Van Sangyan

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From the Editor’s desk

Biofertilizers contain microorganisms that colonize the rhizosphere on application and promote growth by increasing the supply/availability of primary nutrients to the host plant, and thereby reduce the use of chemical fertilizers and pesticides. The microorganisms in bio-fertilizers restore the soil's natural nutrient cycle and build soil organic matter. Therefore, they are extremely advantageous in enriching soil fertility and are more cost-effective than chemical fertilizers.

This issue of Van Sangyan contains an article on the prospects of biofertilizers. There are also sections on the soils of India, and how afforestation can rehabilitate barren lands, along with other useful articles. The back cover of this issue insists proper utilization of vermicompost, which is also a biofertilizer.

I hope that you would find all information in this issue relevant and valuable.

Readers of Van Sangyan are welcome to write to us about their views and queries on various issues in the field of forestry.

Looking forward to meet you all through forthcoming issues.

Dr. N. Roychoudhary
Chief Editor
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Mango Mealybug: A Major Pest

Kritish De
West Bengal

Mango (Mangifera sp.) is the most important commercially grown plant of India. According to National Horticulture Board, Government of India, India ranks first among world’s mango producing countries accounting for about 50% of the world’s mango production. Other major mango producing countries include China, Thailand, Mexico, Pakistan, Philippines, Indonesia, Brazil, Nigeria and Egypt. India’s share is around 52% of world production i.e. 12 million tonnes as against world’s production of 23 million tonnes (2002-03). But, this important fruit crop plant is attacked by several insect pests every year which causes economic damage. According to ICAR - National Bureau of Agriculturally Important Insects, Bangaluru there are 84 species of insects acting as pest of mango plant of which 4 insects viz. Drosicha mangiferae Green, Hemaspideroctus cinereus (Green), Icerya aegyptiaca (Douglas) and Icerya seychellarum (Westwood) come from the family Monophlebidae (commonly called monophlebids or giant scales). Among them, last three species act as minor pest but the first one, Drosicha mangiferae Green is a major pest. It is commonly called mango mealybug. Though the members of the family Pseudococcidae (Hemiptera: Coccoidea) are commonly called “mealybug”, however, it is also called “mango mealybug” because of its close resemblance with the mealybugs.

Distribution
Giant Scales are mostly found in tropical countries, especially mango orchard of India, Pakistan, Bangladesh and other S.E. Asian countries.

Morphological description of adult male
Body is reddish orange in color and visibly divided into head, thorax and abdomen. Head is small, bears one pair black compound eyes and one pair antennae. Antennae are as long as the length of the body, black in color, segmented. Each segment of antennae bears one pair lateral bristle. Thorax has two black spots, one on dorsal side and another on ventral side. Thorax bears three pairs of externally jointed legs and one pair black colored wings. Coastal margin of wing is strongly developed. Median – flexion line and claval furrow of wing are also well developed. Abdomen has four pair of fleshy caudal tassels. Penis sheath strongly tapering, the apex produced into a slender, almost cylindrical style with rounded tip.
Morphological description of adult female

Body is elongated oval, body length (10 mm or more) is twice than the width (5 mm or more), dorsal side somewhat concave but ventral side is flattened. Body is covered by white waxy coating. Body is divided into head, thorax and abdomen but these parts are fused so that it is tough to distinguish. One pair segmented, dark brown colored antennae are present. Wings are absent. Three pairs of externally jointed dark brown colored legs are present. Thoracic spiracles often with pores, concentrated near entrance of atrium. Well developed anal tube present, with a simple sclerotized ring or band of pores at inner end. Abdominal spiracles present and simple, without a pore collar (it is the microscopic key character of family – Monophlebidae to distinguish it from family - Pseudococcidae). Mature female often with flutted ovisac or with a marsupium (it is the field key character of family – Monophlebidae to distinguish it from family - Pseudococcidae).

Life cycle

*Drosicha mangiferae* Green has 1 generation each year. Female lay eggs between April to May. Purple-colored eggs are laid in egg sacs comprising mass of wax threads, in the loose soil around (within 2 – 3 m radius) the infested trees. Initially, maximum eggs are laid daily i.e. 56 per day and at the end minimum eggs are laid i.e. 1 per day. The egg laying
ranges from 221 to 361 per female in 9 to 16 days. The eggs hatch in the month of December – January and 1\textsuperscript{st} instar nymph emerge and move upward the plant with an average speed of 12.4 cm/minute. 1\textsuperscript{st} instar nymph can live without food for 5 to 19 days and this stage lasts for 45 to 71 days in both male and female after which they moult to form 2\textsuperscript{nd} instar nymph. The 2\textsuperscript{nd} instar nymph moves upward the plant with an average speed of 17.3 cm/minute. The 2\textsuperscript{nd} instar nymph can live without food for 3 to 23 days. The 2\textsuperscript{nd} instar stage lasts for 18 to 38 days in both male and female. After that, they moult to form 3\textsuperscript{rd} instar nymph. The 3\textsuperscript{rd} instar moves upward the plant with an average speed of 37.1 cm/minute. The 3\textsuperscript{rd} instar nymph can live without food for 3 to 23 days. The 3\textsuperscript{rd} instar stage lasts for 15 to 26 days for female and 9 to 15 days for male. Then, the female moults to form adult whereas, the male goes to pupa stage. The pupa stage lasts for 9 to 15 days. After that, the adult male appears. During the month of March – April, both adult male and female are present. Life span of adult male is about one week, but life span of adult female is about one month. During this time, they perform copulation. The males fly where the flightless females are present and mating time varies from 6 to 20 minute.

**Damage**

Only nymph and adult female cause damage to the plants, but adult male causes no damage. The nymphs and adult female suck sap from inflorescence, tender leaves, shoots and fruit peduncles. As a result, the affected inflorescences are shriveled and get dried. Rigorous infestation affects the fruit set and causes fruit drop. They exude honey dew over the leaves, on which sooty mould is developed which causes damage. Chief host of this insect is *Mangifera* sp. (Anacardiaceae) i.e. mango plant. Though it is a major pest of mango plant, it also causes damage to cacao, tamarind, citrus etc.

**Control Measures**

It can be effectively controlled by ploughing the soil (upper 6") during May – June as female lays eggs in the soil. Mixing methyl parathion dust 2% @ 250gm/tree in the basal region after ploughing gives good result. Spraying of 0.20% carbaryl or 0.040% monocrotophos also kills nymps on shoots. Research shows that Profenofos (Curacron \textsuperscript{®} 50
at 800ml/100L water and Methomyl (Lannate* 40 SP) at 250gm/100L water is effective against first and second instar nymph.

Eco-friendly and popular method to minimize the damage to the tree is the use of physical barriers against nymphs to crawl up the stem. During the month of November to February, banding of the basal trunk of the tree with 15 – 20 cm wide slippery alkathene sheet prevents newly hatched nymphs to climb the tree. Making sticky bands at 30 – 40 cm above the ground level with rosin and castor oil or grease or coal tar also prevent the nymphs to climb the tree.

Research shows that the fungus Beauveria bassiana (Bals.-Criv.) Vuill. can effectively reduces first instar nymph of this insect. It is reported that three species of jumping spiders (Salticidae) - Lyssomanes sikkimensis Tikader 1967; Myrmarachne bengalensis Tikader 1973; and Zygoballus indica and one species of wolf spider (Lycosidae) - Lycosa mackenziei Gravely, 1924 predate on this insect. Thus, these spiders can also be used for biological control of giant scales.

Note : Though Drosicha mangiferae Green is commonly called mango mealybug, however, the Rastrococcus mangiferae (Green) (Coccoidea: Pseudococcidae), Rastrococcus invadens (Green) (Coccoidea: Pseudococcidae) are also commonly called mango mealybug.

References :

1. Abdul Latif (1949). The taxonomic Status of Drosicha stebbingi (Green) and Drosicha mangiferae (Green) (Hem., Coccid.). Bulletin of Entomological Research, 40, pp 351-354. doi:10.1017/S0007485300022811.


Bamboo and Rural Livelihood

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Bamboo is one of the fastest growing ancient woody grasses and known as green gold and poor man’s timber. Another peculiarity of bamboo is that most species flower very infrequently, with intervals as long as 60 to 120 years. These species exhibit ‘mass flowering’ where all plants in the population flower at the same time. Bamboo is an important forest resource for the rural communities both for farming activities as well as a source of food and cash income. It belongs to family Gramineae and subfamily Bambusoideae and is found in forest and non forest areas. It is closely associated with indigenous culture and used for house construction, bamboo ply, agricultural implements, handicraft, irrigation, brooms, umbrellas, medicine, food, fuel, fodder and papers since ancient time. Today it has much potential for income generation, employment generation and poverty alleviation by improving the economic condition of bamboo-dependent people. It grows everywhere in the world except in extremely cold climates.

It is thought to have originated in China, where the first use of bamboo to make every day items was recorded. With the growing demand of timber it is substitute of timber due to renewable property. Particular environmental conditions like higher temperature, air humidity, availability of water promotes clum growth. It is harvested for construction purpose when clums reaches greatest strength and sugar content in sap is lowest. Higher sugar content in sap at the time of harvestation promotes pest infestation rate. Major bamboo research began after 1920 when history of plant was studied. There are 1200 species belonging to 90 genera throughout the world. In India there are 125 species of bamboos belonging to 23 genera. India is second richest country in the world after China in terms of Bamboo genetic resources. It occupies an area of 14 million hectare land in India. It is found in all parts of the country from tropical to temperate regions except Kashmir region where bamboo does not occur naturally. More than 50 % of bamboo species occur in Eastern India.

Madhya Pradesh ranks first in its forest cover and forestry plays a very important role in improving the economy of the state. Bastar, Balaghat, Hoshangabad, Mandla, Raipur, Shahdol, Seoni, Jabalpur etc are the bamboo rich regions in Madhya Pradesh. Dendrocalamus strictus, Bambusa vulgaris, Bambusa bambos, Gigantochloa rostrata, Schizostachyum pergracila are the
main species of bamboo growing in Madhya Pradesh of which *Dendrocalamus strictus* is most important species and grows throughout the state. Bamboo, which is an important forest produce, has high significance in socio economic life of the rural people. In Madhya Pradesh, two communities *basod* and *nistari* are the main consumers of bamboo. Basods are the people belonging to community of bamboo craftsmen who are traditionally dependent on bamboo for their livelihood. The nistaris use bamboo for house repair and crop harvesting and other domestic uses.

The importance of forest in an area is reflected by the multiple uses, such as source for fuel wood, tools and implements, timber, fodder, leaf litter and other NTFPs. Bamboo is one of the NTFPs which is used in improvement of rural livelihood of the people in different ways:

### Bioenergy

Through pyrolysis, bamboo can be converted into three valuable products: bamboo charcoal, oil and gas. Bamboo charcoal is traditionally used as a substitute for wood charcoal or mineral coal. It can serve as a fuel, absorbent and conductor. In some areas the situation is so bad that poor villagers need to purchase fuel wood or walk miles to collect the fuel wood; hence bamboo plantation in waste land are excellent alternate of fuel wood. Utilization of this renewable fuel can save vast natural forest resources and fossil fuels such as coal, oil and gas. This would allow retention of carbon already sequestered in forests and in fossil fuels. It can produce 30% more oxygen than a hard wood forest of comparable size. Biomass based power generation has huge potential to electrify the non-electrified villages and biomass gasification technology can also create employment in rural areas.

