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Van Sangyan

Editoriral Board

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:

by e-mail to vansangyan_tfri@icfre.org

or, through post to The Editor, Van Sangyan,
Tropical Forest Research Institute,
PO-RFRC, Mandla Road,
Jabalpur (M.P.) - 482021.

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.

From the Editor's desk

Efforts for the conservation of the Elephant in India were initiated in 1873 with the promulgation of the Madras Wild Elephant Preservation Act, 1873. The elephant was included in Schedule I of the Wildlife (Protection) Act, 1972 on 5.10.1977. A number of legislative measures were taken in the subsequent years which resulted in controlling the process of deforestation of elephant habitat and prohibiting ivory trade. Attempts for the conservation of elephants got a big boost in February 1992 when Government of India launched Project Elephant. As a result of various conservation measures, elephants now enjoy a comprehensive legal support and their population has gone up from 15,627 in 1980 to 28,274 in 2001. There has also been some reduction in the cases of human deaths caused by elephants. But the overall status of elephants and their habitat continues to be precarious. Incidences of killing of elephants by poachers for ivory and by farmers in retaliation to crop damage, are on the increase. Habitats and corridors of elephants are under tremendous pressure in many States on account of deforestation, encroachment and other biotic factors. In some regions, poaching of tuskers has disturbed the sex-ratio in elephant populations to alarming proportions. Human-elephant conflict has become a serious issue and the people are turning hostile to elephants and the forest staff. The conservation strategies should also strive to nature and encourage the love and sympathy that a large number of people in India still have for elephants.

The best way to manage forests to store carbon and to mitigate climate change is hotly debated. Trees absorb carbon dioxide from the atmosphere, and wood can be a substitute for fossil fuels and carbon-intensive materials such as concrete and steel. To make good decisions about how to cultivate forests for climate-change mitigation, such as whether it is better to harvest or conserve trees, we must better understand the cause and future behaviour of this in situ carbon sink.

This issue of Van Sangyan contains an article on Status, habitat, threat and conservation of elephants and Terrestrial carbon sink and climate change, There are also useful articles on Growing media for healthy seedling production, Forest products of Telangana state, Marwar teak (in Marathi), Financial contribution of women farmers (in Hindi), Hybrid seed production technique, Flowering in bamboo and biodiversity of Rhododendron anthopogon and Panthera uncea.

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

Looking forward to meet you all through forthcoming issues.

Dr. N. Roychoudhary

Scientist G & Chief Editor

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Elephants: Status, habitat, threat and conservation

(On August 12, 2015 World Elephant Day)

Dr. Rajesh Kumar Mishra, Dr. Naseer Mohammad and Dr. N. Roychoudhury
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Since 2011, August 12 has been set aside as World Elephant Day. Supported by numerous conservation agencies, it's a day to "spread awareness, share knowledge, and provide solutions for better care and management of both captive and wild elephants. Elephants face numerous challenges, including poaching, habitat loss, exploitation, abuse, and proximity to human conflict and poverty. The International Union for Conservation of Nature lists African elephants as "vulnerable" and Asian elephants as "endangered."

On August 12, 2012, the inaugural World Elephant Day was launched to bring attention to the urgent plight of Asian and African elephants. The elephant is loved, revered and respected by people and cultures around the world, yet we balance on the brink of seeing the last of this magnificent creature. We admire elephants in part because they demonstrate what we consider the finest human traits: empathy, self-awareness, and social intelligence. But the way we treat them puts on display the very worst of human behavior." World Elephant Day asks you to experience elephants in non-exploitive and sustainable environments where elephants can thrive under care and protection. On World Elephant Day, August 12, express your concern, share your knowledge and support solutions for the better care of captive and wild elephants alike.

India is home for about 50 to 60% of all of Asia's wild elephants and about 20% of the domesticated elephants. As such, the country is of paramount importance for the survival of the species. The elephant plays a central role in Indian life and has done for many centuries. Elephants are closely associated with religious and cultural heritage, playing an important role in the country's history. They remain revered today. An India without elephants is simply unimaginable.

Population of Indian Elephant

Elephant Range	110,000 km² approx
Country Ranking	2nd of 13
Total Wild Elephants	23,900 – 32,900 total
	10,300 -17,400 (south)
	2,400 – 2,700 (central)

	10,300 – 11,300 (north-east)
	900 – 1,500 (north-west)
Country Ranking	1st of 13
Total Captive Population	3,500
Country Ranking	3rd

Asian elephants are smaller than African elephants, and their backs are more convex or level. Their head has two domes rather than one, and they have smaller ears. Their trunk has just one "finger" while African elephants have two, but they are both just as dexterous. Unlike African elephants, predominantly only male Asian elephants have tusks, and even tusk less males – makhnas – are regularly recorded. Some females have just short, stunted tusks known as tushes. Their skin is smoother than African elephants, grey-brown in colour, and often lacking pigment in patches on the trunk, ears and neck, which consequently appear pink. Males can be taller than 3m at the shoulder, with females reaching up to 2.5m. Asian elephants can live for up to 55-70 years in the wild, but only one in five may make it to this age, and as many as half may die before they are 15.

Once infants reach sexual maturity, females tend to stay with the herd, while males are driven away and may form small bachelor groups, or roam independently. The females remain in small family herds led by a matriarch who tends to be the oldest, largest and most experienced female. Calves are cared for by their mothers and aunts. The matriarch will determine the group's movements and activities, and on occasion related family groups may come together to form larger clans. Groups may roam widely depending on the availability of food and water, and often follow traditional, seasonal migration routes, sometimes travelling up to 30km per day. When human activity of any form cuts across one of these routes, elephants trying to pass between feeding sites may suddenly find themselves unable to do so, and/or encountering people, often with tragic outcomes.

A herd of adult and baby elephants walks in the dawn light with the highest mountain in Africa, Mount Kilimanjaro

Asian Elephants are herbivores and need to eat about 10% of their body weight every day: up to 150-200kg for adults. As a result they may spend up to 18 hours per day feeding on grasses, leaves, fruits, roots, vines, and bark of as many as 200 different species. They also need to drink up to 200 liters of water every day, and their trunk can take in 5-10 liters in one suck.

Elephants are able to survive in a variety of different locations because of the huge variety of food sources that they consume. Many people assume that elephants that are in the wild only live in the grasslands. While that is one of their main habitats, they can also be found in the desert of the Savannah,

forest areas, where there are swamps, and everything in between. They form emigrational paths that they continue to follow year after year. This allows them to take advantage of the foods that grow in various areas. The paths that they walk are clearly there just like a road and they are fascinating to see when you are looking at areas that don't have any clear pathways other than these from the elephants as they roam around.

An Asian elephant swims in a 65-meter-long pool at Fuji Safari Park in Susono, at the foot of Mt. Fuji, Japan.

Most of the elephants remaining in Africa live in National Parks. These areas have been put in place to help give them plenty of room to survive. They are also well protected in these locations to help the population count rise. However, this can be stressful for the elephants as they love the ability to freely roam. They also love to play and to bathe in water so they don't mind traveling long distances to find it. One of the reasons why elephants have been able to survive for so long in the wild has to do with their high level of intelligence. While they do have their natural habitat where they want to be, they also have the mentality to know when they have to move on and they have to adjust to new habitats in order to continue to survive.

Elephants don't have predators other than humans so when they do move to new habitats being able to find adequate supplies of food is the one thing that they have to worry about. If they can find it, then they will likely be able to thrive there. One of the biggest threats to elephants in the wild is the continually destruction of their natural habitat. This gives them less room to roam in order to find adequate supplies of food. They can consume more than 50 tons of food per day so they need quite a selection of it to choose from. When elephants are limited to certain locations though they can completely wipe out the vegetation there. As a result it will be difficult for it to grow back.

When elephants can freely roam though in their natural habitat they actually do lots of good for the environment. They clear away trees and plants so that new forms of vegetation can grow there. It is due to humans clearing away their natural habitat though that they are struggling out there in the wild. Even with some great conservation efforts in place they remain in serious jeopardy of losing their natural habitat.

The habitat for elephants in captivity is a far cry from what they experience in the wild. Most zoos offer them a generous amount of room to roam but it is nothing like what they would have in the wild. Still, they have plenty of water and food so they don't need to travel for those reasons. They are also offered plenty of toys so that they don't become bored. When they are in a circus setting they are living in even worse

conditions. They are often chained up and forced to stand still in small cages. This can lead to a great deal of stress for elephants. They are instinctively driven to be able to move at their own leisure.

In past centuries, the forests of India literally teemed with elephants. Although no census or estimates of the wild population exist, it is said that in the early 17th century the Mughal Emperor Jahangir had 113,000 captive elephants throughout his empire. Extrapolating from this figure, it is easy to imagine a wild population comfortably in excess of a million.

Today's population is obviously a fraction of that, but large numbers of sustainable herds exist – particularly in the south and northeast. Wild elephants in India are facing a variety of problems, but most focus around the usual issues of habitat loss and human-elephant conflict. These have been on the increase since the middle of the 20th century as the explosion of the population and the demands of economic development led to the clearing and cultivation of former elephant habitat.

Concern for the threat to the elephant led to the formation in 1992 of the government backed "Project Elephant". This scheme was intended to preserve habitat and establish elephant corridors, allowing for the traditional migration patterns of established elephant herds. Addressing human-elephant conflict issues and improving the welfare of domesticated elephants was also a central part of the organization's brief.

The organization presided over the establishment of 25 Elephant Reserves throughout the elephants' traditional range and covering a total area of 58,000 km². A population survey of the reserves in 2005 found that over 21,000 elephants were living in the protected areas and the population was actually on the increase.

An aerial picture taken on April 5, 2013, shows the main herd of elephants in Zakouma National Park, 800 kilometers east of N'Djamena in Chad. Ninety percent of the elephants of the park have been poached in the last decade.

Project Elephant has also established the MIKE (Monitoring of Illegal Killing of Elephants) programme of CITES. This has uncovered a significant increase in the poaching of bull tuskers, which has damaged the population dynamics by disturbing the sex ratio. In some areas, the normal level of 1:12 (male-female) has been so distorted that 1:100 has been known. This abnormality seriously affects the genetic viability of what on the surface can look like healthy sustainable populations.

India has a long history of elephants in domestication with the animals participating in many areas of Indian life from war and ceremonial use to transport, construction and logging.

A survey by Project Elephant in the year 2000 found a total of 3,400 domesticated elephants owned by the following groups:

Private owners	2,540
Temples	190
Forest departments	480
Zoos	80
Circuses	110

India has some of the strictest elephant legislation in Asia, which should provide adequate protection for the country's 3,600 domesticated elephants. However the laws are rarely adhered to or enforced and many of India's captive elephants suffer as a result. There is a mixed picture with regards to elephant conservation and welfare issues in India. Project Elephant has made a huge difference and provided a focus for conservation effort. Although there are still many remaining problems, these efforts are beginning to bear fruit regarding the conservation of India's wild elephants. The situation regarding the captive animal reveals a more worrying trend. Despite a rich culture of domesticated elephants, many animals are not receiving the welfare they require under the law and are suffering as a result.

The escalation of poaching, habitat loss, human-elephant conflict and mistreatment in captivity are just some of the threats to both African and Asian elephants. Working towards better protection for wild elephants, improving enforcement policies to prevent the illegal poaching and trade of ivory, conserving elephant habitats, better treatment for captive elephants and, when appropriate, reintroducing captive elephants into natural, protected sanctuaries are the goals that numerous elephant conservation organizations are focusing on around the world.

Two elephants reach out to each other at the Sonepur Cattle Fair in the Saran district of Bihar on November 28, 2012.

Elephants are simply one more natural resource that is being caught up in human greed on the one hand and human need on the other. We somehow need people to become reacquainted with nature or they can have no clue as to the interrelatedness of cause and effect."

The escalation of poaching, habitat loss and the ivory trade are just some of the major threats to African and Asian elephants. On World Elephant Day, an international event held annually on 12 August, conservationists hope to raise awareness of the plight of elephants and focus on greater protection of the world's largest terrestrial animal.

More than 65 wildlife organizations across the world support the day to spread knowledge about the conservation of the creatures. Goals include working towards better protection for wild elephants, improving enforcement policies to prevent the illegal poaching and trade of ivory, conserving elephant habitats, better

treatment for captive elephants and, when appropriate, reintroducing captive elephants into natural, protected sanctuaries.

A male elephant charges towards unseen Indian villagers after they threw stones in an attempt to scare away the herd of wild elephants that strayed close to the village of Rakamjote, close to the India-Nepal border, on May 26, 2015. Indian forest guards and local villagers used firecrackers to scare away the elephants after sightings caused unease among villagers. Human-elephant conflicts are on the rise in India as villagers and farmers encroach on the elephants' natural habitat.

Without intervention, both African and Asian elephants face extinction– with African elephants classified as "vulnerable" and Asian elephants "endangered" on the International Union for Conservation of Nature's Red List.

African elephant population was about three to five million in the last century, but was severely reduced to its current level because of hunting. In the 1980s, an estimated 100,000 elephants were killed each year and up to 80% of herds were lost in some regions. The demand for ivory on black markets, of which China's is one of the largest, is a predominant reason for the illegal poaching. In Kenya, poaching has spiked sevenfold between 2007 and 2010, and since 2012, more than 400 elephants have been killed. Conflict with humans is also a significant concern, as human populations increase and forest-cover decreases, forcing elephants into close proximity with human settlements.

As human populations have expanded, the habitats of African elephants have been converted for settlements, agriculture and developments. The fragmentation of their habitats makes breeding difficult and allows poachers to more easily find the animals and set traps. According to WWF, there are between 40,000 and 50,000 Asian elephants left in the world. The three subspecies of Asian elephant – the Indian, Sumatran and Sri Lankan – used to roam across most of Asia, but now they're restricted to just 15% of their original range, largely due to habitat loss.

Indian elephants may spend up to 19 hours a day feeding and they can produce about 220 pounds of dung per day while wandering over an area that can cover up to 125 square miles. This helps to disperse germinating seeds. They feed mainly on grasses, but large amounts of tree bark, roots, leaves and small stems are also eaten. Cultivated crops such as bananas, rice and sugarcane are favored foods as well. Since they need to drink at least once a day, these elephants are always close to a source of fresh water.

