source: (https://indiabiodiversity.org)

It is a good light demander and grown at a height of 200m in the hilly areas, fire resistant species which grows in moist soiland can tolerate shade and poorly drained soil too.

Agroforestry system

It has been effectively used to prevalent abandoned Taunya areas. Barely, chilli, pumpkin and cardamomare considered as the common intercrops in Alnus based systems in Hills.

Uses

Wood is used for firewood, carpentry and construction. Its leaves are used for fodder as it contains 4% nitrogen content. The fallen leaves can be used for making manure and biofertilizers. Bark is used for dyeing and tanning purposes.

Bauhinia purpurea (Common Name- Guriyal, Family- Fabaceae)

Distribution

It is a plant of tropical and subtropical climates usually found in moist types of vegetation ranging from evergreen lowland rain forest to mountain forest. It occurs at lower elevations frequently along the valleys in its native habitat.

(Source: https://indiabiodiversity.org)

Agroforestry system

It is an important multipurpose tree species in the traditional agroforestry system of the Garhwal Himalayan region (Bhatt & Verma, 2002). The species is suitable for various systems such as Agri-silvicultural, Silvi-horticultural, and Silvi-pastoral but most common way of its cultivation is along with the wheat (Sachan, 2006).

Uses

Wood is used for making agriculture implements, scantlings and rafters in the interior constructions. Flower buds are used as vegetables. Foliage is used for fodder and bark is used for tannin and medicinal purposes.

Celtis australis

(Common name - Kharik Family – Ulmaceae)

Distribution

It is an indigenous species of the Western Himalayaand ranges wide towards eastward to Nepal and is commonly cultivated in N-W Himalayan region (J&K, H.P and Uttarakhand) and parts of the Northeast Hill region. It shows

considerable promise as a multipurpose tree species in both Kumaon and Garhwal regions of Uttarakhand.

(Source: https://commons.wikimedia.org)

Silviculture characters

It is a fast growing, moderate-sized, deciduous, woody perennial plant which can withstand in a moderate amount of shade. It can attain 25 m height and 50 cm in diameter, under favourableconditions.

Agroforestry system

This species is usually grown in traditional agroforestry systems for fodder. Silvipasoral systems in hills, marginal and sub-marginal lands are the major potential area for its introduction as a forage production tree. Silvi-horti systems and home gardens are also a good practice for *Celtis australis*. In a study conducted at VPKAS Almora, Ginger *(*Zingiber ***officinale****)* and Turmeric (*Curcuma longa*) were grown under ten-year-old *Celtis australis* and it shows some good result and emphasised the future scope of intercropping.

Uses

The timber quality is excellent and used in making tools, whip handles, cups, spoons, churners, sports items, oars, wooden sticks and agricultural implements. It can also be carved, used to construct carriages, and as a general building material. But it is mainly grown for fodder in hills.

Diploknema butyracea (Common Name- Cheura, Family- Sapotaceace)

(Source: https://commons.wikimedia.org)

Distribution

It commonly occurs in the sub-Himalayan tract between 300-1500m from sea level. In Uttarakhand, this species is limited to Pithoragarh district particularly areas adjoining to Almora, Bageshwar and Champawat.

Agroforestry system

Cheru is planted on the villagewaste lands on degraded areas. It can also be prompted under several agroforestrysystems. This is grown along with Sal (*Shorea robusta*), Amla (*Embelica officinalis*) and Guriyal (*Bauhiniapurpurea*) etc.

Uses

Wood is used for firewood. The bark juice is used to treat indigestion andas anthelmintic, leaves are used to cure mouth ulcers and muscles pain and fruits are edible.

Ficus auriculata **(**Common Name- Timla or Timil Family- Moraceae**)**

(Source:https://indiabiodiversity.org)

Distribution

It is a common tree found in mountain regionand found growing right from foothills to mid & high hills of Himalaya between altitudes 900 to 2000 m above msl on moist, organic matter rich sandy loam soil (pH 5.5 to 6.5).

Agroforestry system

Home gardens and Agri Horticulture systems

Silviculture characters

It is least resistant to fire.

Uses

Leaves are rated as a good fodder, its paste also applied to cure heal the wounds and used in diarrhoea and dysentery. The bark juice is effective in cuts and wounds. Latex of roots is used in diarrhea, cholera mumps and vomiting.

Grevia optiva (Common Name- Bhimal Family- Malvaceae**)**

(Source:https://indiabiodiversity.org)

Distribution

This species is mostly distributed in the North western Himalayas (Uttarakhand, Himanchal etc) and Nepal up toan elevation of 2000m. It is commonly grown under sub-tropical regions of Western Himalaya on boundaries of farmer's land.

Agroforestry system

It is a very common species in the various landuse practices (Agrihorti-silviculture

system, Agri-Horti silvicultural system and Homegardens), Central Himalayan region of Uttarakhand (Bijalwan et al, 2014). Agri-Horti silvicultural model including the *Grevia optiva* in mid elevations of the western Himalayas has considered as sound and more ecofriendly agroforestry practice (Toky, 1989).

Silviculture characters

Strong light demander, it is frost hardy tree and it coppices very well.

Uses

Wood is used for oar shafts, handles and bows. Leaves are quite rich in protein and nutrient content.

Melia azedarach **(**Common name- Daikon Family-Meliaceae)

(Source: https://indiabiodiversity.org)

Distribution

It is a deciduous tree which is native to northeastern India. In the Himalayas it grows at an elevation of 2000 m but in mid hills it is prevalent up to a heightof 1400 m.

Agroforestry system

An Agri-silviculture system is quite prevalent with this species. This species grows well with crops like Wheat and Pulses.

Silviculture characters

Tree is light demander and susceptible to damage by the fire.

Uses

Leaves, seeds, fruits are quite useful for skin problems. Wood used for making agricultural implements, wooden toys, turnery and wood has high calorific value therefore it used as fuelwood. Leaves are considered as good source of fodder and green manure.

Morrus serrata **(**Common Name- Shatoosh/ Kimu Family-Moraceace**)**

Distribution

It is widely distributed in Uttarakhand region of Chakrata, Urgam valley, Almora, Pithoragarh region, Nanital and Bhimtal. It is also seen in altitude ranges between 1,300 m to 1,900 m in the localities of Sitapur, Joshi math and Chamoli.

(Source: https://indiabiodiversity.org)

Agroforestry system

Being a multipurpose tree species it is widely grown for fodderand fuelwood purposes. Agrisilvopastoral system is usually followed.

Silviculture characters

It is a frost tolerant species and raised in irrigated and rainfed conditions too.