### Pulp, Paper and Clothing

It is used in pulp, paper and cloth making. Bamboo paper has practically the same quality as paper made from wood. Paper made from wood may deteriorate over time but paper made from bamboo does not deteriorate. Because of its non irritant quality it is used in baby cloths.

### Furniture and Flooring

Bamboo is used for making furniture from ancient times. Today Bamboo flooring is preferred over wooden floors due to its smoothness, brightness, stability, high resistance, insulation qualities and flexibility.

### Food and beverage

Young bamboo shoots are edible in many parts of the world. Bamboo vinegar is extracted while making charcoal and is used for hundreds of treatments in almost all fields. This liquid contains 400 different chemical compounds and can be applied for many purposes including cosmetics, insecticides, deodorants, food processing and agriculture.
Role of Bamboo products in rural livelihood

Reforestation

It should be selected as an alternative to other trees not only for reforestation but also for afforestation because of fastest growing rate, easy propagation, tensile strength and renewable property. It protects steep slopes, soils, water ways and controls soil erosion.

Bamboo has played and is still playing an important role in improving the livelihoods of rural people. The farmers produce a wide range of bamboo products that are marketed individually at present. The unavailability of transportation, low product prices and varying product quality are some of the main concerns of the bamboo handicraft producers. Therefore, possibilities need to be explored for forming bamboo handicraft production and marketing by the interested farmers. The growing urban population and their increased demand for bamboo products are new opportunities to bamboo dependent people. This will help to improve income as well as employment opportunities to the rural people. With rapid increase in demand due to rising population have caused depletion of bamboo resource in certain areas are also a growing concern among the users. In depth study of bamboo resource and factors responsible for its depletion is needed for future management of bamboo resources.

Central India has many types of bamboo and it has potential of providing self employment and income by bamboo based products. Hence there is need to promote the utilization of bamboo based products.
Hybrid seed production in cotton

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Cotton is a major fibre crop of global importance and has high commercial value. Four out of 50 recognized cotton species in the world are cultivated. Two of them [Gossypium arboreum (2n = 26) and Gossypium herbaceum (2n = 26)] are diploid, and remaining two [Gossypium hirsutum (2n = 52) Gossypium barbadense (2n = 52)] are tetraploids. More than 80 per cent of the world’s area is covered by Gossypium hirsutum and Gossypium barbadense; however diploid cottons are also cultivated in Asia and Middle East. India is the only country where all the cultivated species and some of their hybrid combinations are commercially grown.

Cotton and cotton textiles constitute a major share of agricultural export. In sixties, the production of cotton was about 5 million bales, mostly of short and medium staple cotton. With the advent of hybrid cottons in the seventies, a sea change was brought in cotton scenario both qualitatively and quantitatively. Today, 23.15 million bales of cotton consisting of short, medium, long and extra long staple are produced annually.

HISTORICAL PERSPECTIVE

The phenomenon of heterosis or hybrid vigour is known in cotton since 1894 when Mell first reported an increase in agronomic and fibre properties through cotton hybrids. Thereafter, Balls reported hybrid vigour in the inter-specific crosses between upland and Egyptian cottons. Since then, a number of workers in India, USA and elsewhere recorded the heterosis for various traits both in the intra-hirsutum and inter-specific (Gossypium hirsutum x Gossypium barbadense; Gossypium herbaceum x Gossypium arboreum) crosses. Several workers reported higher heterosis in case of inter-specific (G. hirsutum x G. barbadense) hybrids compared to the intra-specific (G.hirsutum x G. hirsutum) crosses. However this heterosis could not be commercially exploited due to the tedious task of hand emasculation and pollination required for the hybrid seed production, especially in the absence of male sterility systems in cotton during those days.

With an objective to achieve self sufficiency in cotton, especially for the long and extra long staple cottons, serious attempts to develop hybrid cottons combining both the yield and quality attributes began in India in the late thirties mainly at the Cotton Research Station, Surat in Gujarat State of India under the leadership of late Dr. C. T. Patel. Their strenuous efforts to commercially exploit heterosis bore fruits during late sixties.
when Hybrid-4, a cross between G 67, a commercial cultivar of Gujarat and Nectariless an exotic accession from the USA, was developed and released for commercial cultivation.

HYBRID SEED PRODUCTION
In cotton, there are two methods of hybrid seed production, viz., Conventional method and Male sterility based method.

CONVENTIONAL METHOD
- Breeder or certified seed of male and female parents is used for the production of hybrid seed.
- Land requirement: must be free from volunteer plants of cotton.
- Isolation requirements: isolation of 50 meters for certified seed production from other varieties of same or other species is necessary for certification.
- The female and male parents are planted in the same field in separate plots in 4: 1 or 5: 1 ratio.
- Sowing of parental material is done in such a way that there should be nicking in the flowering time of both the parents.
- The female and male parents are planted at wider spacing for easy movement during crossing.
- Spacing: Between rows - 150cm; Between plants - female -120 cm, Male - 60 cm.
- Seed rate: Female – 3.75 kg/ha, Male - 2.75 kg/ha
- The off type plants are rogued out before initiation of crossing programme. Higher doses of fertilizer and recommended plant protection measures are used to raise healthy crop to get continuous flush of flowers.

Crossing techniques
In cotton, hybrid seed production is carried out by artificial crossing. The crossing refers to hand pollination. The crossing technique consists of three main steps, viz.,

1. Selection of Bud
   - The selection of flower bud for emasculation is an important step in hybrid seed production. The crossing work is initiated after one week of flower initiation. The flower buds of proper stage (buds which are likely to open the next day) are selected for emasculation. Such buds have generally cream colour and are well developed.

2. Emasculation
   - The process of removal of anthers from the selected flower bud is referred to as emasculation.
   - Anthers of selected buds are gently removed with the help of nail of the thumb as suggested by Doak (1934).
   - The emasculated buds are covered with tissue paper bag of red colour to prevent natural out-crossing.
• The best time for emasculation is 3-6 PM. Some people use straw tube to cover the ovary of emasculated bud. Emasculation is not required when hybrid seed is produced using male sterility.

3. Pollination

Emasculated buds are pollinated the next morning with the pollen of male parent. Best time for pollination is 8-11 AM, when the stigma receptivity is max. Generally, 4-5 buds are pollinated by one flower of male parent. After pollination, the red tissue paper bags are replaced by white tissue paper bags. For identification, a label or thread is also tied on the pedicel of crossed bud for identification of crossed bolls.

Precautions

• After pollination, keep suitable identity by tying cotton thread for easy picking and avoiding mixing.
• Remove all unemasculated and unused flowers (other than crossed ones) daily so as to retain only genuine crossed flowers (bolls) on the female parent. Destroy leftover collected male flowers after use.
• Remove off-type plants, if any, in female and male parents before crossing is commenced.

MALE STERILITY BASED METHOD

Two types of male sterility systems are mainly used in cotton, viz., Genetic male sterility, and Cytoplasmic genetic male sterility.

Genetic Male Sterility

In cotton, Gregg male sterility is the only source utilized in India, Pakistan and USA. This male sterility is governed by two recessive genes (ms5 and ms6). The male sterility is transferred to any female parent through backcross technique. Maintenance of GMS lines involves sibmating between male sterile plants and heterozygous male fertile plants. Cross of this male fertile genotype with sterile line will always produce male sterile and male fertile plants in 1 : 1 ratio. Fertile plants are identified after flowerings are removed. The male sterile plants are pollinated with the pollen of male parent to get hybrid seed. In case of male sterile parent, 3-4 seeds should be sown per hill because 50% of the population (male fertile) is removed when flowering starts.

Cytoplasmic Genetic Male Sterility

In cotton, mostly G.harknessii (D2 CMS) cytoplasm is used as a source of cytoplasmic genetic male sterility (G. trilobum D8 CMS and G. aridum D4 CMS also induce stable male sterility for practical hybrid seed production). The restoration in D2 CMS involves monogenic dominant action with one enhancer gene. The male sterile parent (female) is pollinated with the pollen of restorer (male) parent. After pollination,
flowers are covered with tissue paper bags to avoid natural out crossing with other plants.

**Male sterility in diploids**

There are at present two sources of GMS

1. **Hisar source**: The recessive GMS in *G. arboreum* cotton variety, DS 5 (GMS-1) have white flowers with petal spot. The GMS-1 was isolated as a spontaneous mutation.

2. **Akola Source**: The GMS line GAK-423A is developed by transferring the genome of *G. arboreum* (AKH-4) in to *G. anomalum* cytoplasm (Meshram and Wadodkar, 1992). This source has yellow, larger flowers than DS 5 GMS and possesses dark petal spot.

India is the first country to release a GMS based hybrid (AHH-1) in diploids.

**Chemically Induced Male Sterility**

Chemicals FW 450 (Sodium a-dichloro-iso-butyrate) and TD 1123 (Chemical constituent not known) have been demonstrated to posses male gametocide action. However, their commercial viability has not been established so far.

**Topping**: Top and side shoots may be nipped suitably to control optimum growth and better boll development. Inadequate or excessive irrigation should be avoided. Stop irrigation a week before last picking.

**Picking**: Pick completely opened crossed boll (kapas) as and when ready in baskets and sort out. Any bolls without thread be kept aside and only genuine crossed bolls are kept separately for use. Remove hard locks, stained kapas etc. keep good crossed boll kapas for processing. Dry well-cleaned kapas in shade after each picking and store in a good place picking-wise lots. Slow ginning is to be practised to recover good quality seed and without cutting the seed. After ginning, the seeds may be kept well spread, air dried, without heaping.

**Acid delinting**

100ml of commercial sulphuric acid/kg seed treated for 2-3 minutes and washed thoroughly with lime water/fresh water till free of acid.