The Nilgiris-Eastern Ghats (NEG) region of Southern India supports the largest wild population of Asian elephants in the world and therefore has critical importance for the

long-term viability of this species. Male elephants in these regions have been decimated by ivory poaching for three decades and population genetic studies have indicated low levels of genetic diversity. Researchers from Pondicherry University will develop a DNA database of individual elephants in the NEG using DNA extracted from elephant dung in order to assess the genetic diversity of the population, and to compare the landscape genetics of NEG elephant population to the Anamalai Tiger Reserve (ATR) population further south. Landscape genetics can produce maps that clearly demonstrate to wildlife manager's areas where wildlife populations are connected, sites where connectivity needs to be maintained through stringent protection, and sites where new corridors need to be developed. Better landscape management also encourages better land-use strategies as human-elephant conflict often happens when elephants attempt to traverse human dominated areas to reach another habitat.

Human-elephant conflict is one of the biggest environmental and socio-economic crises of rural Sri Lanka. Annually elephants cause over $10 million of crop and property damage and in retaliation the farmers kill the elephants. On average 225 elephants have been killed by farmers annually since 2008 and elephants have killed about 60-80 people annually, most in their own villages and fields. The corridor from the Wasgamuwa National Park to the elephant's main water and food source is vital for elephants but it is also used by villagers living adjacent to the forest reserve. It is not unusual to see school children, men and women walking and biking while elephants are present, always fearful of an elephant attack. So they harass the elephants to scare them away and unfortunately such behavior makes elephants more aggressive rather than scared of people. This project undertaken by the Sri Lanka Conservation Wildlife Society purchases a bus to provide service through the elephant corridor. The bus will provide a safe and secure conveyance for the villagers while allowing the elephants to use the corridor without being harassed, injured or chased from their habitat.

Tigers and elephants are protected within nature reserves in India. However, due in part to their growing population in the Corbett landscape in northern India, many have ventured beyond the boundaries of the reserves, crossing through forest patches and local villages on their way to reach nearby forested areas. As they pass through these areas, known as "corridors," they can come into conflict with humans and their livestock.

The Corbett landscape is famous for its vast numbers of tigers and elephants, which play an important role both ecologically and economically, as they are responsible for much of the eco-tourism in the region. With the growing population of these animals, incidents of human-wildlife conflict will only increase in the coming years. You will help researchers to assess the perceptions and needs of the local communities, as well as trial strategies to further strengthen local support, such as by testing methods to reduce crop damage.

Today the Asian elephant is not just a living symbol of the cultures of Asia but it is also very much ingrained in the socio-cultural

values of the people in the west and northern hemisphere. Therefore the loss of the Asian elephant will not be just a huge loss for the people of Asia but to the entire world.

A herd of elephants walk in the Tsavo East National Park, 280 kilometers east of Kenya's capital of Nairobi

For conservation biologists these are challenging times—where we need to develop innovative strategies to balance the needs of people and their aspirations while at the same time attempting conserve one of the most endangered mega-herbivores of the world. Ravi Corea and his team work to develop innovative conservation projects on the ground to forge a future where elephants and people can coexist; solar powered electric fences, elephant alert systems, habitat enrichment programs, programs teaching habituated elephants how to paint, and even projects that are making novelty paper out of elephant dung.

Elephants are one of the greatest examples of an ecological "keystone" species: the lives of so many other organisms depend on their existence and they define the ecosystems in which they are found. Their consumption of vast amounts of vegetation, and even how they physically open up clearings, for example, ensures that certain plant species don't come to dominate in any one environment. This results in a much greater variety of plants and also animals that feed on them. Elephants' feeding behaviour is also such that what they spill or shake free from high branches can suddenly become available to other animals. Elephants are also known to enlarge and deepen water supplies with their tusks in times of drought, and this too benefits countless other animals. Furthermore, numerous plants rely on them to disperse their seeds and help them germinate in their very own parcels of organic fertilizer. Animals that subsequently feed on these plants, and the animals that feed on them, therefore indirectly depend on the elephants. Because of the great quantity of seeds that they are passing and the distances over which they do so, one can see how elephants genuinely do shape their environments, and as such they have been referred to as the "mega gardeners of the forest". Lose the elephants and the ecosystems rapidly deteriorate

Because of the vast areas they need in which to roam, the foremost threat to Asian elephants is habitat loss on a massive scale. The spread of human settlements, plantations, farming, mining and railways in rapidly developing nations is leaving elephant groups marooned in ever-decreasing pockets of forest. Approximately 95% of their original habitat has been destroyed by people. Deprived of their habitat, and increasingly isolated from other groups, elephant numbers are falling. Those that survive are forced into areas of human activity, if not just to pass between forest patches, then directly to raid crops. The once harmonious relationships between elephants and people are breaking down, and all too

frequently both people and elephants are killed when conflict flares up.

In addition, while it is not as significant a threat as it is to African elephants, the ivory trade has never been overcome. While the market for ivory has dropped off in some parts of the world, there has been an upsurge in demand in others, particularly China, and poaching of Asian elephants still occurs. Because only the males have tusks that are of any interest to poachers, their targeted removal from populations can upset the gender balance in populations and threaten their future viability.

Finally, while its full extent has yet to be documented, the trade in live Asian elephants, capturing them from the wild to supply the captive market, also threatens the survival of particular populations in some areas.

The immediate priority to save the Asian elephant is to secure as many of their traditional migration routes as possible. These wildlife corridors will often connect two protected areas, and so once secured they can be incorporated into one of those protected areas. The process may require the purchase of land and the voluntary and supported resettlement of any communities living within the corridor and conflict zone.

Human-elephant conflict is most likely to occur and become progressively worse in these regions as elephants try to access feeding sites and water, and may raid crops and enter villages to do so. A variety of approaches are required to prevent conflict between people and elephants, including physical barriers to keep elephants away, the driving away of elephants, early-warning systems to forewarn of potential encounters, land-use planning, and various other ways of working with local communities so that they can continue to live side-by-side with elephants.

The last swimming elephant in the Andaman Islands, India

Swimming elephants like 60-year-old Rajan used to be a regular sight in the Andaman Islands, south of India, but this five ton Asian elephant is now the last of his kind.

Countering both poaching and the live trade meanwhile includes a variety of law enforcement measures, ongoing training and capacity building of rangers, guards and other wildlife officials, combined with information gathering to keep one step ahead of the criminals.

Through a combination of the above approaches, Elephant Family is working to save Asian elephants wherever its intervention is most needed and can be

delivered effectively. This is achieved through developing long-term strategic alliances with a number of local partner organizations across Asia, and with them ten large-scale conservation projects and other grass-roots community projects that demonstrate effective and innovative conservation solutions

Elephants can be beneficial to their environments because they are a keystone species meaning that their presence in a habitat is very important for the survival of other species as well. Elephants alter the environment to benefit other species in many ways. They eat plants, which prunes them and promotes the growth of other plant species as well because they are able to receive sunlight that was previously blocked (Field Trip Earth). They also distribute seeds in the 200 pounds of fecal matter that they produce everyday (Animal Life Resource 2008). This distribution of seeds provides for the survival of vegetation as well as providing a source of plant foods for other heterotrophs (Field Trip Earth). Finally, the paths that they create through seasonal migration provide routes that other animals can also use. These paths also create firebreaks which can stop a fire from spreading by providing an area that lacks vegetation which would otherwise act as fuel for the fire (MacKenzie 2001). As elephants suffer habitat loss from desertification, we may see that their disappearance has a positive feedback effect, as these fires will no longer be prevented. Elephants are obviously very critical for the overall biome and its biodiversity. This makes the conservation of elephants and even more vital issue.

Elephants are important for our survival. By saving them we are forced to save big forests. By saving big forests we save all animals. If we do not, all nature will disappear and we destroy ourselves

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Terrestrial carbon sink and climate change

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Introduction

Carbon is the basis of life on Earth. It is incorporated into plants through photosynthesis, absorbed by animals through their food, present in the atmosphere as carbon dioxide, locked into rock as limestone, and pressed into fossil fuels such as coal and oil. In the Jurassic age, there was much more carbon in the atmosphere than there is now. The carbon taken up by plants on land and in the sea gradually exceeded the amount released during decay, and this excess carbon became locked away as fossil fuels beneath the surface of the planet. In other words we can say that life on Earth was acting as a carbon sink till two centuries back. But during last two centuries, this trend has been drastically reversed as forests have been reduced and fossil fuels have been burnt, meaning that more carbon has been released into the atmosphere than has been absorbed (Houghton 2002).

Although the oceans are currently the greatest carbon sink, terrestrial carbon sinks are also important. The greatest terrestrial carbon sinks occur in young, growing forests, because a hectare of trees holds up to 50 times more carbon than a hectare of grasses or crops. Older forests and soils may also accumulate carbon but the rates are generally low compared with the rate for young trees.

There is strong evidence that the terrestrial biosphere has acted as a net carbon sink over the last three decades. Its strength is highly variable ranging from 0.3 - 5.0 Pg C yr^{-1}; an amount of significant magnitude compared to the emission of about 7 Pg C yr^{-1} from fossil fuel burning (Schimel 2001). Uncertainties associated with C emissions from land use change are large. On average, the terrestrial carbon sink is responsible for removing from the atmosphere approximately one third of the CO_2 emitted from fossil fuel combustion, thereby slowing the buildup of atmospheric CO_2. The ocean sink is of similar magnitude. Given the international efforts to stabilize atmospheric CO_2 concentration and climate (i.e. Kyoto Protocol, C trading markets), the terrestrial C sink can be viewed as a subsidy to our global economy worth trillions of dollars. Because many aspects of the terrestrial carbon sink are amenable to purposeful management, its basis and dynamics need to be well understood (Canadell *et al.*, 2007).

Knowledge of carbon exchange between the atmosphere, land and the oceans is important, given that the terrestrial and marine environments are absorbing about half of the carbon dioxide that is emitted by fossil fuel combustion. Atmospheric carbon dioxide and oxygen data confirm that the terrestrial biosphere was largely neutral with respect to the net carbon exchange during the 1980s, but became a net carbon sink in the 1990s. This recent sink can largely be attributed to northern

extra tropical areas, and is roughly split between North America and Eurasia. Tropical land areas, however, were approximately in balance with respect to carbon exchange, implying a carbon sink that offset emissions due to tropical deforestation. The evolution of the terrestrial carbon sink is largely the result of changes in the land use over time, such as growth on abundant agricultural land and fire prevention, in addition to responses to environmental changes, such as longer growing seasons, and fertilization by carbon dioxide and nitrogen. Nevertheless, there remain considerable uncertainties as to the magnitude of the sink in different regions and the contribution of different processes (Scheme *et al.*, 2001).

The Intergovernmental Panel on Climate Change concluded that "a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber fibre or energy from the forest, will generate the largest sustained mitigation benefit". Sustainable management practices keep forests growing at a higher rate over a potentially longer period of time, thus providing net sequestration benefits in addition to those of unmanaged forests.

Forests as carbon sink

Forests play an important role in storing and recycling the earth's carbon. The cycling of carbon by the terrestrial biosphere is controlled by photosynthesis, respiration and decomposition. The managed forests have the potential to conserve and sequester carbon and thus mitigate emissions of carbon by 11-15% of the fossil fuel emissions (Roma et al 2000). Global forests have huge carbon carrying capacity (CCC) and carbon sequestration potential (CSP). Forests promote sequestration of carbon (C) into soil and biomass. Site specific carbon (C) sink depends on composition, age, site quality and management of stand.

With the advent of the Kyoto Protocol and its recognition of the use of forestry activities and carbon sinks as acceptable tools, the potential role of planted forests as a vehicle for carbon sequestration has taken on a new significance. After the Kyoto Protocol, the project Reducing Emissions from Deforestation and Degradation (REDD) has attempted to mitigate green house gases through enhanced forest management in developing countries in order to mitigate the effect of climate change problem IPCC, (1996) advocated an increase in the size of the carbon pool through massive afforestation and reforestation, besides maintaining the existing C pools in the terrestrial ecosystem.

Forest management such as rotation length is seen as an activity that countries may apply under the Kyoto Protocol to help them meet the commitments for reduction of green house gas emissions IPCC 2000. However, the benefits can get reversed through disturbances and harmful practices during harvest which would release the carbon back to the atmosphere. Individual trees and stands of trees sequester carbon within their main stem wood, bark, branches, foliage and roots. Carbon sequestered by the main stem wood results in longer sequestration while other components sequester and release carbon on shorter intervals due to natural pruning and decomposition (Montagmini *et al.*, 1998).

Management of forest resources is one such major temporal factor, influencing resource stability and the carbon pool. Under a given management policy, both the long period of forest growth, and the

slow turnover and decay of the carbon pool, enhance the relevance of stand level management policies as cost-effective mechanisms mitigating climate change. Apart from regional level uncertainties like the nature of land use and the estimation of carbon storage in vegetation and soil, the carbon flux of tropical forests is greatly influenced by uncertainty in regenerative capacity of forests and in harvest and management policies (Reddy *et al.*, 2000).

Man made plantations

Man made plantations can serve many purposes because it can act as a carbon sink by sequestering large amount of carbon in itself, also it can act as energy plantations whereby it is felled at regular intervals to provide for the energy needs. If we have the knowledge of the carbon sequestration potential of different plant species, it will become very easy to plan and manage the plantation which can serve the above said purposes. Research has been carried out for quite a number of species but a lot more has to be done.

Carbon sequestration potential of tree species varies with species, climate, soil and management. Forest plantations have significant impact as a global carbon sink (Terrawong *et al.*, 2012; Rahman *et al.*, 2012). Young plantations can sequester relatively larger quantities of carbon while a mature plantation can act as a reservoir. Long rotation species such as teak (*Tectona grandis*) has long carbon locking period compared to short duration species and has the added advantage that most of the teak wood is used indoors extending the locking period further. (Sreejesh *et al.*, 2013)

World scenario

The significance of role of biomass of tree species in carbon sequestration has long been recognized, but very little attempts have been made to estimate the biomass accumulation and their contribution for sequestration of carbon, especially in mined out areas. Carbon sequestration rates vary by tree species, soil type, regional climate, and topography and management practice. (Bohre and Choubey, 2012).

The world's forests account for more than half of the organic carbon stored on land (Goodale, 2002). Currently, forests of the temperate zone are actively accumulating carbon in large enough quantities to affect the global carbon budget (Goodale, 2002; Canadell, 2007). A number of phenomena may be contributing to this enhanced carbon accumulation (McGuire 2001; Schimel, 2001; Pacala, 2001; Hurtt, 2002; Caspersen, 2000; Thomas 2010), including recovery from historical land use (e.g., abandoned agricultural land reverting to forested land), carbon dioxide (CO_2) fertilization of photosynthesis, increased nitrogen (N) deposition, and climate change. In the future, climate change is likely to play a major role in the carbon balance of temperate forests and other land ecosystems, although the sign and magnitude of the resulting feedbacks to the climate system are uncertain (Cox 2000; Freidlengstein, 2001). The projected warming of between 1.1 °C and 6.4 °C over the next 100 y (Alley 2007) could affect the carbon balance of terrestrial ecosystems by altering biogeochemical processes such as plant photosynthesis and microbial respiration (Canadell, 2007; Melillo, 1990; Melilla, 1995, Shaver 2000).