Uses

Leaves used as fodder for goats and sheep. Fruits are edible, wood used for making agricultural implements.

Pyrus pashia (Common Name- Mehal, Family-Rosaceae)

(Source: https://indiabiodiversity.org)

Distribution

It is a small to medium size deciduous tree which grows mainly in moist soils of the mid-hill region between 700 and 2,000 m above the mean sea-level.

Agroforestry system

Homegardens and Agri- Horti systems

Silviculture characters

It can resist water scarcity and can survive well in surrounding air or water pollution.

Uses

The leaves and branches utilized as anti-diarrheal agents. The fruits are edible as they are high in nutritive value also fruit juice is astringent in nature and has diuretic properties. Flowers are consumed as herbal medicine for lowering blood lipid levels.Leaves and Branches serves as fodder sheep and goats.

Quercus leucotrichophora **(**Common Name- Banj Family- Fagaceae)

Distribution

This species is mostly distributed in northern India. It is the most useful and keystone tree speciesof Himalayan region, mostly found in associated with *Rhododendron arboreum, Lyonia ovalifolia and Myrica esculenta* in different parts of Garhwal Himalayas.

(Source: https://indiabiodiversity.org)

Agroforestry system

This species forms an important part of Agri-silviculture, silvipasture systems and forests at different altitudinal gradient. In Agri silviculture system it is grown with crops like Zea *mays*, *Brassica campestris*, *Pisum sativum and Cajanus cajan* and in silvipasture system oak is grown along with wheat. According to a recent study (Kumar *et al*., 2020) the cultivation of wheat along with Banj based on traditional Agri-silviculture system in Dargi village in Garhwal region resulted in maximum production of grain and straw (8.16 q ha and 18.76 q ha respectively).

Silviculture characters

Shade to lerant (in seedling stage).

Uses

It is used as fuelwood due to its high calorific value and good burning properties too. Leaves are used for cattle fodder. The leaf litter is rich in nitrogen and used to make as compost for fields. Wood is also used for making the agriculture implements.

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An overview of blue gold - *Indigofera* tinctoria

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Indigofera L. is the third largest genus in legumes comprising 750 species belonging to the pea family Fabaceae. One of the most significant species usually utilized to make the dye indigo is *Indigofera tinctoria* L. An economically and medicinally valuable leguminous plant, *Indigofera tinctoria* is also known as true indigo, avuri/neel in Tamil, neelyamari in Malayalam, Indian indigo in English, and neelini/neelika/nenjini in Sanskrit. A shrub that grows one to 2 m tall, true indigo. Depending on the climate where it is cultivated, it could be annual, biennial, or perennial. It produces pink or violet flowers and pinnate, light green foliage. One such notable plant, *Indigofera tinctoria* L., was cultivated in India. Therefore, present study was indicated that *Indigofera tinctoria* is an economic important multi utility species in India. The present paper provides comprehensive information on ethnobotanical uses of *Indigofera tinctoria* Linn for further research.

Distribution

They can be found all throughout the tropical and subtropical parts of the earth. It is unknown where *Indigofera tinctoria* came from. It might be an Indian invention. Its distribution has significantly expanded due to indigo cultivation. The majority of African nations, Asia (from Arabia to South-East Asia) and Australia all have wild or naturalised populations of it. There is no doubt that it has been introduced to tropical America. The plant is native to tropical Africa, South and Southeast Asia, India, and North America. Many regions of India, particularly the Central-East regions of Bihar and West Bengal, cultivate the plant.

Botanical Description

Stem

The stem is cylindrical, full, erect shrub to 1.5 m tall, less woody at the base, abundantly branched; the young parts and the twigs are covered with bifid, appressed, whitish hairs.

Leaves

The leaves are imparipinnate; the leaflets a re opposite, oblong, elliptic or oblanceolat, membranous, puberulent on the lower surf ace, mucronulate at the apex, rounded or ra rely obtuse, and entire along the margins. The petiolules are 1-1.5 mm long, and the stipules are awl shaped.

Flowers

Sessile inflorescence with bracts that are small and persistent, axillary racemes with many flowers and lengths of 5 to 10 cm. Corolla pink, tomentose outside, standard

to 5 mm long, broadly elliptic, wings and keel as long as standard; calyx bell-shaped, 1-1.5 mm long, pubescent. Small, bisexual flowers that are crimson or pinkish. 10 stamens, with the highest stamen being 4 to 5 mm long and the other 9 joined together around the ovary. Superior Single-carpel, pubescent ovary with a long style on top.

Fruit

Fruit a linear pod 20–35 mm long and 2 mm wide and thick, straight or slightly curved, rounded in cross-section, brown when ripe, 7–12-seeded fruits slender pods.

Seeds

Seeds are shortly square-shaped to oblong, 2 mm × 1.5 mm in cross-section, hard seed coat.

Seed Rate

Propagation is by seed, of which 20–30 kg/ha is needed.

History and cultivation of indigofera

Natural indigo has been cultivated all over the world for centuries and has been in use for more than 4000 years. However, its connection with India is particularly strong—the term indigo comes from the Latin Indicum that means "Indian." Indigo plantations in India date back to 1777 when Louis Bonnard, a Frenchman, introduced it to Bengal in eastern India. He started cultivation at Taldanga in Bankura district and Goalpara in Hooghly district. In the early 19th century, the British developed many indigo plantations, as it was a highly profitable crop — there was a lot of demand for the blue dye in Europe, which had a status similar to exotic commodities like tea, coffee, silk, and gold. Even today, natural indigo is highly prized, especially in the fashion industry. The traditional method of indigo dyeing is still done in several parts of Gujarat and Rajasthan in western India where block printers use it to create a pattern called 'Ajrakh'."

The process of creating natural indigo is very complex and requires immense skill. The leaves are first fermented with a very precise chemical process to obtain the blue shade. Unlike other textile dyeing processes, the fabric does not turn blue in the dye pot. It is exposed to the air, which slowly turns the drying piece of dyed fabric from yellow to green, and eventually into deep dark blue.

Today, indigo is mostly cultivated in the Indian states of Tamil Nadu, Andhra Pradesh, Uttarakhand, West Bengal and Rajasthan. Most of them are small farmers or traditional growers who have been in the business for generations. There has been a revival of indigo cultivation in India in the past few years due to an increased interest in natural indigo. Indigo is a 75-to-90- day crop and is quite expensive. The actual cost of production of natural indigo is INR 4545 ($61.31) per pound. Synthetic indigo is much cheaper and costs around INR 600 ($8.09) with taxes. Around 900 tons of synthetic indigo is imported from China every month. Farmers do not get a fair price for their natural indigo due to the high price differential. This leads to adulteration and a loss of confidence in a centuries-old production and extraction system. To ensure that it is a regenerative crop in all ways, the farmer needs to be the focus on Indigo.