**References:**

पड़ती भूमि पर वनों का पुनर्वासन

ऑ. प. के. भौगोलिक
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पड़ती भूमि पर वनों को विकसित करना वनीकरण कहलाता है। इस प्रकार से विकसित वन को कृत्रिम वन कहते हैं। ऐसी भूमि जो अनेक कारण से अधोगति का प्राप्त हो चुकी है, तथा इसका वर्तमान में उचित उपयोग नहीं हो पा रहा है, पड़ती भूमि कहलाती है। अप्रभावण रूप से देखा जाता है कि बढ़ती हुई मानव तथा पशु संख्या ही भूमिका करते हैं जा जलाय लकड़ी तथा पशु चारा की पूर्ति के लिए वनों के अत्यधिक दोहन के लिए उत्तरदायी है, जिससे भूमि क्षेत्र होकर पड़ती भूमि का निर्माण करता है। वनों के अन्यायुद्ध कटाई पर रोक लगाकर तथा नये वनों का रोपण करके पड़ती भूमि को सुधारा जा सकता है।

पृथ्वी पर मानव के अशर्त को बनाए रखने के लिए कुल भूमि का 33% भाग वनों से आच्छादित होना चाहिए। अतः आवश्यकताओं की पूर्ति के लिए भूमि को सर्वत्र स्थिरता में बनाए रखना अति आवश्यक है। भारत के कुल भौगोलिक क्षेत्रकल का लगभग 50% भाग अधोगति को प्राप्त हो चुका है। कुछ भागों के कृत्रिम खेती कटाई से बाद आना, अंतरिक्ष, अवनुक्षेत्र (सूखा पड़ना) व अनिश्चित वर्ष के मुख्यांग परिवर्तित हो रहे हैं।

इसके विपरीत प्रभाव भूमि के उपजाऊन पर भी पड़ रहा है और भूमि की उड़र शक्ति भी कम हो रही है।

आज देश में पड़ती भूमि का क्षेत्रफल करीब 17.5 करोड़ हेक्टर है। हालांकि पड़ती भूमि विकास उद्यम समिति ने 12.0 करोड़ हेक्टर पड़ती भूमि दर्शायी है। जिसमें 3.6 करोड़ हेक्टर वन क्षेत्र कथा तथा 9.3 करोड़ हेक्टर अन्य क्षेत्र में है। मानव तथा जूठ का संबंध समानता है। अश्लील एवं विकास के लिए एक दूसरे के परिपूरक है।

देश में कुल पड़ती भूमियों में मध्यप्रदेश की हिस्सेदारी काफी अधिक है। जिसमें ज्यादातर क्षेत्र गलीसूकूल बीड़ भूमि, खाली पड़ी हुई वन भूमि व पवरीली भूमि का है। इन सभी भूमियों के सुधार के लिए उचित वैज्ञानिक प्रशिक्षण की आवश्यकता है। सामान्यत: पड़ती भूमियों का अंतर्गत उन भूमियों का माना जाता है, जो कि कृत्रिम के लिए अनुपयोगी है।

परन्तु यद्यपि अभ्यासी में ऐसी सभी खाली पड़ी भूमियों जो ध्यान न देने के कारण निकट या अनुपयोगी रह गई हो, अधिकांश भूमि क्षेत्र के कारण अनुरंजित व अवलंबकारी हो गई हो, पड़ती भूमि के अंतर्गत आती है।

वानिकी की उपभोग संयुक्त एवं महत्त्व
1. राष्ट्रीय पारिसंचालक संस्थान को बनाए रखना।
2. राज्यों तथा आदिवासियों को अधिक से अधिक रोजगार
3. बढ़ती हुई आबादी एवं उसी अनुपात में बढ़ती हुई मांग की पूर्ति हेतु वनों का अधिकता उपयोग
4. राष्ट्रीय आवश्यकताओं की पूर्ति हेतु वनों का अधिक उपयोग कटाई से बचाव
5. पड़ती भूमि के स्तर में सुधार
6. भूमि की उर्वराशिकता एवं जल-संरक्षण में सहायक
7. भूमि कटाई रोकने एवं जल संरक्षण में सहायक
8. पौष्ठिक तत्वों का संरक्षण एवं पुनर्विकास

पड़ती भूमि पर पौधों की विरासत वृद्धि के लिए उपयुक्त प्रजातियाँ

पड़ती भूमि तथा अपशिष्ट भूमि का पुनर्स्थापन का तकनीकी ज्ञान विकसित किया गया है। इस हेतु विभिन्न पक्षियों में विभिन्न प्रकार में प्रायोगिक कार्य किया गया, तथा विभिन्न प्रजातियों का चरण एवं उसकी उपयुक्तता को इसी अपशिष्ट एवं अपशिष्ट/पड़ती भूमि में कार्यात्मक किया गया। संदर्भीत प्रयोगों के आधार पर निम्न निर्देश दी गई है।

1. कंकणलिंग मुद्रा : सफेद शिरस, सिस, आर्टेलियन बाँध, खंबर, केंटिया, नीलगिरी प्रजाति
2. त्वरणीय मुद्दा : खेत, बुखार, महानीम, सफेद सिरसा,
नीलगिरी प्रजाति, जामुन, अरूण, बेर, बहजा
3. भारतीय भूमि : खेत, आवान, अमलतासा, शीतल,
सफेद सिरसा, कालातिरस्ता, बुखार, सुबुखार, शीतल,
4. भूमि क्षण रोकने के लिए वृद्ध प्रजातियाँ : बेर,
शीतल बूसू, सिरिसा, खेत, नीम
5. भूमि को उत्पादक बनाने के लिए : सुबुखार, बुखार,
अरूण, शीतल, बहजा
6. जलाकृ लकड़ी के लिए : बुखार, खेत, करंज,
घावड़ा, जामुन, सुबुखार
7. ग्रूप निर्माण तथा बस्तियाँ हेतु : पोपलर,
यूकॉलिटरस, बूसू
8. पशुचारा के लिए : सुबुखार, बुखार, सिरिसा, बेर,
शीतल, खेत
9. फलों हेतु : आम, जामुन, महुआ, कैथा, ईमली, बेर,
भिला, लेंथु, गुलार
10. विज्ञानीय वृद्ध प्रजातियाँ : ओवला, हरा, नीम, बेर,
बहजा
11. शीतल वृद्ध होने वाले वृक्ष : विलायती बुखार,
शीतल, अरूण, सिरिसा, बुखार, खम्हार
12. जलमग्न क्षेत्रों हेतु : यूकॉलिटरस, करंज, सिरिस,
बुखार, अरूण, सफेद सिरसा, काला सिरसा
13. भूमि कालक् रोकने हेतु : बूसू, लेन्टाना प्रजाति,
प्रोसोपिस
14. बट्टानी, बंजर एवं वधिरी भूमि हेतु : बेर,
जामुनलेबी, बेर, पपाश, कुलु
15. कोय़मा खान क्षेत्र : विलायती इमली, सिमेरुबे,
र्चलका, अकेशिया मेनजिमा, कैथिया साइडमिया,
सिरिस, खम्हार
16. लौह अपक्र खानन : सुबुखार, नीलगिरी प्रजाति,
सफेद सिरसा, खम्हार, शीतल, ओवला
17. तूफान खानन क्षेत्र : खम्हार, नीलगिरी प्रजाति,
अकेशिया लेंटिकुलॉरिस, सफेद सिरसा
18. चूला खानन क्षेत्र : बुखार, र्चलका, सुबुखार, खेत,
सफेद सिरसा, लुतनजोल, नीलगिरी प्रजाति, खम्हार,
नीम

आवश्यक/उपयोगी जानकारियाँ:

- महत्वपूर्ण पीढ़ों के वृद्धि एवं आर्द्रता हानि को बचाए
रखने के लिए विशिष्ट वनकल्प का प्रयोग द्वारा अध्ययन किया गया जिसमें घास का महत्व सबसे
उपयुक्त पाया गया।

- वामीकम्पोस्ट एवं कम्पोस्ट खाद का मिश्रण (प्रयोग
2 किग्रा.), जलशालित 10 ग्राम प्रति गढ़े (45 से.मी.
x 45 से.मी. x 45 से.मी.) के साथ (कार्बनिक आर्द्रता
को बढ़ाने के लिए) तथा घास मल्ट प्रयोग करने पर पीढ़ों
की जेव मात्रा वृद्धि एवं पीढ़ों की ऊंचाई तथा
मोटाई वृद्धि में बहुत लाभदायक पाया गया।

- पदाती भूमि पर 40 ग्राम गूँगी और 40 सुपर
फास्टेट प्रति पीढ़े के दर से समुच्च प्रयोग
लाभदायक है।

- पदाती भूमि पर नाली खोदकर 20 ग्राम वैम (VAM)
और राजीवियम (सूक्ष्णीव) प्रति पीढ़े के हिसाब से
सफेद सिरसा तथा काला सिरस पर प्रयोग करने पर पीढ़ों
की लम्बाई, मोटाई के साथ साथ मुदा में
कार्बनिक पदार्थ एवं उनके जल अधिशोषण क्षमता में
अधिकता पाई में कार्बनिक पदार्थ एवं उनके जल
अधिशोषण क्षमता में अधिकता पाई गयी।

- पदाती भूमि पर 2 मीटर x 2 मीटर तथा 4 मीटर x
4 मीटर की दूरी पर सिरिसू के पीढ़े लगाकर एक
प्रयोगकल्प अध्ययन उनके द्वारा किया गया जिसके
साथ इस प्राणी के जीवन और उनके जल अधिशोषण
संसाधन में प्रयोग किया। किसी ही तरीके के
लिए यह प्रयोग लाभदायक माना जा रहा है।

खनिज खाद्य पदार्थ का पारिप्रेक्ष्यक प्रयोग

1. खानन क्षेत्र की भूमि का तकनीकी पद्धतियों
द्वारा विकास करना।
2. खाद्य क्षेत्र में भूमि के विकास की विधियाँ :-
   - अभियाजकीय विधि
   - जैविक विधि

3. निम्न खाद्यानों में प्रायोगिक कार्य किया गया :-
   कॉकसला खाद्य, लोहा खाद्य, ताबा खाद्य, 
   चूूँ खाद्य, बॉक्सराइट खाद्य

4. खाद्य क्षेत्र में निम्नलिखित पैमानों के आधार पर वृक्षारोपण हेतु प्रजातियाँ का चयन।
   - प्रभावित क्षेत्र में विकसित होने वाली प्रजातियाँ।
   - प्रभावित भूमि में नाइट्रोजन रिवीकरण वाली प्रजातियाँ।
   - स्थानीय लोगों हेतु, इंधन, चारा एवं रेतों उपयोग करने वाली प्रजातियाँ।
   - पक्षीय तितलियों एवं अन्य वन्य प्राणीयों को आकर्षित करने वाली प्रजातियाँ।
   - उन्नत एवं स्वस्थ वृक्षों द्वारा बीजों का चयन।

कॉकसला खाद्यानों की भूमि का विकास

आध्याय क्षेत्र
   - जेवरा एवं विश्रामपुर (ग्र.ग.)
   - सिमरीली (म.प.)
   - तालचर (उड़ीसा)

उचित प्रजातियाँ
   विलायती हमली (जंगल जलेबी), सिमेलुआ न्याका, कैकतिया मोनियम, कैकतिया संमिया, सिसू , खंडम\n
प्रयोगात्मक परिणाम
   - अच्छे परिणाम हेतु प्रयोग कर वर्ष 100 ग्राम गुरूरिया 25 ग्राम एस.एस.पी. एवं 25 ग्राम पोटास मूसेट तेजी पौधा दाला जाये।
   - बीजों की अच्छी उपज एवं वृद्धि हेतु खाद्य की मिट्टी एवं कंपोस्ट का 1:2 का मिश्रण गड़बड़ो में भरा जाये।

- तापीय दबाव को कम करने के लिये अयथितित गृह रहड़ी-गलती पत्तियों जिससे गृह दृष्टि में ह्रास की अधिकता को बढ़ाना।
- खाद्यानों के आसपास की पड़ती भूमि में तीन टाइड क्वालेन्ट की प्रजातियों की पहचान की गई, जिनका वृद्धि एवं जैविक को प्रभावित करने से संबंध है।
- उपरोक्त वर्णित पौधों की प्रजातियाँ हर्वा नाइट्रोजन रिवीकरण अधिकार बढ़ाया गया।

लौह अवकाश खाद्यानों की भूमि का विकास अध्ययन क्षेत्र
   - दल्ली राजस्थान (म.प.)
   - महानायक खाद्य (म.प.)