Forest ecosystems contain a large part of the carbon stored on land, in the form of both biomass and soil organic matter (SOM). The long-term fate of C in forest ecosystems depends on whether it is stored in living biomass or soils. Forest trees also control the major terrestrial bidirectional

transfer of C between the atmosphere and the soil: forests take up large amounts of CO_2 from the atmosphere through photosynthesis, and return large amounts through respiration by vegetation and decomposers in the soil. Carbon stocks in soil exceed those in vegetation by 2: 1 in northern temperate forests to over 5: 1 in boreal forests (Schlesinger, 1997). Thus changes in soil C stocks can be more important than changes in vegetation C stocks for forest C budgets.

Increasing atmospheric carbon dioxide concentration CO_2 with subsequent changing climate, increased nitrogen deposition, and changing land use have changed (and will change) the forest C stocks. Over the past 200 yr, approx. 405 ± 30 Pg C has been emitted into the atmosphere as CO_2 as a result of fossil fuel burning and cement production (75%), and of land use and land-use change (25%), predominantly deforestation (IPCC, 2001). As a result, the global average atmospheric CO_2 has raised by approx. 35%, from 280 ± 5 to 377 ppmv, in 2004. This increase in CO_2 accounts for approx. 40% of these anthropogenic emissions, the remainder having been absorbed by the oceans and terrestrial ecosystems. On average during the 1990s, annual global emissions of greenhouse gases amounted to 6.4 ± 0.3 Pg C from fossil fuels, plus 1.7 ± 0.8 Pg C from land use and land-use change, mainly deforestation in the tropics. There are four main global sinks for these emissions: the atmosphere (3.2 ± 0.1 Pg C); the oceans (1.7 ± 0.5 Pg C); tropical vegetation (1.9 ± 1.3 Pg C); and temperate and boreal vegetation, mainly forests (1.3 ± 0.9 Pg C). In particular, plant photosynthesis is responding to this increase in [CO_2]. (Hyvonen, *et al.*, 2006)

Indian forests

According to the Forest Survey of India report 2013 the recorded forest area in India is 69.79 m ha. This has been classified as reserved, protected and unclassified forest. The Indian forests are divided into very dense forests with an area of 8.35 m ha, moderately dense forest with an area of 31.87 m ha and open forests 29.57 m ha. The forest cover has been steadily increasing from 21.02% in 2009 to 21.05% in 20011 to 21.23% in 2013. There has been an increase in the forest cover in the hills and tribal areas since SRF 2011 but a decrease in the forest covers of the mangroves and North Eastern states since 2011. The growing stock of Indian forests and Forests Outside Forests is 5658 m m^3.

Natural regeneration is adequate in 48% of the recorded forest area, inadequate in 28% and there is no regeneration in 10% of the recorded forest area. The main reasons for the loss of forest areas in India are forest clearance in encroached areas, open cast coal mining, biotic pressure, shifting cultivation, illicit felling, insurgency influences to name a few. But the situation is not so grim with afforestation and conservation initiatives and reclamation activities.

How the Changes in Hydrological Cycles influence Carbon Sink?

Changes in the global hydrological cycle are a possible consequence of increasing concentrations of atmospheric greenhouse gases (Houghton 2002). Analysis of climatic data since 1900 over the continental U.S. show increases in precipitation, specific humidity, soil moisture and stream flows, indicating an altered hydrological cycle. Many of these hydro-climatic changes directly influence processes involved in carbon uptake (photosynthesis) and release (respiration) from vegetated areas. Whether an active

hydrological cycle results in carbon sequestration (positive uptake) by terrestrial ecosystems, however is dependent on complex interactions between ecosystem physiology and both the magnitude and timing of changes in hydro-climatic conditions (Nemani, *et al.*, 2002). Increase in precipitation can potentially enhance plant growth both by increasing the supply of and reducing the demand of water.

Globally, mid and high-latitude ecosystems have benefitted from both the increased amount of precipitation and warmer spring temperatures after the mid 1970s, and may have contributed to the well known mid latitude carbon sink (Dia and Fung, 1993).

Conclusion

The concentration of greenhouse gases in the atmosphere is increasing day by day with the advancement of technologies and increasing urbanization throughout the globe. Carbon dioxide is the major greenhouse gas beside others on the basis of its concentration and global warming potential. Although the largest sink of carbon dioxide is oceans, but the terrestrial carbon sinks is equally important keeping in view the carbon sequestration potential of different forest ecosystems like the tropical forest ecosystems. The impacts of climate change can be mitigated by reducing the concentration of greenhouse gases from the atmosphere. The concentration of carbon dioxide in the atmosphere can be partially reduced by sustainably managing forests and increasing carbon stock on degraded lands through plantation of fast growing tree species, which can sequester more greenhouse gases. Reclamation activities in nature affected areas or the areas disturbed by developmental activities like mining can also help in increasing the terrestrial carbon stock thereby reducing the pressure on the atmosphere due to fossil fuel emissions.

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Growing media for healthy seedling production

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Successful greenhouse and nursery production of container-grown plants is largely dependent on the chemical and physical properties of the growing media. One of the most important reasons for the poor quality of the plants produced in many nurseries in India is the poor quality of the potting mixture (Vikas Kumar et al., 2014). Much more attention needs to be paid to its selection and preparation. It is necessary to find out what kinds of soil, sand and compost are available locally. An ideal potting medium should be free of weeds and diseases, heavy enough to avoid frequent tipping over and yet light enough to facilitate handling and shipping. The texture of the mixture is most important. It determines whether the plant get air, moisture and nutrients or not in the right amount. The media should also be well drained and yet retain sufficient water to reduce the frequency of watering. A sandy loam or loamy sand, which contains between 40 and 70 per cent sand is needed. For nursery use, the C/N ratio of matured compost must be less than 15. Other parameters to consider include cost, availability, consistency between batches and stability in the media over time. Selection of the proper media components is critical to the successful production of plants.

On the other hand, the purpose of a good potting medium is to enable vigorous and healthy seedling growth within the limited space of a container and to prepare seedling for successfully transplanting in the field. The potting medium will be physically support for growing seedling, and stores and supplies nutrients, water and air to the root system. Porosity is one of the most important physical properties of the growing medium because it determines the space available in a container for air (aeration), water and root growth (Liegel and Venator, 1987). Aeration is important because the root system "breathes" in the large, air filled pores (macropores). Poor aeration affects adversely the root formation (morphology) and structure (physiology) and it also leads to decrease seedling vigor (Scagel and Davis, 1988).

Characteristics of potting medium

The following points should be considered during the healthy potting medium preparation:

1. It should be in light weight, easier to handle, friable and easily blended.
2. It should have good porosity with well drainage as well as good water holding capacity.
3. It should be store longer period without changes in physical, chemical and biological properties.
4. The potting medium should be 4.5 to 6.0 pH and good cation exchange capacity.
5. The medium should be free from pest and disease as well as free from weeds.
6. It mixtures of low silt, clay and ash content.
7. It should be maintained a constant volume either wet or dry condition.
8. It should be promotion of firm root plug formation and dimensional stability.
9. It should be low inherent fertility and bulk density.

The better the medium, the better will be the development of a healthy, fibrous root system and the quality of seedling produced. Any nutrient deficiency can be compensated foe with additions of chemical fertilizers and other amendment.

Soil mixture

This is the most commonly employed medium for pot plants. It usually consists of red earth, well decomposed cattle manure, leaf mold, river sand and also charcoal in some cases. It must be pass it through by sieving (1-2 cm) to remove roots, stones, and lumps, before filling it to any containers. Soil mixture commonly used for propagation is

- Red earth - 2 parts
- FYM - 1 part
- Sand - 1 part

Well drainage

The growing medium must allow adequate drainage from macro pores, so that water does not remain at the bottom of the container where it would inhibit root respiration. The presence of macro pores is a function of particle size, particle arrangement and the degree of compaction. The presence of small pores helps to retain water concentration. The organic provides a large number of micro pores.

Porosity

The porosity (percentage of air space divided by total container volume) of a good growing medium for container tree seedlings should exceed fifty percent (50 %) and the aeration porosity (the percentage of air space remaining after saturation when water has freely drained) should range from 20 to 35 percent depending on the medium. Overall balance of both macro and micro pores is necessary for a high quality container medium. Porosity is depends on particle size, size class mixture, texture and their changes overtime. There is direct

proportional relation between particle size and aeration pores but inversely proportional to water holding capacity.

Procedure for determining total porosity, aeration porosity and water retention

1) Obtain the following materials: container with a drain hole at bottom, plug for drain hole in container and graduated cylinder or other device for measuring water volume.
2) Plug drain hole and fill container with water. Measure volume of water in container (container volume) using a measuring cylinder.
3) Empty container and fill with potting mixture that has been air dried slowly and thoroughly. Saturate by adding water at one edge of container and measure the quantity of water added (total pore volume).
4) Unplug, drain and collect water that runs out. Measure volume of water drained (aeration pore volume).
5) Porosity is obtained by dividing pore volume (step-3) by container volume (step-2).

   Porosity (%) = {(container mix pore volume / Container volume) X 100}
6) Aeration porosity is obtained by dividing aeration pore volume (step-4) by container volume (step-2).

   Aeration porosity (%) = {(aeration pore volume / Container volume) X 100}
7) Water retention porosity is obtained by subtracting aeration porosity (step-6) from porosity (step-5).

   Water retention porosity (%) = Porosity – aeration porosity

Cation exchange capacity

It is a measure of the ability of soil or potting medium to hold nutrients. The cation exchange capacity means that nutrients will not be retained. They will be washed out (leached) from the mix during irrigation. The high cation exchange capacity results in nutrients being held to the mix and available to the seedlings. As a result, high cation exchange capacity medium is able to continually provide nutrients to the seedling. As generally, the greater the addition of organic matter or compost, the higher the cation exchange capacity of the mixture.

Components of potting media

Potting media are either composed of a single substrate (unmixed material from a single source) or more likely are mixtures of various organic and organic or mineral components. Mixtures of various components with complementary physical and chemical properties will produce superior potting media. Composting improves their physical properties and balances the ratio of carbon to nitrogen in

the material. Components of properties of individual potting medium are mentioned below:

Media Components – Organic Amendments

Peat

Peat is a very common component in both nursery and greenhouse mixes. Peat is usually included in a mix to increase the water-holding capacity or to decrease the weight. It consists of the remains of aquatic marsh, bog or swamp vegetation which has been preserved under water in a partially decomposed state. When such peat is derived from sphagnum, hypnum or other mosses, it is known as peat moss. It's used in mixture after breaking them and moistened. Peats used in forestry are usually classified into three types: moss peat, reed-sedge and peat humus. Moss peat, more often called peat moss, is the most common form used in the industry and is derived mostly from sphagnum moss. Peat moss is the least decomposed form of the peat types, is typically light tan to brown in color, lightweight (6.5 lbs/yd^3), high in moisture-holding capacity and very acid (pH 3.8 to 4.3). A significant problem with peat moss is "wetting up." Peat moss is inherently hydro phobic (repels water). To address this situation, some suppliers offer a product with a wetting agent already included. Before using peat moss, you should conduct a simple test to see how difficult the product will be to wet. If the product does not include a wetting agent, you can incorporate one, or use hot water if available, to speed up the wetting process. Peat moss is typically sold in compressed bales that expand 50% to 100% when properly fluffed. Most recipes call for peat moss on a volume basis (e.g., 50% peat moss: 50% per lit., vol: vol).

Sphagnum moss

Commercial sphagnum moss is the dehydrated young residue or living portion of acid-bog plants in the genus Sphagnum such as *S. papilliosum*, *S. capillacem* and *S. palustre*. It is generally collected from the tree trunks of the forest species in south Indian hills above 1500 m above M.S.L. during rainy period. It is relatively sterile, light in weight and has a very high water-holding capacity. It is the commonly used medium in air layering. It differs from moss peat (peat moss) in that it is the young residue or live portion of the plant. Sphagnum, or "top moss," is commonly used for plant shipment, propagation or to line hanging bas kits. Substances have been extracted from sphagnum peat which inhibits the growth of fungi associated with damping off.

Reed-sedge peat

It is formed principally from reeds, sedges, marsh grasses, cattails and other associated swamp plants and is widely used in Florida. Peat humus is usually derived

from reed-sedge or hypnum moss peat and represents an advanced stage of decomposition. This type of peat is usually dark brown to black and has a low moisture-retention capacity.

Coir (Coconut Fiber)

Coir is a relatively new organic amendment primarily used in the greenhouse industry. It has been suggested as a potential substitute for peat moss. The raw material, which looks like sphagnum peat but is more granular, is derived from the husk of the coconut fruit and originates from several countries including Sri Lanka, India, Philippines, Mexico and Costa Rica. Because it originates from such diverse geographic locations, it is difficult to characterize specific chemical and physical properties. Based on current data, growers should be most concerned about the total soluble salts (electrical conductivity), sodium and chloride levels in their coir product before making a wholesale switch to this organic substrate. The typical pH range for coir is 5.5 to 6.8, and the average dry bulk density is 4 lbs/ft^3. It contains significant amounts of phosphorus (6 to 60 ppm) and potassium (170 to 600 ppm) and can hold up to nine times its weight in water. Since coir contains more lignin and less cellulose than peat, it is more resistant to microbial breakdown and, therefore, may shrink less. Coir is easier to re-wet after drying than peat moss.

Softwood Bark

Bark is the primary component (80% to 100% by volume) in most outdoor container nursery mixes. For many years, bark was viewed as a forest waste product, but today the availability for container use is limited in some markets due to alternative demands (e.g., landscape mulch, fuel) and reduced timber production. Pine bark is preferred over hardwood bark since it resists decomposition and contains fewer leachable organic acids. Pine bark is usually stripped from the trees, milled and then screened into various sizes. A good potting medium usually consists of 70% to 80% (by volume) of the particles in the 1/42- to 3/8 inch range with the remaining particles less than 1/42 inch. Bark is described as fresh, aged or composted. Many growers use fresh bark but typically add 1 lb N/yd^3 to compensate for the potential nitrogen draft that occurs in the pot. Composting bark involves moistening the bark, adding 1 to 2 pounds N/yd^3 from either calcium nitrate or ammonium nitrate, forming a pile and then turning the pile every 2 to 4 weeks to ensure proper aeration. Composting bark typically takes 5 to 7 weeks. Aging is a cheaper process, but aged bark has less humus and a greater

nitrogen draw-down in the container than composted bark.