Chemical compounds

The indigo plant contains chemical compositions *viz*., indical, endoxyl, isatan and labenzyme. The active ingredients of Indigo are alkaloids, glycosides, flavonoids, tannins and phenolic compounds, amino acids, carbohydrates, minerals. Other compounds are ash, acid-soluble ash, and water-soluble ash. As a natural product, indigo is a secondary metabolite. This plant contains colorless glucoside in the form of enol that is formed indoxyls such as indican, and it is oxidized as blue indigo by aerobic oxidation. Since the biosynthetic pathway of indigo production and its quality has not been fully identified, the purity and the quality of this natural product are uncontrollable, which is one of the main reasons for replacing indigo with chemical dyes.

Indigo dye extraction

Today in the world, the tendency to use natural dyes has increased, which is effective in implementing ecological standards. The blue color of this plant is one of the oldest dyes known to human. It is called the "King of Colors" because the indigo has an attractive blue color, very high color stability and high strength to combine with a wide range of other natural colors. No other plant has such a high status as Indigofera species in many past civilizations. A substance called indigo is extracted from indigo leaves.

The method of indigo dye extraction from *Indigofera tinctoria* plant has been consisting of steeping, beating, and dye recovery stages. In the steeping process, the release of indoxyl molecule and glucose moiety occurs from its precursor (indican), located in the plant vacuole. This hydrolysis reaction is catalyzed by glycosidase (β-glucosidase) enzyme of plant or microbial origin. In the second step or beating process, the released indoxyl undergoes spontaneous dimerization in atmospheric oxygen to form indigo. As these indigo particles are hydrophobic and insoluble in water, they form aggregates and sediment readily, which is considered as the third step or dye settling stage.

Ethnobotanical uses

Indigofera tinctoria is traditionally used in Indian and Chinese medicinal system for the treatments of various ailments.

Indigo powder being used in Indian traditional medicine for the treatment of removing worms in teeth and gums, sores on skin, urinary problems, mouth ulcers, hair rejuvenation, skin diseases and dog bite, etc.

The roots, stems and leaves are bitter, thermogenic, laxative, trichogenous, expectorant, anthelminthic, tonic, naturopathy, splenomegaly, echolalia, cardiopathy, chronic bronchitis, asthama, ulcers, skin diseases, diuretic and are useful for promoting growth of hair.

The juice expressed from the leaves is useful in the treatment of hydrophobia. An extract of the plant is good for epilepsy and neuropathy. The plant possesses anti-toxic property. The plant is stimulant, alternativr, deobstruent and purgative. Indigo is antiseptic and astringent.

The Juice of the leaves and indigo in powder are used mixed with honey in enlargement of liver and spleen, epilepsy and other nervous affections. In hydrophobia two ounces of fresh juice with an equal quantity of milk is given in the morning for 3 days as a prophylactic;

Juice is also given in asthma, whooping cough, palpitation of heart, in some lung diseases and kidney complaints as in dropsy.

Decoction of the root is given in calculus; Juice of the young branches mixed with honey is a used application for aphthae of the mouth in children. An Infusion of root is given as a root is given as an antidote in cases of poisoning by arsenic.

Externally, leaves crushed are used as stimulant, Poultice or plaster in various skin affections to haemorrhoids etc., and to cleanse a heal wounds and ulcers. Powdered indigo is also used for sprinkling on ulcers.

It is applied mixed with castor oil to the navel of children to promote the action of the bowels and mixed with warm to the pubes and hypogastria as it stimulates bladder and therefore useful in cases of retention of urine.

Hence, *Indigofera tinctoria* provides a significant role in the prevention and treatment of a various disease and in the protection of the system from damage. The therapeutic potential of this species is effective and versatility is such that further detailed research appears crucial.

करंज: कृषिवानिकी के अंतर्गत बहुपयोगी वृक्ष

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परिचय

वक्त के साथ साथ खेती का नक्शा भी बदल रहा है। लोग ज्यादा और जमीन कम , यानी पैदावार घटने के पूरे पूरे आसार ऐसे में कृषि वानिकी एक बेहतर रास्ता साबित हो सकता है। देश की जनसंख्या विस्फोटक दर से बढ़ रही है जिसके कारण कृषि योग्य भूमि का क्षेत्रफल कम होता जा रहा है इसका प्रभाव वनों पर भी पड़ रहा है। वर्षा की मात्रा व वर्षा के दिन भी कम होते जा रहे है। ईंधन की कमी और जलाऊ लकड़ी का मूल्य अधिक होने के कारण प्रतिवर्ष 500 करोड़ मीट्रिक टन गोबर को उपलों के रूप में जलाया जाता है। यदि इस गोबर को खाद के रूप में उपयोग किया जाए तो मिट्टी में उपयोगी जीवांश पदार्थ की वृध्दि हो जाएगी। भारत में कुल 21 प्रतिशत भाग में वन है जबकि इस सम्बन्ध में हमारा लक्ष्य 33 प्रतिशत है। विश्व में प्रति व्यक्ति औसतन 1.6 हैक्टेयर वन क्षेत्र है। इसकी तुलना में भारत में यह प्रति व्यक्ति 0.09 हैक्टेयर ही है। यू.एन. की एक रिपोर्ट के अनुसार भारत में प्रति व्यक्ति पेड़ो की संख्या कुल 28 है जोकि विश्व के सभी देशों से सबसे कम है| अतः देश में वनों का विस्तार नितांत आवश्यकहै।आज की बढ़ती हुई मानव एवं पशु संख्या को ईंधन , इमारती लकड़ी, चारा, खाद्यान्न, फल, दूध, सब्जी इत्यादि की आपूर्ति के लिये घोर संकट का सामना करना पड़ रहा है। ऐसी परिस्थितियों में कृषि वानिकी ही एक ऐसी पध्दति है , जो उपर्युक्त समस्याओं का समाधान करने में सक्षम है। कृषि वानिकी समय की मांग है। अत कृषकों के लिये इसे अपनाना नितांत आवश्यक है। खेत के पास पड़ी बंजर , ऊसर एवं बीहड़ भूमि में कृषि वानिकी को अपनाने से केवल उनका सदुपयोग होगा साथ ही खाद्यान्न, जल, सब्जियां, चारा, खाद, गोंद आदि अनेक वस्तुएं उपलब्ध होगी। साथ ही रोजगार के अवसरों में वृध्दि होगी और पर्यावरण में निश्चित रूप से सुधार होगा|