उद्धीन प्रजातियाँ
   सुबबूत, नीलगिरी प्रजाति, साफ़ेद सिरस, खमेर, सिसू , औपनिव

प्रयोगात्मक परिणाम
   - पीनेरुपण में खाद्य की मिट्टी एवं कंपोस्ट खाद्य को 12 में मिलाकर गड़बड़ो भरे गये।
   - पश्चि/वज्री की अपेक्षा भूसा तथा रहड़ी-गलती पत्तियों की मिट्टी में अच्छे परिणाम पाये गये।
   - अधिकार जैविक को बढ़ाने के लिये 100 पी.पी.एम. नाइट्रोजन और 25 पी.पी.एम. फास्फोरस ढाला गया।

ताबा खाद्य क्षेत्र की भूमि का विकास प्रयोगात्मक क्षेत्र
   - मलाजक्षेत्र (म.प.)

रोपण हेतु उचित प्रजातियाँ
   खमेर, नीलगिरी प्रजातियाँ (प्रोडिस, कमाल्डयुएल्सेसए टेंट्रोकार्बिनस), अक्कोलिया बेविक्टोलिया, साफ़ेद सिरस

परिणाम : गृहों में अच्छी वृद्धि हेतु नेष्टिन, बैक्टियन और फॉर्म्यह की प्रति पौधा 1 ग्राम का उपयोग किया गया।
चूना खदानों की भूमि का विकास अध्ययन क्षेत्र

- कुटेश्वर खदान, बारही, कटनी (म.प.)

रोपण हेतु चर्चित प्रजातियाँ

- बबूल, सिँघु, सुबूतुल, खीर, सफेद सिंहर, रतन जोती, नीलागिरी प्रजाति (हाइब्रिड), खमर, साइमालुआ ग्लोका, नीम

बॉक्ससाइट खदान की भूमि का विकास अध्ययन क्षेत्र

- अमसकंक (म.प.)

रोपण हेतु चर्चित प्रजातियाँ

- ऑक्सिडिलेशन की द्रवांग, नीलागिरी प्रजाति (कमालुजेलेसेन्स), बालल बुर्जी, धीर पाइन

पहली भूमि में वानिकी की संभावनाएं

1. सर्वप्रथम पहली भूमि ज्ञात की ओर से वर्तमा दिखाऊँ जा रही है, जो निकटवर्ती घरों, घरों, इकाई के साथ कर देना चाहिए।

2. पीपी पानी के साथ गड़दड़े, अप्रेश, मही, में खाद लेना चाहिए। गड़दड़े को मिटटी की बाहर रहने लेना चाहिए, जिससे नेत्र धूप में दीवार तथा अन्य हालातक जीव नष्ट हो जाय।

3. दीवार के प्राकृतिक से बचने के लिए आदर्श पादस्त को छिड़काव (प्रति 10) गड़दड़े के भित्तर करना चाहिए।

4. पीपी पानी का सबसे अच्छा समय जुलाई, अगस्त होता है।

5. गड़दड़े का भ्रम उसमें से निकली हुई मिटटी तथा गोबर की पकी हुई खाद का भिंत्र (1:1) से करना चाहिए।

6. एक गड़दड़े में एक ही पीपी पानी लगाना चाहिए।

7. उचित गहराई पर पीपी को लगाना चाहिए तथा पीपी की मुख्य जड़ को शॉर्था रखना चाहिए।

8. पीपी पानी के बाद मिटटी को पीपी के बाद तक हो तक तथा दबा देना चाहिए।

9. पीपी पानी के तुलना पश्चात पानी दालना चाहिए या जब हक़की बारिश हो रही हो उस तक रोपण करना चाहिए।

10. यथा समय पीपी सांयकताल लगाये (यदि वर्षा न हो रही हो तो)

11. कुछ पहली भूमि में आवश्यक तत्वों की कमी होती है और पीपी लगाने के पश्चात 40 ग्राम यूरिया तथा 40 ग्राम सिंगल वायर फास्टेट प्रति गड़दड़े के हिसाब से दालना चाहिए। साथ ही यह अन्य कंप्यूटर चाहिए के यूरिया का छिड़काव 20 ग्राम तथा 20 ग्राम द्वितीय माह के अन्तराल में दालना चाहिए। उपरोक्त दोनों ही रसायनिक खाद छिड़काव के तुलना बाद आरे की गद्दी से पानी अवश्य देना चाहिए।

12. गर्मियों में सुबह या शाम के समय ही पानी देना चाहिए।

13. कम नमी बाले क्षेत्रों में इस प्रकार की संभावना करने के लिए वर्षा का जल पीपी की तली में या आवश्यक संख्या हो परतु किसी भी रित्म में वर्षा का जल पीपी की तली में या आवश्यक संख्य हो। परतु किसी भी रित्म में वर्षा जल भरते तो तली का स्वर्ण न करें। अन्यथा पीपी रोपण प्रस्ताव सक्ता है।

14. गर्मी के मौसम में सुंदर पत्तों का मलबा पीपी के चारों ओर झालकर दर्ज करना चाहिए जो न संकेत मिटटी की आर्द्रता की जमी हो समय तक नहीं रखेगा अपितु इन पत्तियों के क्षेत्र के पश्चात मृद में पोषक तत्वों की भी वृद्धि करेगा।

15. एक दो साल तक उपयोग पर नियंत्रण अवस्था करें।

16. छोटे पीपी की जानकारी से सुखाना अति आवश्यक है। अत: पीपी की जा सूची बनाकर करें।

विभिन्न पहली भूमि के लिए उपयुक्त वृक्ष प्रजातियाँ ।

1. कम गहराई तथा चट्टानीय मूलभूमि

(Degraded/skeletal/lateritic/eroded soils)

नीम (Azadirachta indica), अंबला (Emblica officinalis), बबूल (Acacia nilotica), बेल (Aegle marmelos), खीर (Acacia catechu), सलेन्ड्बा (Boswelia)
serrata), बांस (Dendrocalamus strictus), सुंबुल (Sesbania sesban), ऑस्ट्रेलियन बब्बल (Acacia auriculiformis), अंजन (Hardwickia binata)

2. सूरती भूमि (Sandy soil)

जामुन (Syzygium cumini), खैर (Acacia catechu), खमेर (Gmelina arborea), ईमली (Tamarindis indica), नीलगिरी प्रजाति (Eucalyptus tereticornis), सलई (Boswellia serrata), बेल (Aegle marmelos)

3. शारीरी भूमि (Alkaline soil)

अंवला (Emblica officinalis), बब्बल (Acacia auriculiformis), करंज (Pongamia pinnata), सफेद शिरस (Albizia procera), अर्जून (Terminalia arjuna), शीशम (Dalbergia sissoo)

4. जल प्लावित भूमि (Water logged soil)

नीलगिरी (Eucalyptus tereticornis), करंज (Pongamia pinnata), अर्जून (Terminalia arjuna), सलई (Boswellia serrata), जामुन (Syzygium cumini), बब्बल (Acacia auriculiformis)

5. अम्लीय भूमि (Acidic soil) pH 5.5 से कम

खैर (Acacia catechu), नीम (Azadirachta indica), करंज (Pongamia pinnata), सफेद शिरस (Albizia procera), शीशम (Dalbergia sissoo), बब्बल (Acacia auriculiformis), अंवला (Emblica officinalis)
The Prospect of Bio-fertilizers for Sustainable Plant Development

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Agro-ecosystem is defined as a collection of agronomic crops and animals considered in the context of the biological, physical, social and economic environment. Bio-fertilizers act as renewable inputs helping in better crop nutrient management and maintenance of soil health; different bio-fertilizers including the role of VAM in plant growth is described henceforth.

To increase the agricultural output, agro-ecosystem integrated management is efficiently practiced; the integrated management of such a system can lead to establishing better performance. The paramount issues in agricultural production consist not only of yields per land unit but of qualities of food and fiber that can be produced and delivered per hectare of land, unit of energy and human time expended. The increase in crop production and land productivity in India is one of the essential steps to meet the food demand of the growing human population. With no possibility of stretching the land resources, increased agricultural production has to come through the adoption of better management technology. Increasing dry land farming and development technologies for arid lands with soil related constraints now acquire a new importance and emerges as a new frontier for agricultural development. Long term sustainability in agriculture is possible through:

- The use of low cost farm grown inputs which work in harmony with nature. Bio-fertilizers act as perpetually renewable inputs helping in better crop nutrient management and maintenance of soil health.
- Better soil and water management.
- By adoption of improved agricultural practices.

Trees and other plants survive on essential nutrients like nitrogen, phosphorus, potassium and several minerals they receive from soil and carbon source provided to them by photosynthesis. In agriculture, chemical fertilizers have been widely used, but their requirements have gone up substantially per plant because of the inefficient uptake by the plants resulting from their leaching away from soil, and reduced uptake by plants grown on soil from which microelements catalyzing the uptake of these fertilizers by plant have been depleted due to intensive crop production, thus resulting in the use of chemical fertilizers becoming a very costly affair.
Many microbial inoculants have been developed for improved supply of nitrogen, phosphorus and trace elements to the plants for significant development. Application of bio-fertilizers as a major alternative tends to minimize the ecological disturbance. Most of the bio-fertilizers are formed by microbes like algae and fungi. They, so often portrayed as the simplest and humblest vestiges of life, are in fact the most versatile and talented, products of evolution. Stem-nodulating legumes such as *Sesbania rostrata* and incorporating *Azolla*, blue green algae and other sources of symbiotic and non-symbiotic nitrogen fixation in the farming system are fundamental to sustainable agriculture. The only disadvantage of the organic supplements is that they are required in bulk and they cannot be transported over distances. But this argument can be answered by the fact that most of these bulky organic supplements can be generated at the farm itself. The nutrient rich composts and bio-fertilizers also help in substituting market purchased inputs, and thus are economically attractive for the farming families.

Some of the important groups of bio-fertilizers are detailed below.

**Azolla-Anabaena symbiosis**

*Azolla* is the globally distributed small aquatic fern comprising of 7 living species. In their leaves a heterocystous di-nitrogen-fixing blue green alga *Anabaena azollae* is always present as symbiont. *Azolla* is an alternative N source. The agronomic potential of *Azolla* as bio-fertilizer for rice has been recognized in many countries including India, Philippines, USA, Sri Lanka and Thailand. A trial under International Network on Soil fertility and Fertilizer Evaluation for Rice (INSFER) conducted at 37 sites in 10 countries also confirmed the bio-fertilizer potential of *Azolla*. *Azolla* when grown in fallow rice fields increased its fresh weight by 2-6 folds in a week and produced 330 tons fresh biomass ha⁻¹ which was equivalent to 840 kg N.

**Nitrogen-fixing bacteria Rhizobium**

Symbiotic N₂ - fixation by *Rhizobium* with legumes contributes substantially to total biological nitrogen fixation (BNF). *Rhizobium* inoculation is a well known agronomic practice to ensure adequate nitrogen nutrition of legumes in place of fertilizer nitrogen. The three Rhizobial genera include *Rhizobium*, *Bradyrhizobium* and *Azorhizobium*. Root infection by Rhizobia is a multistep process initiated by pre-infection events in the rhizosphere. Various events which lead to the formation of nodules include mutual recognition of host plant and *Rhizobium* species, rhizobial adherence to the root hairs, root hair curling, root hair infection, division of cortical cell to form root primordia and finally formation of nitrogen-fixing tissues in the nodules. In the formation of nodules, several bacterial and plant genes are involved and structure, function and regulation of several such genes are now
known. Various bacterial genes involved in symbiosis are *nod*, *nif* and *fix* genes. Several plant genes, specifically induced in root tissue as a consequence of the interaction with Rhizobia, are known as nodulin genes. Rhizobia can infect wheat, rice, maize and oil seed rape forming nodule-like structures. The slow growing rhizobia are grouped under the genus *Bradyrhizobium* and the fast growing under the genus *Rhizobium*.