Hardwood Bark

The chemical properties of hardwood bark are significantly different from pine bark. The pH of fresh hardwood bark is usually less acid (pH 5 to 5.5) than peat moss or pine bark. Composted bark may be rather alkaline (pH = 7 to 8.5). Hardwood bark typically contains toxic compounds and, for this reason, should be composted before use. According to the University of Illinois, for each cubic yard of bark, a grower should add 2 to 3 pounds of actual nitrogen, 5 pounds of superphosphate, 1 pound of elemental sulfur and 1 pound of iron sulfate. These amendments should be blended into the bark and some water added to the blended pile. Turning the pile three to five times during the 60-day process is recommended to get a uniform product. The temperature in the pile should approach 150°F to eliminate most pathogens.

Wood Substrates

Historically, wood-based substrates have been avoided due to concerns about nitrogen draft. More recently, wood-based substrates have been successfully tested as renewable substitute materials for the use of pine bark (PB) in the nursery industry. Research shows that the growth of numerous woody and herbaceous plants using debarked loblolly pine logs processed into container substrates is comparable to that of 100% PB. The use of ground whole-tree substrates (containing all shoot proportions of the tree and thus consisting of ~80% wood fiber) from pine trees also promises to be an alternative and sustainable substitute to PB in the production of short-term horticultural crops. However, due to the regional availability of pine plantations and limited supply of these substrates, the ability to sustain the commercial needs from the nursery industry into the future is not certain. Additionally, wood-based substrates have produced nitrogen immobilization due to the high microbial activity, requiring higher nitrogen applications to achieve optimal plant growth. In general, wood-based substrates require approximately 30% more nitrogen than a PB-based substrate.

Compost and Animal Manures

A large variety of compost or animal manure products is available in the marketplace. This section will highlight several considerations when evaluating these materials as a media amendment. Manures: disadvantages include possible high salts, fine particle size and weed seeds. The advantages include the nutrient contribution and potential improvement in media physical properties. Sludge: a primary consideration when evaluating sludge is the potential for elevated heavy

metals including cadmium, lead, zinc, copper and mercury. Plant-based composts: in some areas compost products provide a low-cost media amendment. Critical issues to consider are the availability and consistency of the product and the particle size. Particle sizes for plant-based compost can be either too large or too fine depending on the source material and composting process.

Rice Hulls

Arkansas growers are fortunate in that this organic component is readily available as a result of the sizeable rice industry in the Delta. Rice hulls are available in a variety of forms including fresh, aged, carbonized, composted and parboiled. Fresh rice hulls are typically avoided as container substrates because of residual rice and/or weed seed. Parboiled rice hulls (PRH) are produced by steaming and drying rice hulls after the milling process, which results in a product that is free of viable weed and/or rice seed. Despite being an organic compound, rice hulls consist mainly of lignin, cutin and insoluble silica, providing a slow breakdown of particles and therefore making them an appropriate substrate for long-term crop production. Recent research conducted at the University of Arkansas indicates that amending pine bark with up to 40% PRH will not significantly decrease plant growth or increase the volume or frequency of irrigation for container-grown plants after one and two growing seasons. A number of researchers have demonstrated that PRH is a suitable alternative to perlite in greenhouse substrates. In bedding plant trials at the University of Arkansas, the highest shoot and root growth occurred for plants grown in substrates containing 20% to 30% PRH. The pH of composted rice and parboiled rice hulls ranges from 5.7 to 6.2, and 6.2 to 6.5, respectively. Fresh rice hulls are light in weight (bulk density 6 to 7 lbs/ft^3) and are useful to increase drainage and aeration. Fully composted rice hulls will hold more water than unprocessed hulls. Either fresh or composted rice hulls have a high Mn content. To avoid problems with Mn toxicity, maintain the media pH above 5.

Cotton Gin Trash

Cotton gin trash is another organic waste product readily available in Arkansas. Composted gin trash can increase the water- and nutrient-holding (CEC = 200 meq/100 gm) properties of media and has a pH of 5.5to 6.0. High soluble salts can be a concern, but this can be reduced quickly through leaching with water. Several studies have shown reduced plant growth when the media contains > 50% gin trash.

Media Components – Inorganic Amendments

Inorganic components are included in potting medium to improve the physical characteristics by improving drainage and aeration by increasing the micropores.

Perlite

Perlite is most commonly used as a component in greenhouse growing media or nursery propagation applications. It is produced by heating igneous rock under high temperatures (1,100 to 1,600°F). Perlite differs from vermiculite in that the finished product is a "closed cell" that does not absorb or hold water. For this reason, it is usually included in a mix to improve the drainage or increase the percent of aeration. Perlite is lightweight (6 to 8 lb/ft^3), chemically inert, pH neutral, sterile and odorless.

Vermiculite

It is very light in weight and able to absorb large quantities of water. This can be used as a rooting medium for air layering and also in pots for raising certain plants. In some ways vermiculite is similar to perlite in that they both originate as mined minerals that are then heated to produce a finished product. Perlite and vermiculite differ, however, in the rationale for including them in a mix. Perlite is usually included in a mix to increase drainage but does not increase the retention of nutrients. In contrast, vermiculite with its plate-like structure holds large quantities of water and positive-charged nutrients like potassium, magnesium and calcium. Vermiculite is sterile and light in weight (5 to 8 lbs/ft^3). The pH of vermiculite will vary depending on where it is mined. Most U.S. sources are neutral to slightly alkaline, whereas vermiculite from Africa can be quite alkaline (pH = 9). Vermiculite is used extensively in the greenhouse industry as a component of mixes or in propagation. It is usually sold in four size grades: #1 is the coarsest and #4 the smallest. The finer grades are used extensively for seed germination or to top-dress seed flats. Expanded vermiculite should not be pressed or compacted, especially when wet, as this will destroy the desirable physical properties. Vermiculite has been the focus of news attention several times over the past 30 years with regard to the issue of potential contamination with asbestos-related fibers from a related mica mineral called tremolite. Because of this concern and attention, most mines monitor this issue closely to avoid problems with commercially available product. As is the case with dry peat moss, handlers should wear a dust mask to avoid inhaling these materials.

Sand

Sand is a common amendment used in propagation applications and is occasionally used in a greenhouse or nursery mix. Sand is typically selected as a

media component to improve the drainage or to act as a ballast to decrease container blow-over in outdoor container nurseries. While sand represents a wide range in particle sizes, growers generally use medium to coarse sands (0.25 to 2 mm). Preference should be given to deep-mined sharp sands which are mostly silicon dioxide. Avoid using calcareous sands or sands from the ocean that are obviously saline in nature. Sand rarely occupies more than 10% of the volume of a mix simply due to the tremendous weight (bulk density of 80 to 100 lbs/ft^3).

Soil

Soil is still occasionally used in a container mix primarily because it is locally available or to add weight to a predominantly organic-based mix. Some outdoor nurseries strip the topsoil in preparation for installing container beds, stockpile the soil and then use it over time as a minor component (e.g., 10%) in the mix. Major considerations when using would be the amount of weed seed and presence of residual chemicals. In general, soil should be a minor (<10%) component or not used at all in modern container mixes.

Rock Wool

Mineral or rock wool has been used extensively in Europe and is used in a limited way in the U.S. greenhouse market. Like perlite and vermiculite, it originates from a natural mineral (alumino silicates with some calcium and magnesium) that is heated to 2,700°F to form fibers that are used to make blocks or cubes as a finished product. Blocks or slabs of rock wool are used extensively by hydroponic growers of greenhouse vegetables. Rock wool typically has an alkaline pH, is sterile and chemically inert.

Media Components – Other Inorganic Amendments

Other amendments that Arkansas growers might hear about but are generally not used extensively include pumice, calcined clay, diatomite and zeolites.

Typical Greenhouse Mixes

Common media components used in the greenhouse include peat, perlite, coir, parboiled rice hulls and fine bark. Compared to traditional container nurseries, most greenhouses will use sterilized media.

Premixed

Premixed media is a common sight in the greenhouse industry. Suppliers offer a diversity of mixes in either prepacked (bags, bales, super sacks) or bulk forms. Recipes are specially formulated for propagation, specific crops (e.g., Poinsettia mix) or general crops. If significant quantities are required, growers can purchase media customized to their specific operation by requesting specific amendments including lime, wetting

agents and fertilizer. Primary components in a greenhouse mix are peat moss and perlite.

Typical Nursery Mixes

The most common components in an outdoor nursery mix include bark, peat, sand and soil. Softwood bark typically comprises from 80% to 100% of a mix. Peat is often included to increase the water holding capacity of a mix, while sand and soil are often added to increase the weight, which reduces container tip-over. Many growers use a recipe of 80% pine bark, 10% peat and 10% sand.

General Mixing and Handling Recommendations

1. Test the media pH, total soluble salts (electrical conductivity) and wettability before use.
2. Do Not make changes to your current growing media without experimenting first to see if changes may affect your cultural practices.
3. Thoroughly mix components, but don't overmix, especially if a medium contains vermiculite or plastic-coated slow-release fertilizer.
4. Do NotT store media that contains fertilizer for long periods of time, especially if the media is moist.
5. Avoid contamination of components or finished media by keeping amendments in closed bags or by covering outdoor piles.
6. Do not allow mixes containing a significant amount of peat moss to dry out.

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Forest products of Telangana state, India

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Abstract

In the present article the details of forest conditions, types of soil, economics of the forests and ultimately the products of Telangana forests discussed like canes, Tendu (Beedi Chuttalu), canes, grasses, medicinal plant hers. Oils, gums, shellac, resins, tannins, dyes, Katha, Palm, Bamboos etc., besides of these products, the information on the other regions of India also discussed in briefly. The common climatic conditions for the forest growth and uses discussed.

Introduction

A forest is a multifaceted ecosystem which is mainly self-possessed of trees, shrubs and is usually a closed canopy. Forests are storehouses of a large diversity of life forms such as plants, mammals, birds, insects and reptiles etc. Also the forests have plentiful microorganisms and fungi, which do the important work of decaying dead organic matter thereby stimulating the soil. Nearly 4 billion hectares of forest cover the earth's surface; roughly 30 percent of its total land area. The forest ecosystem has two components- the non-living (a biotic) and the living (biotic) component. Climate, soil type are part of the non-living component and the living component includes plants, animals and other life forms. Plants comprise the trees, shrubs, climbers, grasses and herbs in the forest. Depending on the physical, geographical, climatic and ecological factors, there are different types of forest like evergreen forest (mainly composed of evergreen tree species i.e. species having leaves all throughout the year) and deciduous forest (mainly composed of deciduous tree species i.e. species having leaf-fall during particular months of the year). Each forest type forms a habitat for a specific community of animals that are adapted to live in it. The term forest implies 'natural vegetation' of the area, existing from thousands of years and supporting a variety of biodiversity, forming a complex ecosystem. Plantation is different from natural forest as these planted species are often of same type and doesn't support a variety of natural biodiversity. Forests provide various natural services and products. Many forest products are used in day-today life. Besides these, forests play important role in maintaining ecological balance &

contributes to economy by producing natural products.

Telangana state is bordered by the states of Maharashtra to the north, Madhya Pradesh and Odisha to the northeast, Andhra Pradesh to the southeast and south, and Karnataka to the west. The area of what is now Telangana constituted the north-central and north eastern portions of Andhra Pradesh for almost six decades, but on June 2, 2014, that territory was called off to form a separate state. The capital of both Telangana and Andhra Pradesh is Hyderabad, in west-central Telangana.

The Telangana state forests products like fuel-wood, timber, and charcoal were producing besides of these the Telangana state forests providing a number of other products. These include bamboos, canes, beedi leaves, grasses, oils, resins, gums, medicinal herbs, tanning material, dyes, honey, bees wax, ivory, vegetables, fruits, roots, and tubers.

Soil conditions of Telangana State

Telangana is situated largely in an upland region of the Deccan (peninsular India). Much of its surface area is occupied by the Telangana Plateau in the north and the Golconda Plateau in the south and is composed of gneissic rock (gneiss being a foliated rock formed within Earth's interior under conditions of heat and pressure). The average elevation of the plateau area is about 1,600 feet (500 meters), higher in the west and southwest and sloping downward toward the east and northeast, where it meets the discontinuous line of the Eastern Ghats ranges. Drainage is dominated by the basins of the Godavari River in the north and the Krishna River in the south. As a result of erosion, the topography of the plateau region consists of graded valleys with red sandy soil and isolated hills. Black soil is also found in certain parts of the area.

Telangana has three seasons: summer, from March to June; a period of tropical rains from July to September; and winter, from October to February. Summers are warm to hot and dry, with temperatures often nearing or exceeding 100 °F (38 °C). Annual precipitation, which derives largely from the rainy southwest monsoon winds, varies somewhat across the state. It averages about 35 inches (900 mm) per year, although the annual total often varies considerably from the average and can be as little as 20 inches (500 mm) in drier areas. Average minimum temperatures in Hyderabad reach about 60 °F (15 °C) in January and February and usually read in the low 50s F (about 10 to 12 °C) at higher elevations.

Thorny vegetation covers the scattered hills of the plateau areas, while dense woodlands are found in the northeast along and near the Godavari River. The forests,

covering about one-fourth of the land area, consist of both moist deciduous and dry savanna vegetation; teak, rosewood, wild fruit trees, and bamboo are plentiful. Elsewhere in the state, neem (which produces aromatic oil), banyan, mango, and pipal (Ficus *religiosa*) are among the common trees.

Animal life includes tigers, blackbucks, hyenas, sloth bears, gaurs, and chital, which abound in the hills and forest areas. There are also hundreds of species of birds, including flamingos and pelicans. Telangana is home to some two dozen national parks, wildlife sanctuaries, and protected areas, including two tiger reserves that adjoin similar facilities in neighbouring states.

Economy and main corps of Telangana State

Telangana's economy was long dominated by agriculture, notably the production of rice. The state's rivers, particularly the Godavari and the Krishna, have been tapped to provide irrigation for the dry interior, although many areas still depend on the somewhat unpredictable monsoon rainfall. In addition to rice, other important crops are corn (maize) and cotton. The Nagarjuna Sagar multipurpose dam project on the border with Andhra Pradesh, which diverts the waters of the Krishna for irrigation, has substantially increased the production of rice and sugarcane. Rice flour, rice-bran oil, paints and varnishes, soaps and detergents, cardboard and other packaging materials, and cattle feed are all produced from local paddy rice. Other agricultural commodities include chili peppers, sorghum, pulses (peas, beans, and lentils), castor beans, and peanuts (groundnuts), as well as a variety of tropical fruits. Livestock rising and aquaculture are also important, each accounting for a small but still significant component of annual economic output.