करंज की खेती

करंज (*Pongamia pinnata*) एक बहुउद्देशीय सदाबहार वृक्ष है । इसे सामान्यतः करंज व पापड़ी के नाम से जाना जाता है । इसका वानस्पतिक नाम पोंगामिया पिनाटा है । यह लेगुमिनेसी कुल का सदस्य है तथा यह पेपीलीयोनेसी उपकुल के अन्तर्गत आता है । साधारणतः इसकी लकड़ी किसानों के रोजमर्रा में काम आनेवाले कृषि औज़ारों में, घरेलू कार्यों एवं ईंधन के काम में लायी जाती है। परन्तु आजकल इसके बीजों के तेल से बायोडीजल भी बनाया जाने लगा है , जो 5 से 20 प्रतिशत तक पेट्रोलियम वाले डीजल में मिलाकर इंजनों, वाहनों एवं कृषि यन्त्रों में आसानी से उपयोग किया जा सकता है । करंज का अखाद्य तेल डीजल की तरह भौतिक एवं रासायनिक

विशेषतायें रखने के कारण एक विश्वसनीय एवं व्यापारिक सहज डीजल का विकल्प होने की क्षमता रखता है। इसे डीजल में 5 से 20 प्रतिशत तक मिलाकर इंजन की बनावट में बिना कोई परिवर्तन किए प्रयोग किया जा सकता है। इसकी खली का उपयोग जैविक खाद के रूप में किया जाता है। इसके अलावा यह कम उर्वरता, कम वर्षा वाली व पथरीली मिट्टियों में भी उगने की क्षमता रखता है। जंगली जानवर इसको अधिक हानि नहीं पहुँचा पाते हैं। करंज एक बहुवर्षीय, बड़े आकार एवं सूखा सहन करने वाला वृक्ष है। यह लगभग 5-12 मीटर लंबा तथा धीमी गति से बढ़ने की प्रकृति वाला वृक्ष है।

जलवायु एवं मिट्टी

करंज में अनुकूलन की क्षमता काफी अच्छी होती है और यह विभिन्न प्रकार की जलवायु एंव भूमि में उगाई जा सकती है | इसे शुष्क एवं अर्धशुष्क क्षेत्रों में भी उगाया जा सकता है । जिन क्षेत्रों में औसतन वार्षिक वर्षा कम से कम 600-700 मि.मी. होती है, वहाँ इसकी खेती अच्छी तरह की जा सकती है। वैसे इसे 500 से 2500 मि.मी. औसतन वार्षिक वर्षा तथा तापमान 10 डिग्री सेल्सियस से 45 डिग्री सेल्सियस तक सफलतापूर्वक उगाया जा सकता है । यह पेड़ निम्नकोटि की सीमांत , बलूवाई एवं पथरीली भूमि वाले सूखे क्षेत्रों में उग सकता है | हालाँकि प्रचुर नमी वाली गहरी बलूई दोमट मिट्टी इसके पौधारोपण के लिए सबसे उपयुक्त होती है | सूखे के अतिरिक्त यह क्षारीय भूमियों को भी सहने की क्षमता रखता है|

प्रवर्धन तकनीक

करंज का सफल प्रवर्धन बीज एवं कलम दोनों से किया जा सकता है| इसके बीज में एक वर्ष तक जीवन क्षमता विद्यमान रहती है | करंज के लिए निम्नलिखित प्रवर्धन तकनीक अपनाई जा सकती हैं-

क. बीजों के माध्यम से प्रवर्धन

करंज के बीजों के माध्यम से आसानी से प्रवर्धित किया जा सकता है | इसके लिए जुलाई-अगस्त महीनों के दौरान बीजों को सीधे नर्सरी बेड/पॉली बैग में बुआई करके तथा पौधरोपण वाले खेतों में सीधे बुआई करने का विकल्प अपयाना जा सकता है | 24 घंटे तक बीजों को आई. बी. ए. (30 पी.पी.एम.) या जी. ए. 3 (20 पी.पी.एम.) में भिगोने से इसकी अंकुरण क्षमता में वृद्धि होती है| अच्छी एवं गुणवत्ता युक्त पौध प्राप्त करने के लिए 2:1:1 के अनुपात में उपजाऊ मिट्टी, रेत व गोबर खाद का नर्सरी मिश्रण , सर्वोत्तम व आर्थिक रूप से किफायती होता है|

ख) वानस्पतिक विधि द्वारा प्रवर्धन

करंज प्रवर्धन की वानस्पतिक विधि में करंज के 15-20 सेंटीमीटर लम्बी तथा 2-3 सेंटीमीटर मोटी कलमों को जुलाई-अगस्त माहों में पॉलीथीन में लगाने चाहिए।

इन कलमों को सीधे ही क्यारियों में लगा दिया जाता है । क्यारियों या थैलियों में लगे पौधे जब लगभग 60 सेंटीमीटर के हो जायें तब असिंचित क्षेत्रों में 5 × 5 मी. और सिंचित क्षेत्रों के लिये 6 × 6 मी. की दूरी पर गड्ढे खोद लिये जाते हैं। गड्ढों का आकार 45 × 45 × 45 (लम्बाई × चौड़ाई × गहराई) सेंटीमीटर का होता है।

इन गड्ढों में उचित मात्रा में खाद एंव उवर्रकों को मिलाकर भरने के बाद मानसून आने के बाद अथवा जुलाई-अगस्त के महीनों में पौध रोपण कर दिया जाता है । रोपण के लिये स्वस्थ पौध का चयन करना चाहिये।

कलम द्वारा प्रवर्धन

करंज की 1-2 सें.मी. मोटी तथा 15-25 सें. मी. लंबी तथा अर्द्ध-कठोर डालियों में कलमें तैयार की जा सकती हैं | आई.बी.ए. तथा एन.ए.ए. के 800 पी.पी. एम वाले घोल में भिगोने से कलमों में शीघ्र जड़ निकलती हैं और प्रस्फूटन होता है |

लेयरिंग तथा ग्राफ्टिंग द्वारा प्रवर्धन

एयर लेयरिंग तथा क्लेफ्ट ग्राफ्टिंग के माध्यम से भी करंज का प्रवर्धन किया जा सकता है | क्लेफ्ट ग्राफ्टिंग के लिए करंज के एक वर्ष की आयु वाले पौधों के रूट स्टॉक (प्रकंद) के तौर पर उपयोग में लाया जा सकता है| बेहतर गुणवत्ता वाले पेड़ों के रूट स्टॉक आकार के सांकुरक संग्रहित किए जा सकते हैं| रूट स्टॉक पर तैयार किए गए सांकुरकों में फन्नी आकर की कलमें डाली जाती हैं और इन्हें वाष्परहित पॉली टनेल सिस्टम में रखा जाता है | पन्द्रह दिनों के बाद कलम में गांठ (जोड़) बननी शुरू हो जाती हैं जो 60 दिनों तक जारी रहती हैं| इसके बाद इन कलमों को पॉली टनेल सिस्टम से निकालकर कठोरीकरण (हार्डेनिंग) कक्ष में डाला जाता है|