The ability to fix high amount of N (efficiency) is governed by the symbiotic capability between *Rhizobium* and the host plant. It may be necessary to introduce superior strains of *Rhizobium* to ensure adequate N$_2$ fixation for maximum growth and yields of the host plant. The performance of inoculation is variable. In pigeon-pea, significant increase in early nodulation due to inoculation was not always well correlated with the final grain yields. Increase in grain yield of the pigeon-pea ranged from 19 to 68% over un-inoculated controls.

**Diazotrophs**

Diazotrophs which comprise a large group of aerobic chemolithotrophs (*Thiopbacillus, Desulphovibrio*), anaerobic photoautotrophs (members of Rhodospirillaceae, Chromatiaceae and Chlorobiaceae), aerobic to micro-aerobic heterotrophs (members of Azotobacteraceae and Bacillaceae), Corynebacteriaceae (*Azotobacter*) and Spirillaceae (*Azospirillum*) are the free-living as well as associative form which fix nitrogen in the rhizosphere of a variety of crop species. Diazotrophs like *Herbaspirillum* spp. grow endophytically in the stems and leaves of sugarcane and rice. *Azoarcus* inhibits roots of Kallar grass (*Leptochloa fusca*) and rice. Although many genera of bacteria are isolated from the rhizosphere of various cereals, many members of *Azotobacter* and *Azospirillum* genera have been widely tested to increase yields of cereals under field conditions. Many experiments have been performed in several countries to investigate the effect of inoculation of various strains of *Azotobacter chroococcum* and *Azospirillum* spp. on cereals and grasses. *Azotobacter* is effective only in soil with a native *Azotobacter* population. *Azospirillum* are the other useful inoculants. It is widespread in distribution and easy to culture and identify. In Israel, field experiments with *Azospirillum* were carried out using different cereal crops. Multi-location trials in India showed that seed inoculation with *A. brasilense* increased the mean grain yield of pearl millet significantly at 6 out of 9 locations tested.

**Frankia**

*Frankia* is a member of Actinomycetes or ray fungi. It forms nodules with higher plants like *Alnus* and *Elder*. There is a need to determine the defence response of a crop to *Frankia* and technologies to engineer the plant to nodule with *Frankia*. It produces true mycelium and the spores are not produced.
Cynobacteria
Species of *Anabaena, Nostoc, Scytonema, Calothrix, Aulosira, Nodularia, Lyngbya* and *Mastigocladus* etc. are able to fix nitrogen. Most of the crops which grow in plenty of water like rice etc. have association of these blue green algae or Cynobacteria. It is a common observation that if a soil is under rice cultivation there is native cynobacterial flora and may not need fresh inoculation. If crops are changed as in most parts of the country, there is need to use fresh inoculums. Usually a mixture of these algae is used and not monoculture. The cynobacterial flakes are mixed at the rate of 10-15 kg ha\(^{-1}\) one week plantation.

Phosphate solubilizing bacteria
A large number of heterotrophic and autotrophic soil micro-organisms are now known to have the capacity to solubilize inorganic phosphates through their metabolic activities directly or indirectly. The solubilization of different types of insoluble phosphate varies with the type of microorganism, the type of phosphate available and available carbon source. Rhizosphere soil of wheat possesses a greater number of phosphate solubilizing bacteria than in the non-rhizosphere soil. *Bacillus spp.*, *Pseudomonas* sp., *Brevibacterium* sp., *Acrobacter acrogen*, *Serretia* sp., *Nitrobacter* and *Escherichia freundii* are important phosphate solubilizing and phosphate mobilizing microbes. Phosphatic bio-fertilizer was first prepared by the Russian scientists using *Bacillus megaterium* var. *phosphaticum* as phosphate solubilizing bacteria and the product was termed as ‘Phosphobacterin’.

Phosphate solubilizing fungi
Along with bacteria and actinomycetes certain fungi also solubilize phosphate. *Aspergillus awamori* has been found to be better solubilizer than *Bacillus polymyxa* or *Pseudomonas striata*. Phosphate solubilizing bacteria *Pseudomonas* and fungi *Aspergillus* are found in the rhizosphere of coconut and cocoa.

Plant growth promoting Rhizobacteria
Several strains in *Bacillus* have been patented for commercial production in developed countries. The plant growth promoters belonging to pseudomonads and bacilli play a major role in plant productivity. These are usually non-colonizers. The spore forming bacteria are promising organisms for microbial control. *Pseudomonas fluorescens* is registered as microbial pesticide against *Phytophthora* and *Rhizoctonia*.

Mycorrhiza for sustainable agriculture
The root fungus symbiosis is caused by mycorrhizae. The association of mycorrhiza is wide-spread in bryophytes, a large number of pteridophytes, most or all species of gymnosperms and some 90 per cent or more of angiosperms. The association of fungus and roots of higher plants is termed as ‘mycorrhiza’. Forest crops may have
ectomycorrhizae while endomycorrhizae are present in most agricultural crops. These mycorrhizae differ in their structure and in the systematic position of the fungi involved. There are 8 distinctive types of *Eucalyptus* ectomycorrhizas. Tropical ectomycorrhizas are synthesized on *Pinus ponderosa* by four fungi species, viz., *Amanita muscaria*, *A. pantherina*, *Suillus granulatus* and *Lactarius deliciosus*. *Russula aeruginea* is another fungus forming ectomycorrhiza in *Picea*. Ectomycorrhizal fungi grow best at pH 5-6. Excess of inorganic fertilizers suppress ectomycorrhizal development. It has been found that optimal development of ectomycorrhiza in Chir Pine nurseries occur when nutrients are present in the soil at half the normal level. Shading suppresses ectomycorrhizal development. The poor development of mycorrhizal root results in the stunted growth and chlorosis of leaves. The mycorrhizal plants are able to withstand better water stress condition than the non-mycorrhizal seedlings. The mycorrhizae are described as ‘Biofertilizer’ and ‘Biocide’. The multilayered mantle formed by *Pisolithus tinctorius* which envelops the entire root is typical ectomycorrhizae. The mantle of *P. bicolor* consists of sparse hyphae embedded in a considerable amount of mucilage, similar to ectomycorrhizae formed by *Wilcoxina* species on Pine. Arbutoid mycorrhizae (*P. tinctorius – Arbutus mycorrhizae* or association of ectomycorrhizae with *Arbutus*) may be a modified type of ectomycorrhiza, with structural difference determined largely by the host reaction to colonization by typical ectomycorrhizal fungi. The ectomycorrhizal association produces minor changes in the root morphology. The mantle surrounding the root is absent. There are two mycelial networks, one on outer side and one internal. The orchids have endomycorrhiza which is called Glomerate-endomycorrhizal association of a different type. Ectendo-mycorrhizae are characterized by presence of a mantle and mycelium penetrating the root cells.

**VAM: Vital for soil management**

Vesicular arbuscular mycorrhizal (VAM) fungi are ubiquitous soil microbes and are found associated with crop plants, forest plants and other plants. These fungi are not host specific but differ in their characteristic association with host rhizosphere. VAM has been reported from 1000 genera of plants representing some 200 families. Pinaceae, Orchidaceae and Caesalpiniaceae do not have VAM. Vamycorrhizae are formed by non-separate zygomycetous fungi belonging to the genera *Glomus*, *Gigaspora*, *Acaulospora*, *Enterophosphora*, *Sclerocystis* and *Scutellospore*. The fungi being obligate biotrophs, do not grow on synthetic media and hence are classified according to the morphological characteristics of the spores formed in the soil. Spores are present in dormant stage in soil. Surface wall layer spores seen under scanning electron
microscope may help to identify a species. Endomycorrhiza has been considered as biological enigma.

- Ecology of VAM: The distribution and occurrence of VAM differ both qualitatively as well as quantitatively with the change in edaphic factors and the type of vegetation. The pH of soil plays an important role; same pH may not be equally good for all. The number of spores in soil is also influenced by the season. Maximum number of spores is encountered during July-October. The number of VAM spore also varies with depth of soil and altitude.

- VAM multiplication: VAM fungi may produce zygospore, azygospore or chlamydospore. Most VAM fungi sporulate outside the plant roots in soil. However, there are 10 species of Glomus which possibly sporulate in root.

  Soil inoculum is produced in traditional “Pot-Culture”. Rhodes grass was found to be the best host. Sphagnum moss peat and nutrient film technique channels can be used for VAM culture. Large scale inoculum can be produced by aeroponics or tissue culture of root also. Expanded clay aggregates have been used for mass multiplying VAM fungi in Germany. Axenic culture of VAM (Glomus aggregatum) associated with Cymbopogon martini var. motia) has also been tried.

- VAM in agriculture and forestry: The effect of VAM on plant growth and yield has been extensively studied in relation to economically important plants like rice, jowar, pearl millet, soybean, groundnut barley, sunflower and ginger. A combination of legumes, rhizobia and mycorrhizal fungus brings a significant improvement in plant growth through increased availability of phosphorus together with nitrogen fixation in soil. Nitrogen fixing microbes interact with VAM fungi producing synergistic effects. The combination may prove the cheapest way to enrich tropical soil with nitrogen. Indigenous VAM stimulated growth in mung, green gram (Phaseolus aureus) and Urad bean in pot culture. Mycorrhizal fungi in agroforestry has been found useful for Acacia nilotica, Prosopis cineraria, Proposis juliflora, Acacia famensiana, tissue culture raised plants of edible bamboo (Dendrocalamus).

- Improved productivity in medicinal plants: Plant can serve as factories for the production of vital medicinal compounds. The effect of 3 Glomus isolates on neem seedlings has been reported. Organics amendment with Calotropis has been found useful for Glomus fasciculatum in improving the yields of alkaloid in Catharanthus roseus.