Valuable forest products of Telangana State

Palm

Using leaves of Phoenix and palm plants the mats swipes, bags, huts are being preparing. Most of the people directly depending on this palm plants. Some of the castes dedicated in the collection and preparation of wines. Eg. Thaati, Eetha. The thati fruit also having very good nutritional value.

Tendu (Beedi Aakulu)

Generally tendu called in Telangana as Beedi Aakula Chetlu. Almost all the rural, village people are directly depending on forests, because they are very much close to the forests. The leaves of tendu are obtained from the forests of Telangana, Chhattisgarh, Jharkhand, Orissa, Madhya Pradesh, south-east Rajasthan, and Andhra Pradesh. Tendu leaves are used for bidi-making.

Grasses

In the lakes of Telangana maximum Cyprus types of grass is growing. The tribal people of Telangana, depending on grasses in the preparation of hut roofs, side walls, boats etc., Whereas in other regions of India a large variety of grasses are found in the forests. Some of the important grasses are Sabai (sub-Himalayan Tarai tracts), elephant-grass (Assam), spear-grass, ulla, and panni grasses, etc. Khus-Khus grass (Bharatpur, and Sawai-Madhopur, Rajasthan) is used for making cooling screens during summer season. Rosha, lemon, and ginger-grasses yield medicinal and perfumed oils.

Oils

The main oil in Telangana Ricinus, suff flower, sunflower, sesamum oil etc., the raw materials for a number of perfumes and oils are also obtained from the herbs, plants, and trees. Some of them are camphor, clove, cinnamon-oil, cypress-oil, eucalyptus-oil, jasmine-oil, khus-oil, lavender-oil, lemon-grass-oil, mint-oil, sandalwood-oil, patchouli-oil, turpentine oil, nutmeg-oil, and champaca-oil.

Medicinal Herbs and Plants

A number of medicinal plants, herbs and trees are found in Telangana area like Adilabad, Paalamuru, Khammam, Nallama forests. The leaves, stems, flowers, fruits, barks, roots, and seeds of different plants and scrubs are used as raw materials for the manufacture of a number of medicines. Some of the important herbs used for medicines are aconite, celery, belladone, colocynth, sarasaparilla, jalap, leadwort, chitraka, serpentine, and liquorice. The root of serpentine is an antidote for snake and insect bite. Barks of mountain ebony, Indian oak, quinine, Spanish-cherry, bay-berry, lodh-tree, Indian-red-wood, ashoka, arjuna, and Indian barberry have medicinal value. The stem of ephedrine, white sandal-wood, catechu, and long needle-pine are also of great medicinal importance.

In other region of India containing important medicinal plants like vasaka, Indian aloe, poison-bulb, fever-nut, life-plant, swallow wart, Indian-penny-word, Tasmanian blue-gum, physic-nut, holy-basil, betel, pepper, and typlophora yield different drugs. Similarly, flowers of saffron, iron-wood, violet and fruits of bel, fish-berry, purging-cassia, coriander, cumin, fennel, emblic, opium, long-pepper, black and white pepper, belleric, myrobalan, ammi and solanum are used in medicine making.

Shellac

Lac resin melted into thin flakes, used for making varnish. It is secreted by an insect called Kerria lacca which feed on the saps of host trees like palas, peepal, kusum, sissoo, kul, gular, siras, and banyan. These trees are extensively found in the Gangetic

plains, Telangana, Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Jharkhand, Maharashtra and Assam. India has a monopoly in lac production in the world. It is used for dyeing silk, making bangles, paints, munitions, fire-works, gramophone records, sealing wax, electrical insulation material, shoe-dressing, plastic-moulding, spirit, baking enamels, and anti-moulding compositor for ships.

Resins

Resin is the exudation of paints belonging to Angiosperms families. It is a yellowish solid, insoluble in water, but soluble in alcohol. In the conifer pine forests of the Himalayan region, resin is collected on commercial scale. The resin is used for soap, and sizing paper and cloth. It is also used in the manufacture of sealing wax, linoleum, lubricating compounds, paints, and several kinds of inks.

Gums

Gum is obtained from acacia, carob, mesquite, and kateera-gum. These are used as adhesives in printing and finishing textiles, in the paint and candy industries, in the preparations of sweets, bakery items, traditional food preparations, medicines and drugs.

Dyes and Tannins

Tannins are used for coagulating the protein in hides and skins, so that resistant leather can be produced. Lighter vegetable tannins dominate in the production of leather. Tannins are obtained from the bark of mangrove, sundri trees, wattle, avaram, sumac, arjun, Indian almond, jujube, Cuddapah-almond, hog-plum, chestnut, and leaves of smoke trees.

The dyes are coloured compounds. On being fixed to fabrics, they do not wash out with soap and water or fade on exposure to light. About 150 dye yielding plants are available in Indian forests, but only a few have been utilized so far.

Bamboo

Bamboo is commonly found in the Telangana forests. People directly depending on this species named as Erukala, the tribes of erukala making so many house holding materials like tubs, bags, boxes, huts etc.,

Bamboo is found in most of the monsoon regions where the average annual rainfall is more than 150 cm. Some of the bamboos may attain a height of 30 m. It is used for a diversity of purposes—basket making, roofing, and thatching, construction, paper, and pulp making. In India more than 100 varieties of bamboos are found. According to the Planning Commission bamboo occupies 100,210 sq km of the forest area of the country with an annual production of four million tones. Different types of decorative items such as flower pots, trays, vases, caskets, and even ornaments are made of bamboo in states like Telangana and other states of India

like Mizoram, Nagaland, Meghalaya, Manipur, and Tripura. Bamboo also finds a place in cultural activities of the Mizo people, i.e. Cherraw (bamboo) dance.

Wild Fruits and Vegetables

The fruits and vegetables obtained from the forests are Seethaphal, Nakkera, Kashabusha, Illintha, aadanda, jamun, bel, ber, gular, jack-fruit, amla, tamarind, khirni, karonda, khajur, and chilgoza. Chinch, munga, chkoora, arvi, ratalu, kanhi, akana, kirchi, janingi, sua, saijan, saidu, mushrooms, and guchchhi are obtained as vegetables.

In count to the given benefits from forests, the collection of ivory, honey, bees wax, hides, horns, and furs is also done from the forests. Forests are the grazing grounds for domesticated animals and the abode for over 30,000 species of plants, animals, and micro-organisms. Climate, temperature, and precipitation are also directly affected by the presence or absence of forests. It is said that larger the area under forests, greater is the amount of precipitation.

Conclusion

The present report on the forest products and their efficacy from Telangana state, India may gives basic awareness in the conservation of biodiversity. It also helps to the NGO-organisations, young researchers, and traditional healers and also for further generations. The present credentials also build up the interrelationship of human civilization and forests.

रोहिडा - मारवाडचा सागवन (Marwar Teak)

डॉ. संजय पौनीकर

वन कीट विज्ञान विभाग,

उष्ण कटिबंधीय वन संशोधन अनुसंधान संस्था, जबलपुर-482021

रोहिडा (Rohida) ज्याला वनस्पतिशास्त्रेच्या भाषेत टेकोमेला अनुडूलेटा (स्मिथ) सीमैन (*Tecomella Undulata* Smith) म्हटले जाते । हयाला इंग्रजी मधे अम्मोरा किंवा हनी ट्री, देशी भाषेत मधाचे झाड (Honey Tree), डेर्झट टिक (Desert Teak), मारवाड टिक किंवा पांढरे सेदरचे झाड म्हणुन संबोधले जाते । मराठीत या झाडाला रक्तश्रोडा किंवा रक्तरोहिडा असे ही म्हणतात । हा बिग्नोनिएसी (Bignoniaceae) कुळाचा एक महत्वपूर्ण सदस्य आहे. राजस्थान राज्याच्या वाळवंटी भागात इमारतीचे लाकडे आणि आपल्या औषधी गुणामुळे भरपुर उपयोगात आणले जाते तसेच याचे लाकूड मजबूत, टिकाऊ असते, म्हणून हयाला मारवाडचा टिक म्हणून संबोधले जाते । रोहिडाला आर्युवैदिक औषधामध्ये मोठ्या प्रमाणात उपयोग करण्यात येतो । हा पश्चिम राजस्थानच्या वाळवंटी जंगलात व राज्याचा सीमेलगत लागणा-या हरियाणा व गुजरातच्या काही भागात पण आढळतो । हा वृक्ष महाराष्ट्रात पण नैसर्गिक रित्याने आढळतो. पश्चिम राजस्थान मध्ये सीकर, चुरू, झुन्झुनू, जैसलमेर, अजमेर, पाली, रतनगढ, छपरा, विधासरध, नोखा, जसरासर, नागौर, सादुलपुर आणि बीकानेर या सारख्या विविध क्षेत्रात हा मोठ्या प्रमाणात आढळतो । या व्यतिरिक्त हा जोधपुर जिल्हयात मोगरा व हरिछाला, जालौर जिल्हयात देवावास, बाडमेर जिल्हयात कास्थरी, सिवाना, फूलदी, रावतसर, चौहटान, पोरारियाँ व खारिया कला आणि अरब देशात व दक्षिण पाकिस्तानच्या सिंध व बलुचिस्तानचा काही क्षेत्रात मधे पण रोहिडा मोठ्या प्रमाणात आढळतो. वर्तमान मध्ये याचा

रोहिडाचे झाड

उपयोग ईधंनासाठी व इमारतीचे लाकडासाठी फार मोठ्या प्रमाणात होत असल्यामुळे याची अंधाधुन्ध कटाई केली जात आहे व याची नैसर्गिक पुर्नअंकुरणता क्षमता कमी असल्यामुळे हया जातीचे वृक्ष कमी होत आहे आणि हीच स्थिती राहिली तर हा वृक्ष काही काळानी पृथ्वी वरून

विलुप्त होण्याची भीती आहे. मागच्या काही दशकामध्ये हया वृक्षाची संख्या कमी होत असल्यामुळे या वृक्षाला संकटग्रस्त वृक्षाच्या यादीमध्ये ठेवण्यात आले आहे ।

रोहिडाचे पान फळ

रोहिडा हा एक पर्णझडी व सदाबहार लहान आकाराच्या झाड आहे । याचे खोड आडवे-तिडवे राहते व फांदया वाकलेल्या असतात. याचा वाढण्याच्या दर फार कमी असतो । याची ऊंची फक्त 4 ते 8 सेंटीमीटर प्रति वर्ष व खोडाची गोलाई 50 ते 90 सेंटीमीटर प्रति वर्षी इतकीच वाढते । याचे पान नोव्हेबंर महिन्याच्या प्रथम आठवडयात झडने सुरू होतात व मार्च महिन्याच्या शेवटपर्यत झडत राहतात । फेब्रुवारी महिन्यात नवी पान येणे सुरू होतात । याप्रकारे या वृक्षाची पान कधीही पूर्णपणे झडत नाही ।

या झाडाची फुल येण्याची वेळ डिंसेबर महिन्यापासुन ते मध्य एप्रिल महिन्यात येतात व वृक्षाच्या फांद्यावर मोठे आकाराचे सुंदर व हलके पिवळे गळद संतरी किंवा लाल रंगाचे फुल उमलते. याचे पुष्पन क्रमबद्ध प्रमाणे होते व प्रत्येक पुष्पनात 8 ते 12 पाकळया येतात. यामधे निषेचन स्वपरागण व परपरागण दोन्ही प्रकाराने होऊ शकते । फळ मे-जुन महिन्यात पिकतात। बियांची अंकुरण क्षमता पिकण्याच्या लगेच अधिक असते व एका वर्षा नंतर शुन्य होऊन जाते । रोहिडाला उगवण्यासाठी बियां किंवा ऊतक संवर्धनाचे (Tissue Culture) उपयोग केल्या जाऊ शकते । बियांना 2 ते 3 तासापर्यत थंडया पाण्यात भिजवल्यावर यांची अंकुरण क्षमता वाढते । याचे रोपे पॉलिथिनचा पिशवीमध्ये माती, वाळू व गोबरची सारखी मात्रा घेवून तयार केली जाते, याचे बियांना सर्वसाधारण पणे जुन किंवा जुलै महिन्यात एकत्र करून लगेच पेरल्या जाते व 8 ते 9 महिन्यानंतर 55 मीटर लांब रोपे पावसाळयात पुन्हा रोपले जातात. ही एक सर्वसाधारण हळू गतीने वाढणारी प्रजाती आहे । परंतु ऊतक संवर्धना द्धारे (Tissue Culture) याची जलद गतीने वाढ व उगवल्या जाऊ शकते । अधिक खोड विकसित करण्या हेतु प्लस ट्री (उपयोगी वृक्ष) पासुन 8 ते 10 मिलीमीटरची कलम घेवून भूरासिंग किंवा स्कूल माध्यमाद्धारे अथवा अन्य उपयुक्त माध्यमा मधे ठेवले जाते. एन.ए.ए. (पिप्थेलीन ऐसीटिक एसीड) किंवा आई.बी.ए.(इन्डोल ब्यूटॉरिक एसिड) नावांचे वृद्धि हॉरमोनची 0.5 ते 1.0 मिलीग्राम प्रति लीटर दराने टाकली गेली तर हयामधे मूळ उत्पन होते । हयाचप्रकारे 2 - 4 डी आणि आई.ए.ए. टाकल्यावर कलमाची वाढ होते ।

रोहिडा ही एक कोरडया भागात वाढणारी व उष्ण प्रतिरोधी प्रजाती आहे म्हणून कोरड्या भागात वृक्षारोपण लावण्यासाठी ही एक फारच उपयोगाची प्रजाती मानली जाते । हया वृक्षाची मूळ जमिनीच्या रेतीला किंवा मातीला धरून ठेवते त्यामुळे मातीचे संरक्षण होते । हयामधे काही महत्वाचे रासायनिक घटक असतात जे म्हणून हयाला कॅन्सर व जीवाणू प्रतिरोधी प्रजाती म्हणून ओळखले जाते । रोहिडाच्या सालामधे (Bark) टेकोमाइन, बी-सीटोसेराल, क्रोमोनस, ग्लायकोसाइड, अनडुलॅटोसाइड सारखे विविध प्रकारचे रासायनिक पदार्थ आढळते व विविध वैद्यकीय औषधामध्ये फार मोठ्या प्रमाणात उपयोगात आणली जातात ।