इंटर क्रॉपिंग

छोटी अवधि की तिलहन और दलहनी फसलें यानि सरसों , मूंगफली, तिल, काबुली चना , ग्वारपाठा, सोयाबीन और बाजरामक्का, सब्जियां इत्यादि को 4-5 वर्ष तक के अंतराल के रूप में सफलतापूर्वक उगाया जा सकता है । करंज को कृषिवानिकी की अंतर्गत 5x5 मीटर तथा 6x6 मीटर की दुरी में फसलों के साथ लगा सकते है|

खाद एवं उर्वरक

करंज की अच्छी बढ़वार हेतु प्रत्येक गड्ढे में 2-3 किलोग्राम गोबर की सड़ी हुई खाद या वर्मी कम्पोस्ट खाद , 100 ग्राम सिंगल सुपर फास्फेट डाल कर अच्छी तरह मिला दें।

सिंचाई

करंज एक सूखा सहन करने वाला वृक्ष है। अतः इसे अधिक सिंचाई देने की आवश्यकता नहीं पड़ती है। परंतु रोपण करने की शुरूआती अवस्था में पानी देना बहुत ही आवश्यक होता है। शुष्क मौसम (मार्च से मई) में एक या दो सिंचाई करना उत्तम रहता है।

कीट नियंत्रण

करंज के वृक्षों को अधिकतर हानि गाल इन्डयूसर, लीफ, माइनर, पत्ती खाने वाले, तना छेदक तथा बीज छेदक कीटों द्वारा होती है । इसके बचाव के लिये 1.5 मिलीमीटर मेटासिस्टॉक्स या डायमेथोएट 2 मिलीमीटर प्रति 3 लीटर पानी के घोल का छिड़काव करना उपयुक्त होता है।

कटाई-छँटाई

अधिक बीज उत्पादन के लिये अधिक शाखाओं को विकसित करने की आवश्यकता होती है । अत: इन शाखाओं को विकसित करने के लिये हमें समय-समय पर कटाई-छँटाई करनी पड़ती है।

करंज की खली

करंज के बीजों से तेल निकलने के बाद जो अवशेष बचा रहता है , उसे खली कहते हैं। खली में 5.5 प्रतिशत नाइट्रोजन , 0.9 प्रतिशत फास्फोरस एवं 1.2 प्रतिशत पोटाश पाया जाता है। इसकी खली का उपयोग फसलों में तथा शोभाकारी पौधों एवं वृक्षों में खाद के रूप में इस्तेमाल किया जाता है। इसकी खली का जैविक खाद के रूप में उपयोग करके जैविक खेती को बढ़ावा देकर किसान भाई अत्यधिक आमदनी ले सकते हैं। पौधों को दीमक से बचाव हेतु भी इस खली का उपयोग किया जाता है।

करंज के विभिन्न उत्पादों का उपयोग

लकड़ी

करंज एक बहुउद्देशीय वृक्ष है। इसका प्रत्येक भाग किसी न किसी रूप में उपयोग में लाया जाता है। करंज पौधरोपण से लगभग 45-50 वर्ष तक अच्छी उपज मिलती रहती है। इसके अलावा इस वृक्ष की प्रतिवर्ष कटाई-छँटाई से किसानों को जलाने की लकड़ी मिलती रहती है और परिपक्व वृक्ष बन जाने पर इसे इमारती लकड़ी के रूप में भी उपयोग में लाकर अतिरिक्त आमदनी हो जाती है। इनके अलावा कृषि औजार व बैलगाड़ियां बनाने में भी इस लकड़ी का प्रयोग होता है।इन वृक्षों के साथ-साथ खाली जगह में अन्य कृषि फसलें, जो छाया को पसन्द करती है , उगाकर अधिक लाभ कमाया जा सकता है।

पत्तियां

इसकी पत्तियां मुलायम व गुणकारी होने के कारण इनका उपयोग पशुओं तथा बकरियों के चारे के रूप में किया जाता है। इसकी पत्तियों में 17.6 प्रतिशत क्रूड प्रोटीन , 2.2 प्रतिशत कैल्शियम एवं 0.2 प्रतिशत फास्फोरस उपस्थित रहता है। ये पत्तियां पाचक होने के साथ-साथ पौष्टिक भी होती हैं।

छाल

तने की छाल तन्तुयुक्त होती है। इसका प्रयोग रस्सियां बनाने में होता है। ताजी छाल में प्रारंभ में साधारण मीठा स्वाद होता है। जो शीघ्र ही तीक्ष्णतायुक्त कड़वे स्वाद में बदल जाता है। इसके छाल के काढ़े का प्रयोग बेरी-बेरी रोग के उपचार के लिए किया जाता है।

जड़

जड़ों के रस का प्रयोग दुर्गन्धबयुक्तो कानों को स्वोच्छ् करने, दाँतों को स्वच्छ करने तथा मसूड़ों को मजबूत बनाने में किया जाता है।

फूल

शुष्क पुष्पों के शरबत का प्रयोग मधुमेह में किया जाता है। गमले वाले पौधों के लिये ये पुष्प अच्छी खाद का कार्य करते हैं। कहा जाता है कि सुअपघटित अवस्था में ये पुष्प क्राईजेन्थामम तथा अन्य ऐसे पौधों को जल्दी उगाते हैं , जिनके लिये अधिक पादप आहार की आवश्यकता पड़ती है। ये मधुमक्खियों के लिये पराग का स्रोत है।

बीज

बीजों का मूल्य इनसे प्राप्त होने वाले तेल के कारण है। जिसका उपयोग अनेक उद्योगों और औषधियों में होता है। चूर्णित बीजों का महत्त्व ज़्वर शामक तथा टॉनिक के रूप में है जिसका प्रयोग श्वासनली रोग तथा कुकर खांसी की चिकित्सा में होता है। करंज से प्राप्त बीजों से तेल निकाला जाता है। जिसमें 27 से 39 प्रतिशत तक तेल प्राप्त होता है। परिपक्व बीज (औसत भार , लगभग 1 ग्राम) में लगभग 5 प्रतिशत छिलका तथा 95 प्रतिशत तेलयुक्त गिरी रहती है। वायुशुष्क गिरियों में आर्द्रता 19 प्रतिशत , वसा 27.5 प्रतिशत, प्रोटीन 17.4 प्रतिशत, स्टार्च 6.6 प्रतिशत, कच्चा रेशा 7.3 प्रतिशत तथा राख 2.4 प्रतिशत पाया जाता है। जबकि बीजों में म्यूसिलेज (13.5 प्रतिशत) वाष्पशील तेल की अल्प मात्रा तथा ग्लेब्रिन नामक जटिल ऐमीनो अम्ल रहते हैं।