- VAM as disease-control agent: Fusarium disease severity in Albizia procera and Dalbergia sissoo was significantly reduced when inoculated with mycorrhizal fungi. VAM
formed by *Gigaspora* exerted an inhibitory effect on the development of pigeon pea blight caused by *Phytophthora drechsleri f. sp. cajani*. The addition of *G. fasciculatum* together with the pathogen *S. rolfsii* nullified the effect of the pathogen in peanut. Yields of two varieties of gram in the presence of fungicide metalaxyl increased when *Glomus* spp. were present. *Glomus lates* reduced the percentage of *Fusarium* infection in tomato and Capsicum roots at different rates. Not only fungi but some viruses too are known to be inhibited by VAM fungi.
पराबंधनी विकिरण, ओज़ोन परत और ह्यारा पर्यावरण

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संध्याक एवं मृत्तनामी वर्तमान/आयुर्विज्ञानी एवं पादप तात्विक प्रतिष्ठान प्रभाग
उपाध्यक्ष विधि बन अनुसंधान संस्थान, जबलपुर

पिछले कुछ दशकों में पराबंधनी विकिरण में हो रही वृद्धि का पर्यावरण पर अत्यंत विषमताकारी प्रभाव पड़ रहा है। पूरी दृष्टि में उम्मीद आवारा (एमिन्डिएन पॉपुलेशन) बढ़ते पराबंधनी विकिरण के प्रभाव के कारण नहीं हो रही है क्योंकि वैज्ञानिकों का ऐसा मानना है कि उम्मीद आवारा पारदर्शी एवं अच्छी संबंधतीन होते हैं। पराबंधनी विकिरण की वर्तमान स्तर के पलबयोरण घरों में प्रकाश संचय की गतिविधि में कमी आ रही है। प्रकाश संचय के जोड़ बने एक महत्वपूर्ण अंतरिक भाग है जिसके द्वारा पौधे जल और पृथ्वी के प्रकाश की उपस्थिति में शर्करा का निर्माण कर सकते हैं। घरों की इस क्षमता का पतन उनके लिए विभिन्न कारण हो रहा है। आयुर्विज्ञानी अवधारणाकार द्वारा पराबंधनी विकिरण की प्रतिरोधी पौधों विकिरण करने का दावा किया गया है। परिपूर्ण पराबंधनी विकिरण की प्रतिरोधी पौधों विकिरण होने के वातावरण में पारिवर्धिकी असंतुलन होने का बतरा भी हो सकता है।

पृथ्वी पर जीवन के लिए वायुमंडल में विभिन्न घरों का संतुलन महत्वपूर्ण है। अन्य घरों के समान ओज़ोन भी जीवन की गतिविधि में आवश्यक भूमिका निभाती है। ओज़ोन घरों पृथ्वी के वायुमंडल के ऊपरी हिस्से में एक ऐसा आवरण बनाती है जिसमें अंतरिक ने पृथ्वी की सतह की ओर आने वाला हानिकारक पराबंधनी विकिरण ऊपरी वायुमंडल में ही रकम जाता है। इस प्रकाश धरती के जीव-जंतु हानिकारक पराबंधनी विकिरण के उपारोधक से बचे रहते हैं। लेकिन अगर पृथ्वी पर विभिन्न जीवन-सहायक कारकों का संतुलन बिगाड़ रहा है और ओज़ोन आवरण भी हीना होता जा रहा है। ओज़ोन आवरण के पतले होने के कारण पृथ्वी पर हानिकारक पराबंधनी विकिरण की अधिक मात्रा पहुँच सकती है। इसके परिणामस्वरूप व्यायाम रोग एवं कैंसर जैसी विकृतियों में वृद्धि होने की संभावना है। असल में ओज़ोन आवरण के शीर्षेन्द्र का सम्पूर्ण वायुमंडल में हाज़र क्लोरोफिलीक कार्बन व अन्य हानिकारक रसायनों की मात्रा में वृद्धि हुई है। इस तथ्यों का रिसाव रेफ्रिजरेटर, एयरकंडीशनर, घरें और कुछ औद्योगिक कारों में होता है। इस स्तर के निर्माताओं के लिए रोजगार, दूरसंचार और जानकारी के लिए वायुमंडल में हाज़र होने की आवश्यकता है। इसलिए अगर ओज़ोन नष्ट हो जाए तो विभिन्न घरों पर वायुमंडल में हाज़र होने की आवश्यकता है। घरों में उपलब्ध संसाधन (टरी) ने देखा गया है जो बढ़ते ओज़ोन के स्तर के बारे में आपात किया है। टरी की 2010 में भारत
के कुछ बड़े शहरों में हवा की गुणवत्ता सम्बंधी आकड़ों के अध्ययन से ये परिणाम मिले हैं। टेरी ने बिंता जाहिर की है कि यदि 2030 तक ऐसा ही चलता रहता तो ओजोन और कण पदार्थ, दोनों ही उद्वेद्ध तक पहुंच जाएंगे।

ऐसा माना जाता है कि पृथ्वी के निर्माण के प्रारंभिक दिनों में यहाँ पर पराबंगनी किरणों (अल्ट्रा वायलट रे.) की बरसात होती थी। इसलिए पृथ्वी पर जीवन असंभव था। उस समय वायुमंडल में आक्सीजन बहुत कम मात्रा में थी।

समय के साथ-साथ आक्सीजन की मात्रा बढ़ती गई और वह अल्ट्रा वायलट किरण आक्सीजन को ओजोन में बदलने लगी। पृथ्वी के चारों ओर स्थित समतापमंडल (एक्स्ट्रोस्फीयर) में अर्थात टन ओजोन गैस जमा हो चुकी है।

यदि यह न हो तो सूर्य ने निकलने वाली पराबंगनी किरणों से पृथ्वी पर मंडल और पृथ्वी समाप्त हो सकते हैं।

मानवजाति के लिए आक्सीजन के बाद एक ओर वरदान लाभ हुई, तो दूसरी ओर यह उनके विश्वसनीय कारण भी बनी हुई है। ओजोन परत के तेजी से हो जाते हैं, यह ओजोन परत के तेजी से हो जाते हैं, यह ओजोन परत के तेजी से हो जाते हैं, यह ओजोन परत के तेजी से हो जाते हैं, यह ओजोन परत के तेजी से हो जाते हैं, यह ओजोन परत के तेजी से हो जाते हैं, यह ओजोन परत के तेजी से हो जाते हैं, यह ओजोन परत के तेजी से हो जाते हैं, यह ओजोन परत के तेजी से हो जाते हैं, यह ओजोन परत के तेजी से हो जाते हैं, यह ओजोन परत के तेजी से हो जाते हैं, यह ओजोन परत के तेजी से हो जाते हैं, यह ओजोन परत के तेजी से हो जाते हैं,
समुद्री जीवन को भी धरती के बढ़ते नामकरण और यात्रामंडल में बढ़ रहे कार्यन के अलग विक्रमादि का (1862) क्षणिक रूप से भी जाता है। अंतरराष्ट्रीय शोधकर्ताओं के अनुसार पररावेदनीय विकसित समुद्री जीवों और पौधों के लिए मान्यता पाने की अपेक्षा तत्कालीन में समुद्री जीवों पर ज्यादा 1784 ग्रामों का गहनता से अधिकतम पररावेदनीय विकसित (पूर्वी) के हानिकारक प्रभावों का माना जाता है।

प्रभाव की मान्यता के लिए वर्तमान के उपयोग मुद्र से संबंधित है। 

अंतरराष्ट्रीय प्रभाव के कारण नकारात्मक प्रभाव की जानकारी के लिए परअंतर्राष्ट्रीय शोधकर्ताओं के अनुसार समुद्री वर्तमान के अनुसार पररावेदनीय विकसित समुद्री जीवों और पौधों के लिए मान्यता पाने की अपेक्षा तत्कालीन में समुद्री जीवों पर ज्यादा 1784 ग्रामों का गहनता से अधिकतम पररावेदनीय विकसित (पूर्वी) के हानिकारक प्रभावों का माना जाता है।

प्रभाव की मान्यता के लिए वर्तमान के उपयोग मुद्र से संबंधित है।
पराबंगनी कीर्तियाँ से हमारी रथा करती है। आलूपिनिया का उत्पादन हमारे सामने है, जहाँ ओजोन परत को काफी नुकसान पहुंचा है। इसी तुलसी की वजह से सूर्य की पराबंगनी कीर्तियाँ से बड़ी संख्या में वहां लोग रचत के कैपन का संचार हुआ है। एक अन्य रचत इसके कारण खुद के पिचलन का है। एंडर्सहार्टिका में ओजोन में एक बड़ा घरा हो गया है। एंडर्सहार्टिका के में इसे हिस्से हैं। इस के हिस्से पिचलन है तो तीन क्षेत्रों में वाद में इस के बादरे पैदा हो सकते हैं। इसके अलावा भी कोई बड़ी जो नुकसानबायी होगी। ओजोन परत के अर्थ के के के लसोरीन और ब्रोमीन को अनु जिम्मेदार है। जब इस अनुच्छेद में वूकू गैस में पराबंगनी के छोटे जानी है तो ये कालांतर में ओजोन परत के अर्थ का कारण बनती है। ओजोन परत को नुकसान पहुंचाने वाली सबसे आम हेंसोनज गैस क्योंक्षेत्रों के कारण है जिसमें ये.एफ.ए. के नाम से भी जाना जाता है। इसे बनाने के लिए सबसे घरा है जो ओजोन परत और इसके संरचन को लेकर जागरूक हों। भी लोगों को उन पदार्थों और उनके नुकसान को लेकर जागरूक रहना चाहिए, जो इस परत को नुकसान पहुंचाने है। कई आमतौर पर इसे किसी असाध्य रोग से लेकर अंधेपन तक की नथथनत अवसर है। ओजोन परत को बचाने का चाहिए जब सकता है जैसे पराबंगनी मित्र उपायों का इस्तेमाल करना, एपरोसोन और अन्य सीसीम और वूकू बीजों के उपयोग में बदलना, पायथ्रोपरण को ठप्पा बनाना, यदि फीजर और वातावरण का नतीजा करा रहा तो उसे ठीक करना आदि। इस तरह की कई छोटी छोटी बातें हैं जिनका द्वारा रक्षा ओजोन परत को बनाने में उपयोग दिया जा सकता है। उल्लेखनीय है कि ओजोन परत तकरीबन 97 से 99 प्रतिशत पर तराबंगनी कीर्तियाँ का अवशेषण करती है। इसके संरचन को कलिया धारण करने के लिए माइट्रलट्रोपराकॉन्स के आसार 16 सितंबर को ओजोन विभा के रूप में मनाया जा रहा है।

ओजोन एक हकके नींते रंग की में है। यह आक्रामन के तीन परमाणुओं का यथिक है। वातावरण के ऊपरी भाग में सूर्य की उद्घ चन्दन वाली पराबंगनी कीर्तियाँ से हिया करके आक्रामन के तीनों परमाणुएँ एक साथ बुझ जाते हैं। यह गैस एंडिफिकर, ड्रोनोफिकर एवं एंडिफिकर में एक समान रूप में पायी जाती है। ओजोन परत जमीन में 10 किलोमीटर के 60 किलोमीटर के उड़ियो के के बीच एंडिफिकर में पायी जाती है। इस स्वयंचार पर वायु में ओजोन का अर्थात गैस के वातावरण में पाये गए अर्थात से अधिक होता है। यह गैस सूर्य की पराबंगनी-विकिरण के लिए एक अच्छे फिल्टर का काम करती है।

सूर्य कीर्तियों के अद्वैत भाग में अवधिक ऊंचाई पर वर्तमान-नी (220-280 नैनोमीटर), पराबंगनी-बी (280-320 नैनोमीटर) तथा पराबंगनी-ए (320-400 नैनोमीटर) कीर्तियों होती हैं। पराबंगनी के और भी जीवन के लिए बनता है। स्ट्रूटसफायर में धार्मिक ओजोन परत पराबंगनी-नी का दिवसांतर भाग चीक है और केवल 2-3 प्रतिशत भाग पृथुवी की सतह तक पहुंच पाता है।