दुस-या वृक्षासारखेच रोहिडाला पण विविध किटकाच्या प्रादुर्भाव होतो । आतापर्यत रोहिडा वर 64 प्रकारच्या विविध किटक प्रजातीच्या प्रादुर्भाव झाल्याच पाहिल्या गेले आहे । त्यापैकी 24 किटक प्रजातीच्या प्रादुर्भाव कमी जास्त प्रमाणात होतो. पटियालॅस टेकोमेला (*Patialus tecomella* (Cioniindae, Curculioniodae: Coleoptera) व स्टेगमॅटोफोरा (Cosmopterygidae: Lepidoptera) प्रजातीचे किटक मोठ्या वृक्षांना जास्त प्रमाणात नुकसान करताना आढळतात । तर नाडिसा सिवा [Nadiasa siva (Lasiocampidae: Lepidoptera), वाळवी, ओडाटोटर्मस ओबेसस (*Odontotennes obesus* (Termitidae: Isoptera) आणि पांढरी अळी (व्हाईट ग्रब्स) *Holotrichia consanguinea* Bl. (Melolonthidae: Coleoptera) सारखे किटक वन रोपणीमधे याचा रोपांना जास्त नुकसान करताना आढळतात । या किटकांमधे पटियालॅस टेकोमेला फार महत्वाचा किड आहे । याला रोहिडाच्या डिफोलियटर किंवा मारवाड टिक डिफोलियटर (Rohida defoliator or Marwar teak defoliator) म्हणून पण ओळखल्या जाते । किड रोहिडाच्या पानांना मोठ्या प्रमाणात नुकसान करतो । वन रोपणीतले रोपांना तसेच वृक्षारोपण क्षेत्रातल्या वृक्षांना फार हानी पोहचवतो ।

रोहिडाचे फुल

शुष्क वन संशोधन संस्था, जोधपुरच्या (Arid Forest Research Institute, Jodhpur) विविध प्रायोगिक क्षेत्रा मधे रोहिडावर विविध संशोधन करण्याकरिता प्रोवेलन्स ट्रायल (Provenance Trial) लावल्या गेले आहे । यामधे किटक, पटियालॅस टेकोमेला वर विविध रासायनिक व जैविक किटकनाशकाच्या काय प्रभाव होतो याचा सविस्तर संशोधन केले गेले आहे ।

रोहिडा एक फार महत्वाचे व मूल्यवान लाकडाचे वृक्ष आहे । याचे लाकूड कडक व हलक्या रंगाचे असते । याचा लाकडापासुन खेळणी, फर्निचर तथा कृषि चे उपकरण बनविण्यात उपयोग केला जातो । फांद्याच्या उपयोग ईधंनासाठी उपयोग करण्यात येतो । पान व फळ जनारांच्या चारा म्हणून केला जातो । फळामध्ये परागाची मात्रा जास्त असल्यामुळे यापासुन मध (Honey) प्राप्त करता येते । हयाचा विविध आजारामध्ये उपयोग करतात । जसे मूत्राशयाचे, प्लीव्हाचे, पित्ताशयाचे, त्वचेचे, परमाचे रोग व दुखापतीच्या आजारामध्ये मोठ्या प्रमाणात उपयोग करतात । रोहिडामधे काही रासायनिक पदार्थ असे असतात जे किटकाला दूर ठेवतात व काही पदार्थाच्या किटकनाशक म्हणून उपयोग करण्यात येतो । कृषिवंनासाठी (Agroforestry) एक महत्वपूर्ण व फारच उपयोगी प्रजाती समजली जाते । या प्रजातीला राजस्थान राज्याच्या वाळवंटी भागात पर्यावरण संरक्षण व उडत्या वाळूंना थांबवणारी तसेच वन्य प्राण्यांना आश्रय देणारी वृक्ष प्रजाती म्हणून ओळखले जाते । याच्या पानांमध्ये 60 टक्के ओलावा (Moisture) असते, त्यामुळे उन्हाळयात वन्य प्राणी व पाळीव जनावरे याची पाने खातात ।

रोहिडा राजस्थान राज्याच्या राज्य पुष्प (State Flower of Rajasthan) पण आहे । याला 1982 मध्ये राज्य पुष्पाचे दर्जा देण्यात आले । रोहिडा या वृक्षाचे अयोग्य रितीने वापर थांबावा म्हणून केनियाचा नैरोबी शहरात असलेल्या संयुक्त राष्ट्राचा पर्यावरण कार्यक्रमाने (United Nations of Environment Programme) त्याचा विश्व संरक्षित मॉनिटरिंग केद्रांने (World Conservation Monitoring Centre, Nairobi, Kenya) या वृक्षाला वर्ग -1 (Category-I) मधे समाविष्ट केलेले आहे, अशी ही राजस्थानच्या शुष्क व अर्धशुष्क प्रदेशात वाढणारी एक अति महत्वाची वृक्ष प्रजाती आहे ।

भारत में महिला कृषक, श्रमिकों का आर्थिक योगदान
(स्व. सहायता समूह एवं कुटीर उघोग के विशेष संदर्भ में)

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सारांश

वैश्वीकरण और उदारीकरण के युग में भारत एक विकासशील देश का दर्जा प्राप्त कर चुका है । भारत की अर्थव्यवस्था की रीढ़ है कृषि, यह राष्ट्रीय आय का मुख्य स्त्रोत है । राष्ट्रीय आय में 50 प्रतिशत कृषि का भाग है 80 प्रतिशत रोजगार प्राप्त करने का साधन है । महिला कृषक श्रमिकों का लघु एवं कृटीर उघोगों का महत्वपूर्ण घटक कृषि है । कृषि आधारित कुटीर उद्योगों की आत्म निर्भरता की ऐसी स्थिति में महिला कृषक श्रमिकों के आर्थिक योगदान को नकारा नहीं जा सकता । स्व सहायता समूह के द्वारा कुटीर उद्योगों का संचालन स्वरोजगार उत्पन्न करने की भागीदारी में महत्वपूर्ण कार्य कर रहा है । इसमें कृषक महिलाओं के आर्थिक योगदान को एवं उनकी स्वरोजगार की स्थिति, भूमिका को सुदृढ़ किया है ।

आज के आर्थिक युग में ग्रामीण महिलाएं अधिक स्वावलम्बी हुई हैं, देश के आर्थिक विकास में कृषि, कुटीर उद्योगों, हथकरघा जैसे कार्यो को कर आर्थिक योगदान में महत्वपूर्ण भूमिका का निर्वहन कर रही हैं । कृषि के क्षेत्र में महिला श्रमिकों द्वारा किया जाने वाला कार्य जैसे बुवाई, गोड़ाई, निराई, चारों की कटाई, अनाज निकालाने तक सीमित नहीं है । इसके अतिरिक्त मुर्गीपालन, पशुपालन और मघुमक्खी पालन, रेशमपालन के भी कार्य करते हुए अतिरिक्त आय के विकल्प से जुड़ चुकी है । भारत सरकार ने ग्रामीण महिला स्वरोजगार संवर्धन की भागीदारी बढ़ाने के लिए समय-समय पर नीतियों का निर्माण किया है । 'स्व -सहायता समूहों पर निर्माण की योजना भारत सरकार का एक क्रान्तिकारी कदम है जो प्रदेश में स्वावलम्बन दलों की गतिविधियों में मुर्गीपालन, मत्स्य पालन, वनोपज संग्रह चारगाह विकास रेशम उत्पादन, लाख उत्पादन, उद्यानिकी विकास सब्जी उत्पादन, स्थानीय कच्चे माल के अनुरूप हस्त शिल्प गतिविधियों के रूप में क्रियान्वित की जा रही है ।

स्व सहायता समूह के जरिये ग्रामीण महिला कृषक श्रमिक अपने समय का समुचित प्रयोग कर आर्थिक और मानसिक रूप से स्वालम्बी बन चुकी हैं ।

स्व -सहायता समूह योजना के अन्तर्गत प्राप्त प्रशिक्षण से कुटीर उद्योगों को पुनर्जीवित जीवित करने का प्रशिक्षण दिया गया है। 'इस प्रशिक्षण से उनमें इच्छा शक्ति आत्म विश्वास, कौशल एवं आत्म निर्भरता के गुणों का विकास हुआ है । स्व

रोजगार के लिए प्राप्त मदद से अनुसूचित परिवार, एवं जनजातीय परिवारों ने निम्न व्यवसायों में ज्यादा रूचि दिखाई और उनकी आर्थिक स्थिति सुधरी है। स्वसहायता समूह द्वारा संचालित स्वरोजगार हैं:

1. पशुधन
2. सब्जियों की खेती
3. फूलों की खेती
4. रतनजोत की खेती
5. मशरूम की खेती
6. पशुपालन
7. औषधि पौधों की खेती
8. भू व्यवसाय
9. कागज और बत्तियों से बनने वाले उत्पाद
10. चमड़ा उद्योग के क्षेत्र
11. खाद्य उद्योग के क्षेत्र
12. 12.कृषि यंत्र एवं औजार
13. रंगों एवं रेडीमेड वस्त्र आदि में स्व-सहायता, स्वरोजगार समूह के अंतर्गत ये सभी कार्य बड़ी सहजता एवं ईमानदारी से करते हुए महिला कृषक श्रमिक लाभान्वित हो रही है।

ग्रामीण महिला कृषकों एवं श्रमिकों के विकास हेतु अनेक योजनाएं आर्थिक रूप से कारगार सिद्ध हुई है। भारत में जहॉ कृषि में अनिश्चितता की स्थिति बनी रहती है । कभी मानसून की अस्थिरता ,बाढ़, सूखा, प्राकृतिक आपदा आदि कारणों से गॉव में रोजगार का अभाव हो जाता है । वहां सम्पूर्ण स्वरोजगार योजना के तहत महिलाओं के लिए 30 प्रतिशत रोजगार के अवसर सुरक्षित रखने का प्रावधान है । स्वर्ण जयन्ती ग्राम स्वरोजगार योजना के अन्तर्गत गरीबी रेखा के नीचे जीवन यापन करने वाले परिवारों के स्वसहायता समूह बनाकर स्वरोजगार के लिए ऋण एवं अनुदान उपलब्ध कराया जाता है। प्रत्येक विकास खण्ड पर गठित स्वसहायता समूहों मे से 80 प्रतिशत केवल महिलाओं के होते है । इसका प्रत्यक्ष उदाहरण हिमाचल प्रदेश में सोलन विकास खण्ड की बसाल पंचायत की महिलाओं का है। इन महिलाओं के स्व-सहायता समूह के सदस्यों ने पारम्परिक कार्यो और नए अवसरों के लिए दुधारू पशु के रख-रखाव, उद्यान, अचार, चटनी, सॉस, जड़ी बूटियॉ एवं फूलों की खेती के लिए उद्यान - विभाग से वापसी खरीद व्यवस्था से समूह को जोड़ा गया। इसके अतिरिक्त समूह की महिलाओं ने गेंदे की खेती कर 2500 रु मुनाफा कमाया। केचुए की खाद का कार्य आरंभ किया गया । उन्होने खाद के साथ केचुए बेचकर परिवार की आय वृद्धि की। वर्तमान में सोलन विकासखण्ड में 450 स्वसहायता समूह हैं जिनमें लगभग 5 हजार महिला सदस्य शामिल है।

अतः इससे स्पष्ट है कि महिला कृषक श्रमिकों का आर्थिक योगदान महत्वपूर्ण है।

मध्यप्रदेश और छत्तीसगढ़ के कई जिलों में रेशम उत्पादन गतिविधियाँ संचालित है । रेशम उत्पादन रोजगार उन्मुख, कृषि और वन आधारित उधोग है । रेशम उत्पादन एक

महत्वपूर्ण कुटीर उद्योग बन गया है । यह व्यक्ति के आर्थिक जीवन में एक महत्वपूर्ण भूमिका निभाते हैं । इसके साथ ही महिलाओं की आबादी के एक बड़े हिस्से को तथा 50 प्रतिशत आबादी को रोजगार प्रदान करता है । अतः ग्रामीण महिला श्रमिकों को नए रोजगार के अवसर पैदा करने और पूरक आय अर्जित करने मे बहुत कारगार सिद्ध हो रहा है । छत्तीसगढ़ रेशम उत्पादन परियोजना जशपूर और रायगढ़ जिले में संचालित किया गया है । इस परियोजना के माध्यम से जागरूकता लाना और महिला स्वयं सहायता समूह द्वारा सामाजिक एवं आर्थिक विकास को पूर्ण किया गया है ।

कृषि एवं कुटीर उद्योगों से प्राप्त आय को लघु बचतों को प्रोत्साहन देकर स्वसहायता समूह की अवधारणा व्यापक आधार पर महिलाओं को इस दिशा में संगठित कर रही है । उत्तरप्रदेश में वर्ष 2010 में गरीब आर्थिक मदद योजना के अंतर्गत 300 रु प्रतिमाह के रूप में परिवार की मुखिया महिला का चयन किया गया । इससे महिलाएं आर्थिक रूप से स्वावलम्बी बनकर लाभांश को प्राप्त कर रही हैं ।

इसके अतिरिक्त ग्रामीण महिला श्रमिकों के द्वारा बायोगैस का प्रशिक्षण प्राप्त कर बायोगैस चूल्हे का महत्व प्रचार-प्रसार कर आय अर्जन का कार्य किया जा रहा है । सोलर ऊर्जा के क्षेत्र में भी तकनीकी प्रषिक्षण प्राप्त कर महिलाएँ स्व सहायता समूह के द्वारा स्वरोजगार हेतु प्रोत्साहित हो रही है ।

भारत के अधिकांश जिन क्षेत्रों में ग्रामीण विकास और संसाधनों की कमी बनी हुई है वहॉ भी महिलाएं श्रमिको के रूप में तेंदुपत्ता, महुआ, लाख, चिरौजी आदि वनोपज संग्रहण का कार्य कर अपना जीवकोपार्जन करते हुए राष्ट्रीय आय में योगदान दे रही हैं । संयुक्त राष्ट्र संघ का मानना है कि विश्व में किए जाने वाले कुल कार्यों का दो-तिहाई महिलाओं द्वारा सम्पादित होता है । जबकि आमदनी का मात्र दसवॉ हिस्सा ही उसे प्राप्त होता है 40 के दशक में सयुक्त राष्ट्र संघ द्वारा अन्तर्राष्ट्रीय स्तर पर किए गए सर्वे के अनुसार भारत के कई राज्यों में ग्रामीण महिला श्रमिको ने स्वरोजगार आरंभ किया है । राज्यों की विभिन्न योजनाओ के द्वारा ग्रामीण विकास कार्यक्रमो से जुड़ती जा रही है । स्व सहायता समूह की अनेक योजनाओ से प्रशिक्षण, स्वरोजगार कुटीर उधोगों के लिए ऋण आदि की उपलब्धता भी इस दिशा में क्रियाशील है ।