करंज का तेल और उसके उपयोग

करंज के बीजों से तेल निकालने हेतु सर्वप्रथम बीजों को साफ कर सुखा लेते हैं। फिर बीजों को एक्सपेलर (कोल्हू) में पिरवा लिया जाता है। इसका तेल पीला नारंगी से भूरे रंग का होता है। जोकि कड़वा एवं तीक्ष्ण गंध वाला होता है।

करंज के तेल को पोंगम तेल कहते हैं।

तेल में वसाहीन घटक जैसे करंजिन (1.25 प्रतिशत) तथा पोगेमाला (0.85 प्रतिशत) पाया जाता है।

पोंगम तेल का प्रमुख उपयोग चमड़े के संसाधन के लिये किया जाता है। इसके अतिरिक्त अन्य उपयोग निम्न हैं :

कपड़े धोने का साबुन और मोंमबत्तियों के निर्माण में भी कुछ हद तक पोंगम तेल का प्रयोग होता है। परिष्कृत तेल इस कार्य के लिये अधिक उपयुक्त है क्योंकि अपरिष्कृत तेल से जो साबुन बनता है उसका रंग और गंध अप्रिय होती है।

ट्रांसएस्टरीफिकेशन के बाद तेल का प्रयोग लेथों, जंजीरों, छोटे गैस इंजनों की बेयरिंग, परिवहन गियरों तथा भारी इंजनों में स्नेहक के रूप में प्रयोग किया जा सकता है।

तेल औषधियों के रूप में बहुत उपयोगी माना जाता है। इसका प्रयोग परिसर्प, सफेद दाग तथा अन्य त्वचीय रोगों के उपचार में होता है। इस तेल में करंजिन ही सक्रिय पदार्थ है, जो त्वचा रोगों में रोगहर प्रभाव के लिये महत्त्वपूर्ण है।

तेल तथा इसके सक्रिय घटक करंजिन में कीटनाशी तथा प्रति जीवाणु के गुण भी होता है।

पत्तियों का रस आध्यान, अग्निगांध, प्रवाहिका तथा खांसी में दिया जाता है। यह कुष्ठ तथा सुजाक के लिये भी औषधि माना जाता है। आमवात दर्द से मुक्ति दिलाने के लिये व पत्तियों के गर्म निषेक का औषधयुक्त स्नान किया जाता है।

करंज के तेल का एक महत्त्वपूर्ण उपयोग होता है बायोडीजल बनाने में। इसके लिये यदि 1000 किलोग्राम करंज के तेल में 217 किलोग्राम मेथेनोल तथा 5 किलोग्राम सोडियम हाइड्रोक्साइड मिलाकर 60-70 डिग्री सेल्सियस पर गर्म करें तो ट्रांसएस्ट्रीफिकेशन की क्रिया होती है और परिणामस्वरूप 1004 किलोग्राम बायोडीजल तथा 213 किलोग्राम ग्लिसरीन मिलती है।

कीट-पतंग एवं बीमारियों का नियंत्रण

कीट –पतंगे

लीफ माइनर (एक्रोसेरकोप्स एन्थ्रोरिस) एवं फालिएज फीडर (यूकोरमा बेलेनोप्टईका)

ये सामान्यत: अगस्त-सितंबर महीनों के दौरान नुकसान पहुंचाते हैं | इन कीटों के लार्वा कोमल ऊतकों के उथले अंश को खा जाते हैं | जिससे इनकी वृद्धि अवरूद्ध (पत्तों एक अधिकांश भाग नष्ट हो जाते हैं) हो जाती है | मोनोक्रोटोफास 0.01% (ए.आई) के छिड़काव से इन्हें नियंत्रित किया जा सकता है|

बीमारियों के संक्रमण

डैपिंग ऑफ़ (एस्परजिलस फ्लेवस , फूसोरियम एक्यूमिनेटम एवं माइक्रोफोमिना फेसिलिना) प्रस्फूटन के बाद इसका प्रभाव देखा जाता है जिससे विल्ट रूट रौट की बीमारी हो जाती है । बुआई के बाद इस वजह से कम अंकुरण होता है । इसे बाविस्टीन 0.1% या थायरम 0.3% के घोल से बीज उपचार तथा मिट्टी को उपचारित कर नियंत्रित किया जा सकता है।

अल्टरनेरिया लीफ स्पॉट (अल्टरनेटिव सोलानि) जुलाई से सिंतबर महीनों के दौरान इससे आक्रमण पत्तियों पर होता है जिसके वृद्धि में कमी आ जाती है । मैंकोजेब के 0.3% घोल के छिड़काव से इसे नियंत्रित किया जा सकता है।

कोलेटोरट्रिकम लीफ स्पॉट

यह भी जुलाई-सितंबर महीनों के दौरान पत्तियों को प्रभावित करता है जिससे वृद्धि में कमी आ जाती है । इसे भी मैकोजेब के 0.3% घोल के छिड़काव से नियंत्रित किया जा सकता है।

शीशम एक बहुउपयोगी वन्य प्रजाति

योगेश पारधी, मनोज कुमार पूसाम, राज सिंह यादव, रवि प्रभात कुजूर एवं नाहर सिंह

आनुवांशिकी और वृक्ष सुधार प्रभाग
उष्णकटिबंधीय वन अनुसंधान संस्थान
(भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद्, पर्यावरण वन एवं जलवायु परिवर्तन मंत्रालम भारत सरकार)
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शीशम का मूल निवास क्षेत्र भारत, पाकिस्तान तथा नेपाल है । भारत में यह पूरे उप-हिमालय

क्षेत्र में 1500 मी0 तक की ऊँचाई पर पाया जाता है । शीशम जलोढ़ मृदा (Alluvial soil) का आदर्श वृक्ष है जो आमतौर से नदियों के किनारों पर पाया जाता है आपने शीशम के पेड़ को सड़क या बाग-बगीचे में देखा होगा । शीशम की लकड़ी बहुत मजबूत मानी जाती है। आपके घर में भी शीशम की लड़की के कई फर्नीचर बने हुए होंगे। अधिकांशतः शीशम का उपयोग उसकी मजबूती के लिए ही किया जाता है। लोगों को जानकारी ही नहीं है कि शीशम के लकड़ी के अलावा भी अनेक फायदे हैं। आयुर्वेद के अनुसार, शीशम को औषधि के रूप में इस्तेमाल में लाया जाता है, और शीशम से लाभ लेकर कई रोगों का इलाज किया जाता है।