ओजोन परत में अगर कोई भी होता है, तो पृथुवी की सतह पर पराबंगनी की और भी के अधिक कीर्तियाँ पहुंचेंगी, जिसमें भिन्न भिन्न रोग से लेकर अंधेपन तक की नथथनत अवसर है। ओजोन परत के इस होने से अगर भी वाली पराबंगनी कीर्तियों की बढ़ती मात्रा के कारण धरती वीरान होना है। यह विकिरण वार्षिक रूप से बन्धतयों से लेकर जीव-जन्तुओं तक को समान रूप में हानि पहुंचाती है। मनुष्य में इसके आंख की बीमारियों व बैंडर जैसे बुखार रोग से लेकर अंधेपन तक की स्थिति आ सकती है। इसके लीजे संकर में आने में अन्य दर्जन से लिया स्थान के कंपॉकर वाली पृथ्वी की सतह से वाली पृथ्वी की लोगों व के अवसर है। इसके लायक आता है।

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Van Sangyan: August, 2014
औद्योगिक युग की शुरूआत के साथ ही ओजोन परत की अगुवाई भी शुरू हुई।

सर्वप्रथम, वैश्विक ओजोनोजोरिया विविध-विविध राायनशास्त्री मार्गो मोलाइया तथा बेसर्वबुड गरोल्ड ने क्लोरोफ्लो जैसे कार्बन (मी.एफ.मी.) नामक रसायन की खोज की थी। उन्होंने पता लगाया था कि ओजोन जैसे धरती के रक्षा परमाणु को समायोजन हानि पहुँचने वाला यही पदाथा है।

प्रत्येक अमरीका ने अपने पहले इस रसायन का प्रयोग एयर कंडीशनिंग, रेफ्रीजरेटर के अत्याधुनिक यंत्रों के निर्माण में किया। बाद में, अन्य पश्चिमी देशों—इंग्लैंड, जर्मनी, फ्रांस ने भी इसका अंप्रायूंच प्रयोग करा शुरू कर दिया।

मनुष्य के कुछ क्रिया-कार्यों के फलस्वरूप निकलने वाले रसायन ओजोन परत को क्षति पहुँचा रहते हैं। इन रसायनों को ओजोन परत (ओ.डी.एस.) कहते हैं। इसका उपयोग रेफ्रीजरेटरों और प्रशीतन ईर्पक के अतिरिक्त ब्रिटेन, यूनाइटेड रायल प्रशीतन और स्वास्थ्य उत्पादों, फॉम्प के निर्माण, उद्योगों में मुद्दों मार्ग यंत्रों और लड़न पूर्व प्रक्रियाओं में भी किया जाता है। इसके अतिरिक्त, सुपरसोनिक विमान उड़ान कर उठते हैं जो मुरात्मक ओजोन परत को सुकमान पहुँचाते हैं।

उच्च तापमान के कारण, नाइट्रोजन और अक्सीजन मिलकर नाइट्रिक आक्रायड बनते हैं, जो ओजोन परत को हानि पहुँचाता है। रोमोफ्लोकाबान (हैलोन) रसायन पदार्थ जो आग बुझाने में आयत नाइट्रोजन से ओजोन को सुकमान पहुँचाता है। कार्बन इफ्फ्रिजरेट होमोफ्लोकाबान तथा फ्रेसुरोजन दो अन्य रसायन हैं, जिनमें क्लोरिन पाया जाता है, को काफी हद तक नियंत्रित अवस्था में स्ट्रीटलीवर में पहुँच जाता है, जहां पर यह ओजोन परत को हानि पहुँचा सकता है।

ओजोन परत बचाने की शुरूआत सर्वप्रथम सन् 1972 में स्टर्डोहम में हुए प्रथम संयुक्त राष्ट्र पर्यवेक्षण सम्मेलन में हुई। इस सम्मेलन में सैकड़ों सुपरसोनिक विमानों का वायु ओजोन परत का दर्शाव रखा गया। ओजोन परत की क्षति के लिए राष्ट्रीय आयोग के रूप में वर्ष 1977 में व्यूनिटन में 32 देशों की एक बैठक हुई। जिसमें ओजोन परत की सुरक्षा के लिए एक कार्य योजना को अपनाया गया। ओजोन परत की भारी क्षति के बारे में जानकारी 1985 के विश्व सम्मेलन में दी गई। इस सम्मेलन में नियंत्रित किया गया था कि विविध के सब देश ओजोन पर रसायनों का
आथतेमाल पर रोक लगा दी गई थी। मं पहली जनवरी अनधसूनचत करया गया है। अनुष्ठान के अंतगत कुछ पालन सुनन्नित करने वाले नए ईद्योगं को नवत्तीय सहायता देने पर रोक लगा दी तकनीकी हथतांतरण के व्यय को नवकनसत देशं द्वारा वहन ओजोन हाननकारक पदाथं के प्रनत व्यनक्त करये। भारत के दबाव के कारण आसमं एक जल्दी समाप्त करने की बात कही गई थी। ननरापद गैसं के प्रयोग के नलए नवकासशील देशं को यह भी ननणाय नलया गया कक ओजोन को नुकसान पहुंचाने संशोधन ककया गया। आसमं ननणाय नलया गया कक ओजोन महत्वपूणा सम्मेलन कनाडा के शहर मांररयल मं प्रभाव तथा आसके मनुष्य के थवाथथ्य एवं प्राकृतिक पर परन्तु नवकनसत देश जल्दी बंद कर दं। आस सम्मेलन भारत ने आस समझौते पर ओजोन परत को बचाने की कदशा मं सबसे डेनमाक ा के शहर कोपनहेगन मं हुए एक के अयात और ननयाात को ननयनमत करने के ननयमन एवं ननयंत्रण ननयम। आस सम्मेलन मं नलए गए ननणायं प्रदान करंगे।

भारत ने इस समझौते पर 1992 में हस्ताक्षर किये। भारत के दबाव के कारण इसमें एक अनुच्छेद 5 जोड़ा गया था। इस अनुच्छेद के अनुसार ओजोन हानिकारक पदाथों के प्रति व्यक्ति 300 ग्राम से कम ब्यः बने देशों में इस पदाथों के प्रयोग को बंद करने तथा तकनीकी हल्लांतरण के ब्यः के विकसित देशों द्वारा वहन किया जाएगा। भारतीय रिवाज वेंब ने सभी नित्यी पंथाओं और बैंकों को निर्देश जारी कर ओ-डी.एस तकनीकी बालने और उद्योगों को विचार सहयोग देने पर रोक लगा दी है। ओडीएस के आवाज और निर्देश को नियमित करने के लिए नामांसिम्प्रमाणी शून्य की गई। मांडित्रिय को पालन सुनिश्चित करने व बालूनी सुविधा प्रदान करने के लिए ओडीएस नियमन एवं नियम नियम , 2000 भी अध्युच्छित किया गया है। इस नियम के अंतर्गत कुछ आवृत्यक द्वारों के उत्पादन को होस्टक विभिन्न उत्पादों में पहली जनवरी, 2003 के बाद भी सी एफ सी के इलेमेन लेख नया दी गई थी।

ओजोन परत का छिद्र अटाकेनिका के उपर स्थित है। यह सामान्यतः दिसंबर और अप्रैल के दौरान बढ़ता है। इन्हीं बातों को प्रान्त में रखने हेतु संयुक्त राष्ट्र महासभा ने 23 जनवरी 1995 को एक प्रशासन पारित किया।

इसमें ओजोन की दीमती परत की ओर लोगों का ध्यान आकर्षित करने और इसे गुपित करना रखने तथा जन- सहयोग प्राप्त करने के उद्देश्य से 16 सितंबर को अंतरराष्ट्रीय ओजोन दिवस मनाने की योग्यता की गई थी। 16 सितंबर का दिन इससे बुधवार को एक दिन 1987 में ओजोन के दीमज पले के लिए जिम्बेब्वे पदार्थों की दीमज-दीमज समाप्त करने वाली मांडित्रिय मंदिर से हस्ताक्षर किए गए थे। इसी बात को प्रांत में रखने हेतु हन्निवार 16 सितंबर, 1995 को विवेक भारत में पहला ओजोन दिवस मनाया गया था। परत्य बाद ओजोन परत दिवस मनाने की ही इस दिशा में महत्वपूणा प्रयास नहीं कहलाए जा सकते हैं। इसके लिए आवश्यकता है विकासशील, विकसित देशों और अंतरराष्ट्रीय संघों के बीच आपसी तात्पर्य की, तभी हमें इस कार्य में मनमोहन प्राप्त हो सकती है।

अन्तराष्ट्रीय परियोजनों से यह जात हुआ है कि बायोमॉडल में छोड़े जाने वाले ही लोगों और ईंधन युक रमायण ओजोन परत को तुकसान करने की चेतावनी दी जा रही है। अन्तराष्ट्रीय समझौते के एक स्तर या सुरज के पराबंधन विश्व भर में प्रदान करने वाली कार्बन और जीव-जंतुओं पर धार्मिक प्रभाव दांवत हैं। अन्तराष्ट्रीय परियोजनों के आधार पर मांडित्रिय समझौते की शर्तों में यह तय किया गया कि इस पर हस्ताक्षर करने वाले देश ओजोन परत को तुकसान पहुंचा रहे वे तत्कालीन कार्बन (सीएफसी), हेमोन और कार्बन देटा क्लोराइड जैसे तत्कालीन कार्बन को एक नियमित अधिक में पूरी तरह बनाने कर देंगे। बाद के अवधनों में ओजोन परत के लिए हाउड़ो कीलर समाप्त को भी पातक पाये जाने के बाद इसमें सी एक तथ अधि के बनने करना तथ हुआ।
सीएिसी श्रेणी का उत्पादन तक अनुमति ली गयी थी। 2009 में देश में भूमध्य बाध्यता की शैक्षणिक बचाव के लिए उद्योग सरकार ने 1993 में मंगल बैठक में आयी हुई इसकी मूल आधार से देिने के बाद इसका उत्पादन शुरू कर दिया गया। 1987 में 24 देशों के प्रतिनिधियों का मानदंड में बैठक आयोजित की गई। अगले साल 2010 में दी यह धारण को रोकने के लिए 2010 के अंदर एचसीएिसी मैं की सीमा पर तकनीकी जागरूकता बनाये गए। बीजापुर में विद्युत का उत्पादन के लिए इसकी मूल आधार नीति नहीं है। 2009 में देश में एचसीएिसी मैं का उत्पादन और इलेक्ट्रोमाग्नेटिक जानकारी पर तकनीकी जागरूकता बनाये गए। बीजापुर में विद्युत का उत्पादन के लिए इसकी मूल आधार नीति नहीं है। 2009 में देश में एचसीएिसी मैं का उत्पादन और इलेक्ट्रोमाग्नेटिक जानकारी पर तकनीकी जागरूकता बनाये गए।
मौसम परिवर्तन जैसी मौजूदा चुनौती से निवटने में भी इसकी बड़ी मूर्तिका रही है।

प्रकृति में प्रत्येक कारक का अपना-अपना स्थान निभाता है जिसके चलते वह नाखुशारी और हानिकारक हो सकता है। लेकिन प्रकृति ने मानव को ऐसा दिया दिया है जिसके बल पर हानिकारक तत्त्वों को पहुँचा सकता है और उनका उपयोग सीमित करके उनसे होने वाले तुक्कून से निजात पा सकता है। इसलिए आम जनता को ओजोन आवरण को बनाने के लिए ऐसे उत्पादों का प्रयोग सीमित करने का प्रयास करना चाहिए जो ओजोन गैस के विषय के लिए ज़िम्मेदार तत्त्वों से बने होते हैं।
Biotechnology for forests

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Biotechnology is one of the frontier areas of scientific development in the world today. The definition of ‘biotechnology’ as in Article 2 of the UN Convention on Biological Diversity is “any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use”. Biotechnology is the modification and use of living systems/organisms to develop or make useful products, and it includes everything from the use of improved microorganisms in making food products, to the synthesis of nanopeptides in plants for use in repair of tissues in regenerative medicine.