निष्कर्ष

किसी भी देश के सामाजिक, आर्थिक विकास को जानने के लिए वहॉ की महिलाओं की आर्थिक स्थिति एवं स्तर का आकलन करना आवश्यक हो जाता है । कृषि के क्षेत्र में महिला कृषक, श्रमिकों द्वारा किया जाने वाला कार्य ग्रामीण विकास के साथ-साथ महिला स्वरोजगार की भागीदारी बढ़ाने में उसकी भूमिका को सुदृढ़ आधार प्रदान करता है । अतः गामीण कृषक महिला श्रमिको के द्वारा अर्जित आय और उसकी भूमिका महत्वपूर्ण है । भारत की राष्ट्रीय आय में वृद्धि के द्वारा

अर्थव्यवस्था को सुदृढ़ करने का महत्वपूर्ण प्रयास है।

सन्दर्भ ग्रंथ

भारत में सामाजिक परिवर्तन एवं विकास - डॉ. एस. अखिलेश, संध्या शुक्ल, पृ.सं. - 507, 508, गायत्री पब्लिकेशन रीवा।

कृतिका जनवरी दि. 2014 संपादक डा वीरेन्द्र सिंह यादव प्रका. आराधना ब्रदर्स कानपुर।

रिसर्च जनरल ऑफ आर्टस मैनेजमेन्ट एण्ड सोशल साइन्सेस प्रकाशन ब्रजगोपाल शुक्ल सेन्टर फार रिसर्च स्टडीज रीवा, पृं सं. – 379।

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Hybrid seed production technique in cucurbitaceous vegetables

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Introduction

Large and diverse group of vegetable crops under Cucurbitaceous family Cucurbitaceous consists of 90 genera & 750 species .Vegetable seed production difficulty during earlier days because by using hand emasculation and pollination but recently reduce the cost of hybrid seed production by using genetic control mechanism like male sterility and self-incompatibility. To exploit the phenomenon of heterosis the basic requirements are presence of hetrosis combination, flower size and color, pollen production capacity of male plant and longer duration of stigma receptivity, easiness in emasculation and pollination, attraction to insect as a means of pollen transfer, seed setting and their economic feasibility in production as well as adoption. Since, most of the cucurbits are having large flower size, separation of male and female part (monoecious sex form), colored petals (yellow/white), easiness in emasculation and pollution, adequacy of pollen grain and nectarines support the production of F_1, hybrid seed. The trend of F_1 hybrid seed usage in vegetable crops is increasing globally in term of species, cultivars and volume of seed used. Most of the seed of our main vegetables including tomato, sweet pepper, eggplant, cucumber, squash, pumpkin, melon, watermelon, brassicas such as cabbage, cauliflower, broccoli, Chinese cabbage and radish, and onion in developed countries are of F, hybrid cultivars. The popularity of F_1 hybrid cultivars is due to their vigor, uniformity, disease resistance, stress tolerance and good horticultural traits including earliness and long shelf-life expressed and therefore giving consistent stable high yield. Ever since (since 1930s) the discovery of male sterility (in onion) and self-incompatibility (in cabbage) mechanisms and their proposed utilization in hybrid seed

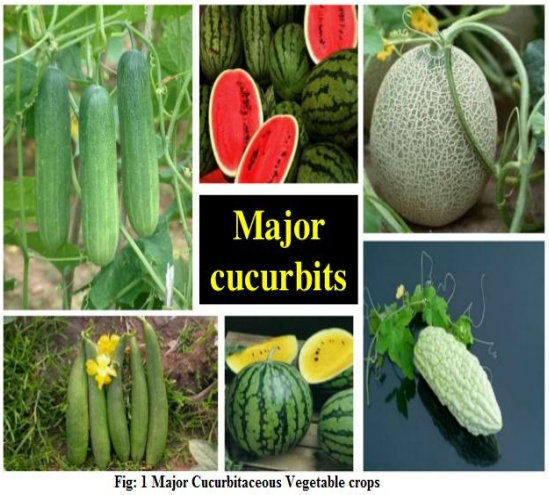


Fig: 1 Major Cucurbitaceous Vegetable crops

Fig: 2 Flower phenotypic observed in Cucurbitaceous vegetable

production, several mechanisms and methods have been evolved for the development of experimental and commercial hybrids.

Table: 1 Different Sex Forms in cucurbits

Monoecious :	**:**	Cucumber, Musk melon, Pumpkin, Summer squash, Winter squash, water melon, Sponge gourd, Round melon, Bottle gourd, Bitter gourd
Gynoecious	**:**	Cucumber, Bitter gourd, Musk melon, Watermelon, Ridge gourd
Androecious	**:**	Cucumber , Musk melon
Dioecious	**:**	Pointed gourd, Ivy gourd
Andromonoecious	**:**	Water melon, Cucumber
Gynomonoecious	**:**	Cucumber, Musk melon, Ridge gourd
Trimonoecious	**:**	Cucumber
Hermaphrodite	**:**	Ridge gourd

Steps in F_1 hybrid seed production

Three steps involved in F_1 hybrid seed production are-

1. Development of inbred, line and their production: The inbred lines developed through exploiting inbreeding depression and fixation of the desired traits in them. The seed of the developed lines are produced in isolation or by hand pollination.
2. Testing of combining ability: The combining ability (GCA/SCA) is tested by line x tester or dialed cross method.
3. Production of F_1 hybrid seed: Techniques have been developed and is variable for crop to crop.

Techniques of hybrid seed production

1. Hand emasculation and hand pollination
2. Hand emasculation and pollination by insect
3. Use of genetic male sterility system:
4. Use of gynoecious sox form:
5. Through chemical sex expression

Hand emasculation and hand pollination

This technique is applicable for limited scale production, since lot of trained labour are required in pinching, pollen collection and hand pollution.

Hand emasculation and pollination by insect

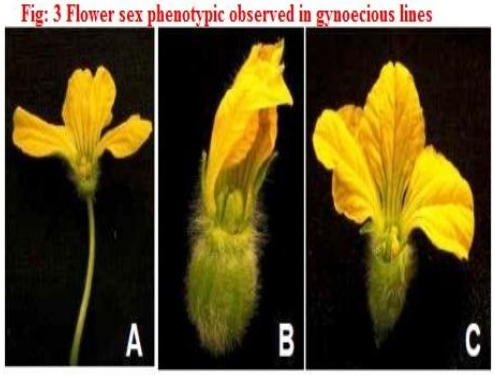
The male flowers from female lines are pinched off day before of anthesis regularly, which honeybees and other insects (voluntary) uses as a pollinizer. The male and female are grown in alternate rows. The fruit set on female lines are of hybrid and harvested for seed extraction. The planting ratio varies within the crops e.g. summer squash 3:1 and 4:1 in muskmelon and cucumber but depend upon the population of bees in plot. The

technique used in bottle gourd, pumpkin, muskmelon, cucumber, summer squash and bitter gourd for hybrid seed production.

Use of genetic male sterility system

Genetic male sterility system has been utilized for commercial hybrid production in muskmelon (Punjab Hyb -1). The genetic male sterility in muskmelon controlled by single recessive gene (msms) for hybrid seed production, the male sterile line used as female parent. Since, genetic male sterile line is maintained in heterozygous forms, 50% fertile plants are to be removed at flowering. The other 50% having non-dehiscent empty another are retained in female rows. The female and male are grown in 4:1 ratio. However, to maintain the good plant population in female rows it is suggested that seed parent should be sown with double seed rate, it is also advised that female line seedling should be raised in polythene bags and transplanted at flower appearance in order to avoid the fertile plants in female rows. The pollination is

Fig: 3 Flower sex phenotypic observed in gynoecious lines



Male Female Bisexual

done by honey bees and 1 to 2 medium sizes hives are good enough to ensure the good pollination and fruit set at female row. The male sterile line is maintained in heterozygous form by crossing with maintainer line under adequate isolation distance or under cover.

Use of gynoecious sox form

The gynoecious sex form has been commercially exploited in hybrid seed production of cucumber (Pusa Sanyog) at IARI R.S. Katrain and in muskmelon (MH-10) at PAU, Ludhiana. For hybrid seed production female and male rows are planted in 4:1 ratio. The female (seed parent) bear only female flowers and pollination by insect (honeybee). To ensure the good fruit and seed recovery, the sufficient population of honeybee 1 to $1^1/2$ colony of medium size has to be kept at the boundary of seed production plot to boost the amount of crossing. The parental lines i.e. male parent maintained by selfing (mixed pollination) and rouge out undesirable plants before contamination take place. The female lines i.e. gynoecious lines maintained by inducing the staminate flower through the sprays of silver nitrate 200 ppm at two to four true leaf stage and then selfing is carried out. It was observed that 10-11 male flowers appear per. 100 nodes. The performance of gynaecious lines is unstable under high temperature and long photo period conditions (Hormuzdi and More, 1989) because of their thermo-specific responses for gynoecious stability. That is why the gynoecious cucumber did not receive much attention in the tropical countries. However, few true breeding tropical gynoecious lines in cucumber and muskmelon have been developed at IARI. As a result of development of true breeding line, muskmelon hybrid Pusa Rasraj was developed. These homozygous gynoecious lines are maintained by using GA3, 1500ppm or silver nitrate 200-300 ppm or sodium thio-sulphate 400 ppm to induce staminate flowers at two and four true leaf stage. Homozygous lines are planted in strict field isolation. The gynoecious lines are crossed with

monocious male parent to produce F_1 hybrid.

Through chemical sex expression

The hybrid seed can also be produce in cucurbits by the application of chemicals for attaining the sex of cucurbits. Specific chemicals are known to induce femaleness and maleness as desired. The spraying of ethrel (2-choloro-ethyl-phosphonic acid) 200-300 ppm at two and four true leaf stage and another at flowering is useful for inducing the pistilate flower successively in first few nodes on the female in bottle gourd, pumpkin and squash for F_1 seed production. The row of male parent is grown side by the side of female and natural crosses pollination is allowed. In the absence of insect, hand pollination is possible when two sexes are separate. Four to five fruit set at initial nodes are sufficient for hybrid seed. The complete suppression of the male flowers in squash can be achieved by applying ethereal at higher concentration (400-500 ppm) twice. The other chemicals like GA3, (10-25 ppm) in cucumber, MH- (100 ppm), ethepon (600 ppm) in squash induces female flower.

Conclusion

The breeding programme should shift towards development of biotic and abiotic resistant variety/hybrids coupled with quality attributes. The value-added breeding approach will add to increase the availability of vegetable by minimizing the post-harvest losses. Considering growing concerns about residue-free vegetables and export of fresh/canned vegetables, it has become imperative to shift to IPM-based practices. In general, productivity is a major criterion to get maximum return but like other vegetable crops, quality and availability of the product during lean periods are also equally important to fetch better price in the markets. Therefore, development of hybrid/varieties with better adaptability under off-season should be undertaken. Further, in order to reduce cost of hybrid seeds it would be appropriate to utilize the available genetic mechanisms for hybrid seed production. In this regard, development of high frequency pistillate lines is advocated. Alternatively, extensive studies on plant growth regulators for large-scale hybrid seed production in many cucurbits should be undertaken. For developing multiple biotic stress resistant lines, validity of already available molecular markers with established linkage may be tested in order to examine their feasible use in breeding programme for development of parental lines.

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बांस का पुष्पनः प्राकृतिक घटना या सुअवसर

योगेश पारधी एवं डॉ. योगेश्वर मिश्रा

आनुवांशिकी एवं पादप प्रजनन प्रभाग

उष्णकटिबंधीय वन अनुसंधान संस्थान, जबलपुर

बांस मानव के जीवकोपार्जन के प्राकृतिक उपहारों में से एक है । यह घास प्रजाति का सदस्य है जो प्राचीन समय से मनुष्य की विभिन्न आवश्यकताओं की पूर्ति करता आया है तथा समय के साथ-साथ मनुष्य ने बांस के विविध तरह से उपयोग कर इसकी उपयोगिता को बढाया है । बांस का उपयोग मनुष्य, बांध, वाद्ययंत्र, घर बनाने तथा खाद्य पदार्थ के रूप में करता है । बांस में फल व फूल काफी समय बाद आते हैं जो प्रजाति के अनुसार इनका समयकाल हर प्रजाति के बांस में अलग-अलग होता है ।

पुष्पनयुक्त बांस का भिर्रा

इस लेख में बांस के बीज की उपयोगिता पर प्रकाश डालने का प्रयास किया गया है । बांस के स्तम्भ व बीज का उपयोग सम्पूर्ण एशिया में खाद्य पदार्थ के रूप में किया जाता है । बांस का उपयोग अलग अलग क्षेत्र में मनुष्य की सांस्क्तिक व रहन-सहन जीवनशैली के अनुसार बदलता रहता है ।

मध्यप्रदेश के जनजातीय क्षेत्र मण्डला, बालाघाट, सिवनी, शहडोल, सीधी, झाबुआ एवं छिन्दवाड़ा जिलो में 150 सेंमी. - 200 सें मी. वर्षा तथा उपजाऊ मृदा तथा अनुकूल जलवायु दशा होने की वजह से बहां काफी मात्रा में बांस के वन हैं जिनमे मुख्यरूप से *Bamboosa arundenecea* हैं । इस क्षेत्र में बैगा, गोंड, भारिया, कोल और भील जनजाति का वास है जो बांस के उपयोग के बारे में काफी जानकारी रखते है । जो उनके उपयोग हेतु काम आ सके। हालांकि वे बांस बीज के बारे में काफी कम जानकारी रखते है इसकी बजह मुख्य रूप से यह हो सकती है कि बांस का बीज काफी वर्षो बाद आता है । कटंग बांस *Bamboosa arundenecea* में तो यह 40-50 वर्ष में एक बार आता है । अतः इन जनजाति को इनके बीज के बारे में काफी कम जानकारी है । जब बांस में बीज आता है तब ये इसे खाद्य पदार्थ के रूप मे उपयोग करने के लिए संग्रहित करते हैं ।