भारत में शीशम को मुख्यतः शीशम के नाम से ही जानते हैं, लेकिन इसके और भी नामहैं । अन्य भाषाओं में शीशम के नाम Hindi (shisham tree in hindi) – शीशम, सीसम, शीसोशीसव English – साऊथ इण्डियन रोजवुड (South Indian rosewood), ब्लैकवुड (Black wood), रोजवुड (Rosewood), शीशम (Shisham) शीशम का वानस्पतिक नाम डैल्बर्जिया सिसो (*Dalbergia sissoo* Roxb. Ex DC, Syn *Amerimnon sissoo* (Roxb. ex DC.) Kuntze, है, और यह फैबेसी (Fabaceae) कुल का है। शीशम के अन्य नाम ये हैंः- शीशम का जन्म अपने आप होता है । आप इसे सड़कों के किनारे देख सकते हैं । यह पूरे भारत में पाया जाता है। शीशम की लकड़ी का प्रयोग भवनों और फर्नीचर के निर्माण में किया इसके साथ ही शीशम के वृक्ष की लकड़ी और बीजों से तेल निकाला जाता है, जिसका औषधि के रूप में प्रयोग होता है। शीशम की निम्नलिखित प्रजातियों का प्रयोग चिकित्सा में किया जाता हैः-

शीशम (***Dalbergia sissoo* Roxb. ex DC)**

यह वृक्ष लगभग 30 मीटर तक ऊंचा होता है।इसकी छालमोटी, भूरे रंग की और दरारवाली होती है। इसके फूल पाण्डुर पीले रंग के और छोटे होते हैं।

कृष्ण शिंशप (***Dalbergia latifolia* Roxb.)**

यह 15-20 मीटर ऊंचा पर्णपाती वृक्ष होता है। जिसकी शाखाएं चिकनी होती हैं। इसके फूल 5-

10 मीटर लम्बे गुच्छों में और मटमैले सफेद रंग के होते हैं। इसकी छाल तथा पत्तियों का उपयोग चिकित्सा के लिए किया जाता है। आपको यह जानकर आश्चर्य हो रहा होगा, लेकिन यह सच है। शीशम के औषधीय गुण से बीमारियों का इलाज संभव है। यहां शीशम के उपयोग से होने वाले फायदे के बारे में बहुत सारी जानकारियां दी गई हैं। आइए जानते हैं कि आप शीशम से किस-किस बीमारी में लाभ ले सकते हैं।

शीशम भारतीय उपमहाद्वीप का वृक्ष है । इसकी लकड़ी फर्नीचर एवं इमारती लकड़ी के लिये बहुत उपयुक्त होती है । शीशम बहुपयोगी वृक्ष है। इसकी लकड़ी, पत्तियाँ, जड़ें सभी काम में आती हैं । लकड़ियों से फर्नीचर बनता है । पत्तियाँ पशुओं के ए प्रोटीनयुक्त चारा होती हैं । जड़ें भूमि को अधिक उपजाऊ बनाती हैं । पत्तियाँ व शाखाएँ वर्षा-जल की बूँदों को धीरे-धीरे जमीन पर गिराकर भू- जल भंडार बढ़ाती हैं । शीशम की लकड़ी भारी, मजबूत व बादामी रंग की होती है । इसके अंतःकाष्ठ की अपेक्षा बाह्य काष्ठ का रंग हल्का बादामी या भूरा सफेद होता है । लकड़ी के इस भाग में कीड़े लगने की आशंका रहती है । इसलिए इसे नीलाथोथा, जिंक क्लोराइड या अन्य कीटरक्षक रसायनों से उपचारित करना जरूरी है । शीशम के 10-12 वर्ष के पेड़ के तने की गोलाई 70-75 व 25-30 वर्ष के पेड़ के तने की गोलाई 135 सेमी तक हो जाती है । इसके एक घन फीट लकड़ी का वजन 22.5 से 24.5 किलोग्राम तक होता है । आसाम से प्राप्त लकड़ी कुछ हल्की 19-20 किलोग्राम प्रतिघन फुट वजन की होती है ।

शीशम उपहिमालय इलाकों के 15 सौ मीटर तक की ऊंचाई से लेकर गांगेय इलाकों तक कुदरती रूप से पाया जाता है, नदी के किनारे वाले इलाके, जो बारिश के पानी से भर जाते हैं, में शीशम अपने आप उग जाता है। शीशम के

लिए रेतीली जमीन जहां पानी न रूकता हो, लेकिन नमी हो, सबसे सही मानी जाती है। यह कड़ी मटियार में कम, लेकिन रेतीली मिट्टी और बीहड़ों में कटी मिट्टी में अच्छा फलता-फूलता है

शीशम का पेड़ कड़वा और कसैला है जो आंतरिक रूप से गर्म है और सूजन का भी इलाज करता है. अगर आपको त्वचा संबंधी परेशानी है तो आप स्वीटऑयल में इस पेड़ के कुछ पत्तों को मिलाएं और इन्हे प्रभावित हिस्से पर लगाएं या रोगी इसकी पत्तियों का काढ़ा बनाकर दिन में दो बार 50-100 मिलीलीटर मात्रा में ले, इससे आपको त्वचा संबंधी कोई भी परेशानी हो वह खत्म हो जाएगी. साथ ही ये किसी भी प्रकार के बुखार को दूर करने में मदद करता है, इसके लिए आप, 320 मिलीलीटर पानी और 160 मिलीलीटर दूध में इसका 20 ग्राम रस मिक्स करें. फिर इसे अच्छी तरह उबाल ले, और फिर एक दिन में तीन बार इसे पिए. अगर आपको त्वचा पर खुजली होने की परेशानी है, तो आप इसके छिलके का पेस्ट बनाकर लगाले इससे खुजली की समस्या दूर हो जाएगी. साल और सागौन से भी अछ गुणवता क लकड़ी के एक मावकपकाले शीशम जात के पेड़ जंगल से गायब हो गए है ।

शीशम के खेती से फायदा

खेती वानिकी के तहत खेत की मेंड़ों पर लगाने पर शीशम का पेड़ 30 साल में 1 फुट से ज्यादा व्यास का यानी चौड़ा हो जाता है। इससे तकरीबन आधा घनमीटर लकड़ी मिल जाती है।जिसकी बाजार में कम से कम कीमत 5 हजार रुपए होती है। इस तरह खेती वानिकी में सौ पेड़ प्रति हेक्टेयर लगाने पर 30 साल में 5 लाख रुपए की आमदनी होती है और टहनियों की कटाई छंटाई से हर साल घर के लिए ईंधन भी मिलता है। किसान अपने खेतों की मेंड़ों व खेतों में ज्यादा से ज्यादा शीशम लगाएं, क्योंकि गेहूं, धान, गन्ना वगैरह फसलों के साथ शीशम लगाने पर आमको अलग से एक उपज मिलती है। फसल के साथ लगाए शीशम के पेड़ को 30 साल बाद बेचने पर होने वाली आमदनी के अलावा शीशम की कटाई छंटाई से छठे, 8 वें और 12 वें साल में मिली लकड़ी से भी आय होती है । शीशम के पेड़ों से पत्तियां, छाल, तेल वगैरह चीजें भी मिलती हैं । शीशम से निकलने वाला हल्के भूरे रंग के तेल का इस्तेमाल भारी मशीनों की चिकनाई के लिए किया जाता है । शीशम सबसे अच्छी इमारती लकड़ियों में से एक है, दरवाजे, खिड़की के फ्रेम, बिजली के बोर्ड, रेलगाड़ी के डब्बे वगैरह बनाने में इस्तेमाल की जाती है । अपने खेत में उगाए गए शीशम के पेड़ काटने के लिए वन महकमे में आवेदन करना चाहिए, 35 दिनों में वनविभाग जरूरी कागजी कार्यवाही पूरी करके देगा । शीशम के लकड़ी ईंधन में भी इस्तेमाल की जाती है और इसकी नई पत्तियां पशुओं के लिए अच्छा चारा है । खेत की मेंड़ों पर लगाए गए शीशम के पौधों को अलग से सिंचाई व खाद देने की जरूरत नहीं होती है, खेत को दिया गया पानी व खाद शीशम को अपने आप मिल जाता है । शीशम की वैरायटी और उससे जुड़ी किसी भी तरह की जानकारी के लिए किसान अपने जिले के वनविभाग की नर्सरी से संपर्क कर सकते हैं । दांतों को मजबूत बनाए रखने के लिए बाजारों में तरह-तरह के हर्बल, केमिकल टूथपेस्ट और पाउडर मौजूद हैं, ऐसे में लोग अब औषधीय गुणों से भरपूर नीम के दातुन या अन्य दातुन को नजरअंदाज करने लगे हैं । जो दांतों की सेहत के लिहाज से गलत है ।

शरीर की जलन में शीशम के तेल के फायदे:- कई पुरुष या महिलाओं को शरीर में जलन की शिकायत रहती है । ऐसे में शीशम के तेल से लाभ मिलता है । शरीर के जिस अंग में जलन हो, वहां शीशम का तेल लगाएं । शरीर की जलन ठीक हो जाती है ।

पेट की जलन में शीशम के औषधीय गुण से लाभ आप शीशम के फायदे से पेट की जलन का इलाज कर सकते हैं । 10-15 मिली शीशम के पत्ते का रस लें । इसे पिएं । इससे पेट की जलन ठीक होती है ।

आंखों की बीमारी में शीशम का औषधीय गुण फायदेमंद

आंखों की बीमारी जैसे आंखों में जलन में शीशम का इस्तेमाल लाभ पहुंचाता है । शीशम के पत्ते के रस में मधु मिला लें। इसे 1-2 बूंदें आंखों में डालने से जलन से आराम मिलता है ।

बुखार में शीशम के सेवन से लाभ

हर तरह के बुखार में शीशम से औषधीय गुण से लाभ मिलता है । शीशम का सार 20 ग्राम, पानी 320 मिली और दूध 160 मिली लें। इनको मिलाकर दूध में पकाएं। जब दूध थोड़ा रह जाए तो दिन में 3 बार पिलाएं । इसे बुखार ठीक होता है ।

एनीमिया में शीशम के सेवन से फायदा

एनीमिया में व्यक्ति के शरीर में खून की कमी हो जाती है । आप शीशम के औषधीय गुण से एनीमिया में लाभ ले सकते हैं । एनीमिया को ठीक करने के लिए 10-15 मिली शीशम के पत्ते का

रस लें। इसे सुबह और शाम लेने से एनीमिया में भी लाभ होता है।

मूत्र रोग में शीशम का सेवनफायदेमंद

मूत्र रोगजैसे पेशाब का रुक-रुक कर आना, पेशाब में जलन होना, पेशाब में दर्द होने पर शीशम के सेवन से फायदा होता है। 20-40 मिली शीशम के पत्ते का काढ़ा बनाएं। इसे दिन में 3 बार पिलाएं। इससे पेशाब का रुक-रुककर आना, पेशाब में जलन होना, पेशाब में दर्द होना आदि समस्याओं में लाभ होता है। इसके साथ ही 10-20 मिली पत्ते काढ़ा का सेवन करने से भी लाभ होता है।

गोनोरिया में शीशम के सेवन से लाभ

शीशम के सेवन से गोनोरिया रोग का इलाज किया जाता है। शीशम के 8-10 पत्ते व 25 ग्राममिश्री को मिलाकर पीस लें। इसे सुबह और शाम सेवन करें। इससे गोनोरिया रोग ठीक हो जाता है।

मासिक धर्म की रुकावट में शीशम का औषधीय गुण फायेदमंद

3-6 ग्राम शीशम के सार का चूर्ण बनाएं। इसे दिन में 2 बार लेने से मासिक धर्म की रुकावट खत्म होती है। शीशम के 20-40 मिली काढ़ा को दिन में 2 बार देने से मासिक धर्म के समय होने वाले दर्द मेंकमी आती है। 10-15 मिली शीशम के पत्ते के रस को सुबह और शाम देने से मासिक धर्म में लाभ होता है। शीशम के 8-10 पत्ते, और 25 ग्राम मिश्री को मिलाकर घोट-पीसकर सुबह के समय सेवन करें। कुछ ही दिनों के सेवन से मासिक धर्म में होने वाला अनियमित रक्तस्राव सामान्य हो जाता है। सर्दियों या ठण्ड के मौसम में इस प्रयोग के साथ-साथ 4-5 काली मिर्च भी प्रयोग में लेनी चाहिए।

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Published by:

Tropical Forest Research Institute
(Indian Council of Forestry Research & Education)
(An autonomous council under Ministry of Environmnet, Forests and Climate Change)
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