बांस के बीज का संग्रहण

जनजाति परिवार इसे आम बोलचाल की भाषा मे इसे कटंग बीज कहते हैं। यह कटंग बीज दिखने में गेंहू की तरह हल्का पीला रंग का होता है और गेंहू से पतला होता है एवं आकार में चावल की तरह होता है। इसलिए इसे कटंग चावल भी कहते है। जब बांस क्षेत्र में लगा बांस बीज परिपक्व हो जाता है तब ये जनजातीय परिवार पूरे बांस क्षेत्र के मैदानी सतह को साफ कर लेते है ताकि कंकड पत्थर व कचरे की मात्रा कम से कम संग्रहण में आए। बांस बीज को ये बांस के पौधे से तोडते नही हैं। ये बीज स्वतः ही धीरे-धीरे गिरता रहता है और ये सारा दिन इंतजार करते हैं

मध्यप्रदेश के बालाघाट में पुष्पयुक्त बांस

और इन गिरे हुए बीजों को जमा करने का सुबह व शाम का समय नियत होता है। इस कार्य में मुख्य रूप से महिलाएं व बच्चे शामिल होते हैं। जमा किए गए बांस बीज के उपर एक चोल चढा हुआ रहता है जो गेंहू के चोल की तरह होता है। बीज के चोल को मूसल की सहायता से निकाला जाता है। इस कार्य में मुख्य रूप से महिलाएं शामिल रहती है जब बीज का चोल निकल जाता है तब इसे साफ कर बीज जमा कर लेते हैं।

बांस बीज का भण्डारण

जनजाति परिवार बांस बीज को इकटठा करने के बाद अच्छे तरीके से सुखाया जाता है तथा इसे लम्बे समय तक सुरक्षित रखने के लिए बांस की बनी टोकरी या मिटटी की बनी कोठियों में रखा जाता है। जिसके उपर गोबर का लेप लगा दिया जाता है ताकि पीडक व हानिकारक कीट इसे नुकसान न पहुंचा पाएं।

रोजगार का साधन

बांस बीज की अपनी आवश्यकतानुसार मात्रा को ये जनजाति परिवार अपने पास संग्रहित रखतें है। बाकि बचे हुए बांस बीज को बाजार में बेच देते हैं। वन विभाग भी अपनी नर्सरी में नये पौधे तैयार करने के लिए इन्ही जनजाति परिवार पर निर्भर रहते हैं तथा उचित मूल्य देकर इन जनजाति परिवार से वन विभाग बांस बीज प्राप्त करते हैं। इस प्रकार गरीब जनजाति परिवार की आर्थिक स्थिति को यह बांस बीज मजबूती प्रदान करता है।

भोज्य पदार्थ के रूप में उपयोग का तरीका

बांस बीज को साफ पानी से धोकर गर्म पानी में उबाला जाता है और इसे चावल को जिस तरह से पकाया जाता है उसी तरह से पकाया जाता है और इसे सब्जी के साथ खाते हैं। दक्षिण भारतीय जनजाति इसे बांस चावल दही राजमा बांस चावल दही बांस चावल के साथ चाव से खाते हैं। असम में इसे मछली सालन के साथ खाते हैं। गेंहू की तरह इसका आटा बनाकर रोटी भी बनायी और इसे रोटी के रूप में भी खाया जाता है। बांस चावल से त्योहारों में खीर भी बनायी जाती है।

बांस चावल एक पौष्टिक भोज्य पदार्थ

बांस बीज प्रकृति का एक अनुपम उपहार है ये काफी लम्बे समय बाद प्राप्त होता है । साथ ही इसकी पौष्टिकता व स्वास्थ्यवर्धकता का गुण इसके महत्व को और बढा देता है । 100 ग्राम बांस बीज में 60-36 ग्राम कार्बोहाइडेड और 265.6 किलोग्राम कैलोरी उर्जा प्राप्त होती है इस तरह यह गेंहू और चावल से अधिक पौष्टिक होता है ।

बांस चावल का प्रजनन क्षमता वर्धक के रूप में उपयोग की मान्यता

दक्षिण भारत की कानी जनजाति का मानना है कि बांस बीज मनुष्य की प्रजनन क्षमता बढाता है वे अक्सर इसे प्रजनन क्षमतावर्धक के रूप में अपने भोजन में विशेष तौर से शामिल करते हैं ।

हिन्दुस्तान टाइम्स में छपी एक खबर के अनुसार कि बांस बीज मनुष्य की प्रजनन क्षमता बढाता है । इस खबर से अचानक ही बाजार में इसकी मांग बढ गई थी इसी खबर को मददेनजर रखते हुये नेशनल इन्स्टीट्यूट ऑफ़ न्यूट्रीशन, हैदराबाद ने एक परीक्षण किया जिसमें यहां पाया गया कि बांस बीज किसी भी तरह से किसी भी जीवित जीव की प्रजनन क्षमता को नही बढाता है । चूंकि इसमें बहुत अधिक मात्रा में कार्बोहाइड्ट और उर्जा पायी जाती है जिस कारण शरीर का उर्जा स्तर बढ जाता है । उन्होने अपने शोध पत्र में इस बात का स्पष्ट उल्लेख किया है ।

वानिकी के लिए सुअवसर

बालाघाट, मण्डला, छिन्दवाडा, सिवनी में बांस के जंगल बहुतायत मात्रा में है । यहां के बांस वन सम्पूर्ण मध्यप्रदेश में अपनी उच्च गुणवत्ता के लिए जाने जाते हैं तथा बालाघाट के बांस नेपानगर व अमलई पेपर मिल में अखवारी कागज के निर्माण में प्रयुक्त होते हैं । महाकौशल क्षेत्र जोकि छत्तीसगढ से जुडा है । अतः यह माना जाता है कि पूर्व समय में जब कटंग बांस में बीज आता था तब यहीं का बीज छत्तीसगढ क्षेत्र में भेजा गया था । अतः इस जानकारी के आधार पर हम कह सकते हें कि महाकौशल क्षेत्र तथा छत्तीसगढ के वनों में लगा हुआ बांस आनुवांशिक रूप से समान है । महाकौशल क्षेत्र में लगे बांस की संतति छत्तीसगढ क्षेत्र में वर्तमान में विद्यमान है । इस तथ्य की पुष्टि इस बात से होती है कि वर्तमान समय में सम्पूर्ण महाकौशल क्षेत्र में कटंग बांस मे फूल व फल आए थे इसी प्रकार इसी समय छत्तीसगढ क्षेत्र में भी कटंग बांस में फल व फूल का आना इस बात को प्रमाणित करता है । चूंकि कटंग बांस में बीज आने के बाद कटंग बांस सम्पूर्ण मृत हो जाता है तथा बीजों से नये पौधों का विकास हो जाता है । यह एक प्रकार का संकट भी है कि सम्पूर्ण बांस वन एक साथ मृत हो जाता है । चूंकि यह प्रकृति की एक अनूठी प्रक्रिया है । जिसे हम बदल नही सकते हैं परन्तु इस संकट के अवसर को सुअवसर में जरूर बदल सकते हैं । कटंग बांस में बीज आने के बाद कटंग बांस के बीज को नियोजित तरीके से एकत्र कर उसे उचित प्रबंधन व नर्सरी तकनीक के ज्ञान का सम्पूर्ण इस्तेमाल कर इसके बीज को एक जगह पर रोपित कर राईजोम बैंक बनाकर सुरक्षित रखा जा सकता है तथा बाद में आवश्यकतानुसार वन में जरूरत के अनुसार रोपित किया जा सकता है । इस प्रकार कटंग बीज को व्यर्थ होने से बचाया जा

सकता है क्योंकि कटंग बीज की जीविता समय काफी कम होती है इस तरह से राईजोम बैंक बनाकर हम बडे पैमाने पर बीज को बचाकर अच्छी गुणवत्ता के बांस के पौधे तैयार कर सकते है।

सार

बांस चावल को भोज्य पदार्थ के रूप में भारत की विभिन्न प्रजातियां मुख्य रूप से करती हैं बांस चावल इन जनजातियों के लिए गेंहू और चावल का वैकल्पिक खाद्य स्रोत है जिससे कि ये अपने चावल गेंहू की बचत कर अपनी आर्थिक स्थिति को मजबूत करने का प्रयास करते हैं। बांस चावल का इस्तेमाल सम्पूर्ण भारत की विभिन्न प्रजातियां करती हैं चूंकि इनके पास खाद्य पदार्थ सीमित मात्रा में उपलब्ध होता है । इस सन्दर्भ में बांस चावल इनके लिए प्रकृति का एक उपहार है।

इस लेख में जनजाति परिवार के द्वारा बांस बीज के संग्रहण भण्डारण व उपयोग करने के तरीकों का उल्लेख किया है और उनसे इसके उपयोग का पता लगाया जिसमें हमने यह जाना कि ये जनजाति परिवार बांस बीज का उपयोग केवल खाद्य पदार्थ के रूप में करते हैं तथा बांस बीज का इस्तेमाल वे किसी भी तरह से औषधि के रूप में नही करते है तथा इसके कोई औषधि उपयोग की जानकारी भी वे नहीं रखते है।

बांस, चावल का उपयोग खाद्य पदार्थ के रूप में आदिकाल से किया जा रहा है, इसमें असाधारण रूप से कार्बोहाइड्रेड और प्रचुर मात्रा में उर्जा प्रदान करने वाले अवयव मौजूद रहते हैं । जो इसकी उपयोगिता को साबित करते हैं । अतः इसकी उपयोगिता का और अच्छे तरह से पता लगाने के लिए बढे स्तर पर जैव रासायनिक स्तर पर अनुसंधान करने की आवश्यकता है ताकि इसमें पाये जाने वाले अन्य विभिन्न तरह के उपयोगी अवयव तत्वों का पता चल सके जिससे कि इन अवयवों का उपयोग भविष्य में विभिन्न तरह की दवाईयां बनाने में किया जा सके।

Know your biodiversity

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Rhododendron anthopogon

Rhododendron anthopogon is one of the smallest *Rhododendron* generally found in alpine slopes, shrubberies, open slopes, often gregarious forming association with *Betula utilis* and *Salix* spp. In India it is commonly known as Dhoop, Atarasu, Talis, Taliseri and Talispatra. *Rhododendron anthopogon* var *album* is synonym of this plant. It belongs to family Ericaceae and order Ericales. This plant is National symbol of Nepal.

It is globally distributed in Himalayan ranges across Pakistan, India, Nepal, Bhutan and SE Tibet. In India it is found in Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir and Uttarakhand at altitude of 3000-4900 m. In Himachal Pradesh it is found in Kinnaur, Lahaul-Spiti, Chamba and Kullu. It is generally found in acidic soils of Himalaya.

It is small, evergreen, aromatic shrub, up to 60 cm high. Stems are densely branched. Bark slightly rough, pinkish brown or grey exfoliating in papery strips. Leaves aromatic, crowded towards the end of the branches, thick margins recurred, clothed above with scattered scales when young and becoming glabrous when mature, clothed beneath with a dense layer of scales which are yellow on the young leaves becoming ferruginous as leaves mature. Flowers sulphur coloured i.e. white or yellow tinged pink in terminal clusters of 4-12. Bracts scaly, margins woolly. Stamens 12-16. Flowering and fruiting period is June-September.

The leaves contain quercetin, myricetin, taxifolin, kaempferol derivatives, ursolic acid and its acetate, epifriedinol, beta-sitosterol, betulinic acid and rutin. Anthopogon oil or Sanpati oil is obtained by steam distillation of aerial parts of the plant which is pale yellow in colour with balsamic aroma. Essential oil is used in cosmetics, shampoos, creams, soaps and perfumes. It is also used on hair and skin.

Plant yields an incense and used by locals in monestries, temples and houses. Plant is used in the treatment of gonorrhoea, headache, throat infection, common cold, lung infection, nausea, stomach ailments, blood disorders, bone diseases, allergies, obesity, flu, stress problems and vomiting. Decoction of whole plant is given to relieve fever. Leaves possess stimulant properties. The leaves are used by local people for

preparing tea and are sold in market under the name of 'Talisapatra'. The smoke of the leaves is used in Indian medicine as a stimulant. The leaves of *Rhododendron anthopogon* get mixed up with those of *Abies webbiana* and used for treatment of respiratory disease.

Although (IUCN) Conservation status of *Rhododendron anthopogon* is Not Evaluated (NE) but due to habitat destruction and overexploitation it is declining very fast. Hence in situ and ex situ conservation is needed to control its further decline and availing its benefits.

Panthera uncea

Panthera uncea is carnivorus animal and commonly known as Snow Leopard and Ounce. It is found in alpine and subalpine regions of Himalayas at altitude of 3000-4500 m. It is first described by Schreber in 1775. It belongs to family Felidae and order Carnivora. It is state animal of Himachal Pradesh and national animal of Pakistan and Afganistan.

It is found in Afghanistan, Bhutan, China, India, Kazakhstan, Kyrgyzstan, Mongolia, Nepal, Pakistan, Russia, Tajikistan, and Uzbekistan. In India it is found in Himachal Pradesh, Jammu Kashmir, Sikkim, Arunachal Pradesh and Uttaranchal. It was known as *Uncea uncea* since 1930 but in 2008 after the genotyping studies it is placed in genus *Panthera*. The genus name '*uncea*' is derived from Old French word *'once'* used for *European lynx* which is medium size cat.

Body is smoky-grey pelage tinged with yellow and patterned with dark grey, open rosettes and black spots. Well developed chest, short forelimbs with sizeable paws, strong hind limbs are adaptations for traversing in steep terrain. The snow leopard's vocal fold lacks a thick pad of fibro elastic tissue so it cannot roar like the other big cats. Adaptations for cold are enlarged nasal cavity, long body hair with dense, woolly under-fur. The long, thick tail maintains balance and can be wrapped around the body for added warmth.

Major prey species of Snow leopard are blue sheep, ibex, wild goat, marmot, hares, small rodents and domestic livestock. It lives in well defined home range. It uses scent marks (Urine) to indicate their territory. These are corpuscular and active at dusk and down. It lives solitary except females with cubs. It is capable to kill all animals in their home range except adult male Yak. Reproduction in Snow leopard occurs in late winters i.e. January-March. Gastration period is 90-100 days. It gives birth of 4-5 cubs at a time. Average life span of Snow leopard is 15- 20 years.

It is given endangered status in IUCN Red List of Threatened species since 1988 because of its declining global population in wild. According to Wild life protection act 1972 it is included in CITES Appendix I and legally protected from hunting in its range states. Global Snow Leopard Forum (12

Snow leopard range countries) declared 2015 as International Year of Snow Leopard under Global Snow Leopard and Eco-system Protection Program (GSLEPP) for awareness among people for its declining population.

Poaching for skin and bones, declining prey, climate change, habitat degradation, habitat fragmentation are major threats to Snow leopard. Hence formulation of suitable conservation strategies and awareness programmes among the public is very necessary to protect this species from extinction.

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