Biotechnology harnesses cellular and molecular processes to develop technologies and subsequently products that help improve the overall living standards of human beings. Though genetic transformation is involved in most of the biotechnological applications developed, biotechnology is not merely the creation of a transgenic (genetically modified) organism. These applications make use of biochemical methods, microbial techniques and advances in molecular biology, apart from the living system to which it is targeted. The techniques employed are not exhaustive or restricted to the above and innovations are being incorporated from time to time for constructive progress.

Biotechnology finds immense use in improving crop and livestock (along with poultry and fisheries) production. It is being harnessed in various aspects of the livestock industry to produce high yielding animal, for enhanced reproduction, to improve nutritional quality and safety of animal-derived foods and their bio-preservation, for production of enzymes and designer livestock products, in meat authentication and so on. With advances in sequencing farm animal genome, the continuing progress in molecular marker technology, and the use of reproductive biotechnology, windows of research opportunities are being opened to improve and revolutionize the livestock industry.

A wide range of crop biotechnologies are available and used increasingly, especially tissue culture based techniques (such as micropropagation and somatic embryogenesis), mutagenesis, interspecific or intergeneric hybridization, genetic modification, marker-assisted selection (MAS), disease diagnostics and bioprotection, and biofertilization. The use of biotechnology benefits agricultural development through
reduction in breeding programme durations, production of improved varieties by MAS, obtaining plants with desired traits by combining cell and tissue culture with new methods of hybridization, and the production of transgenic crops engineered for resistance to pests, diseases, adverse weather conditions and for better nutritional quality.

**Forest biotechnology**

Forests and other wooded areas perform key economic and ecological functions. The primary goal of forest tree improvement was to identify and select wild seed sources suitable for planted forests. Few recurrent breeding programmes developed from this, not excluding shortfalls in the long-range stability, funding and continuity of efforts required to sustain any forest planting programme. A few tree-improvement programmes matured into recurrent forest tree breeding programmes (improving the genetic value of the population while maintaining genetic diversity). The biological imperative to balance genetic gain against genetic diversity has not only given rise to forest tree programmes that do not resemble those for crops or livestock, but also to novel solutions.

The techniques used for crops hold good for trees also, yet their uses for forestry species are not without limitations. The forestry sector differs from the crop or livestock sectors in a number of important ways. Forest trees are highly heterozygous long-lived perennials with late sexual maturity and a lengthy regeneration cycle. Most forest tree species have narrow regional adaptation and are largely undomesticated. Forest biotechnology applications are specific to each type of forest. Among the range of biotechnologies used, those for planted forests are quite different from those for naturally regenerated forests, and it depends on the level of management intensity (e.g. intensive, semi-intensive) and the genetic material being used (e.g. wild material, genetically improved trees).

Tree improvement uses biotechnologies like hybridization, clonal propagation, inducing mutations (γ-irradiation, UV treatment), polyploid (with more genetic base) selection, use of molecular markers and transgenic technology (for production of improved varieties). Forest biotechnology applications have historically been developed for the benefit of planted forests. The use of tissue culture based micropropagation, application of biofertilizers and genetic fingerprinting using molecular markers are some of the techniques used for less intensively managed planted forests. Whereas, in planted forests that provide raw materials for industries, techniques involving molecular markers, QTL (quantitative trait locus) analyses, somatic embryogenesis and functional genomics find use.

Though sophisticated techniques like backward and reverse genomics approaches,
whole genome sequencing and gene silencing approaches can also be utilized, low-cost tissue culture based clonal propagules which are disease free, marker assisted breeding and selection, and genetic modification for novel traits are much sought after for the most intensively managed forests.

Genetically Modified (GM) trees

The genetic modification of a tree involves the transfer and stable integration of a gene responsible for expression of an economically important trait into the genome of the tree. The gene being transferred could either be a cisgene (gene isolated from the same species) or, a transgene (foreign gene / gene from another organism). The genetic modification of any organism with a transgene results in the production of a transgenic organism. The transfer of multiple genes, all responsible for the expression of either a single desired trait or for more than one trait, is also possible. Genetic modification also includes the suppression of genes related to undesired or detrimental characters through gene-silencing approaches. Important traits considered for production of GM trees include drought tolerance, lignin content, insect and fungal resistance.

Many countries currently have biosafety regulations for the production and use of GM agricultural crops, including fruit-trees. In India, there are no regulations, specific only to the production and use of GM trees. All Genetically Modified Organisms (GMOs) and products thereof are regulated as per the “Rules for the manufacture, use / import / export and storage of hazardous microorganisms / genetically engineered organisms or cells, 1989” (commonly referred as Rules, 1989) notified by the Ministry of Environment and Forests (MoEF), Government of India under the Environment (Protection) Act (1986). Before a genetically modified crop or tree is released into the environment, field trials with rigorous monitoring need to be carried out. After experimentation under contained conditions such as in the laboratory and greenhouse, Biosafety Research Level I (BRL-I) trials are performed in the field with the approval of RCGM (Review Committee on Genetic Manipulation), which is followed by BRL-II trials with the approval of GEAC (Genetic Engineering Approval Committee).

An application to GEAC for the environmental release of a GM crop will not be considered unless First crop season of confined field trials at the level of BRL-I, followed by Second crop season of confined field trials at the level of BRL-I or BRL-II, and Third crop season of confined field trials at the level of BRL-II have been completed. In case of trees with long regeneration cycles, genetic manipulation for production of new traits may turn futile, as it will take longer for completion of field trials for three generations before release into the environment, by
which time the new trait will no longer be considered valuable.

Though most GM trees are being modified for insect resistance, stress tolerance and lignin content are also being experimented. GM Rubber tree for enhancing quality i.e., tapping panel dryness tolerance, is the only GM tree that is undergoing approved field trials in India. For the rubber tree, improvement through conventional breeding is limited by long breeding cycles and high levels of heterozygosity. The GM Rubber trees have better drought resistance and increased environment stress tolerance. The target gene incorporated comes from rubber itself, and so it is not transgenic in its strict sense.

In India, no other GM tree produced has gone up to the point of field trials. Whereas, commercial planting of GM poplar has already been done in China on 300 to 500 ha. Though the nation seems to be lagging behind others in the environmental release of GM trees, requirements like the long term confined field trials cannot be omitted. The wider application of genetic modification is also slowed down by severe limitations on the kinds of traits available, complex intellectual property rights regimes and regulatory issues, and the often negative public perception.

Future perspectives

The area of forest biotechnology is expanding from tools development into more hypothesis-driven knowledge acquisition. It is moving from molecular markers into genomics. Biotechnology tools such as molecular markers and the field of genomics can provide knowledge about naturally regenerated tropical forests and important insights into the nature of the entire tropical forest ecosystems including the relationship between forest trees and the microbial communities with which they interact, and this can influence the strategies employed for managing tropical forests.

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Flowering Plants and Insects

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Insects are known to be the most successful and diverse animals on earth. Insects are under credited for their beneficial services. Most of the flowering plants and insects are interdependent for mutual benefits and also for survival. They have developed an intimate insect-plant symbiotic relationship to one another and coevolved. Both the insects and plants have undergone many structural and morphological changes that make them dependable to each other. The association is so deep if insects decrease in number plants also shows its effect by lowering its number.

Relationship of Insects and Plants

Plants are directly dependent on insects for reproduction. Plants propagate by asexual i.e without involvement of gametes, or sexual reproduction i.e involvement of gametes. Most higher plants propagate by sexual reproduction which occurs by process known as pollination. In some plant species pollination occur by wind, in few species by birds and in majority of plant species pollination occurs by insects. In this process, pollen grains are transferred from the anther to stigma of flower. Pollination patterns in plants are of two types i.e self pollination and cross pollination. When pollen is transferred from anther to stigma of same flower it is known as self pollination or self marriage. But in most of unisexual flowering plants reproduction occur by transfer of pollen from anther of one flower to stigma of another flower and this phenomenon is known as cross pollination or allogamy. Cross pollination plays important role in genetic diversity by exchange of genetic material between two different plants which helps in improvement of traits. When flowers are once fertilized then the corolla soon drops.

Need of Insects as Pollinators

Visit of insects are of great importance to plants due to various reasons. In many plants stamens and pistils are situated in separate flowers. Sometimes relative position of stamens and pistils in same flower makes them not possible to self fertilization. Certain cases they both mature at different times and these plants are generally dependent on visit of insects for pollination. The plants which are pollinated by insects are known as entomophilous plants.

Flowers as pollen and nectar sources

A flower comprises of four different floral parts i.e calax, corolla, stamens and carpals. Corolla is brightly coloured, scented. Their main function is attraction of insects and other animals for pollination. Stamens consist of filament, anther and connective. Each lobe
of anther consist two chambers known as pollen sac. Each pollen sac contains pollengrains which are needed to growth, development and multiplication of the insects. Honey bees, butterflies, moths, grasshoppers, Ants, beetles etc are major insect which are closely linked with pollination of numerous plant species. Moths are dull in colour and nocturnal in habit they pollinate night blooming flowers. Butterflies pollinate flowers that have strong scent, red or yellow in colour and produce large amount of nectar. Nectar is important component of butterfly's diet. Butterflies pollinate flowers less efficiently than the bees but their role is very useful. Among the all the insect pollinators honey bees are major insect pollinators.

**Interaction of plants and Insects**

Since time immemorial we have known that flowers are of great importance to insects. Sweet scent and bright colour of flowers attract the insects towards plant. Lines and circles on the corolla guide them to right spot of honey or nectar. Most of the night blooming flowers do not posses these lines or circles. Irregular flowers are always fertilized by insects. Night flowers are generally white, pale yellow, light brown, flesh coloured and odoriferous.
Most of the flowers which open at day are red and which open at evening are white. Flowers are necessary to existence of insects and insects on other hand also necessary to existence of insects. Insects show modification in themselves to obtain nectar and pollen from flowers. Flower in turn also change and adapt to the distinctive forms to the action of insects. Thus there is an interaction of insect upon flowers and of flowers upon insect resulting in gradual modification of both. Most of the time it is seen that plants visited by bees or other insects are more healthy as compared to wind pollination. Most of the insect pollinated plants close flowers or sleep for certain periods but most of the wind pollinated flowers remain open all time. Such phenomenon helps in protection of honey and pollen from robber insects which are not capable to fertilizing them. Some of the flowers which attract flower by their scent them emit their scent at particular times of the day and night. In some species of plants two types of flowers one is larger which are fertilized by insects and others are smaller flowers which are self fertilized. Pollen of the plants which are fertilized by insect are sticky in nature as compared to wind pollinated flowers which is dry in nature.

**Bee Pasturage**

Bees are the most important plant pollinators. Many plants yield pollen, some yield nectar and others yield both. The plants which provide both pollen and nectar to honeybees are known as Bee Pasturage or Nectar and Pollen plants or Bee Flora. Bees normally avoids visiting poisonous plants whose nectar and pollen contains toxicants. *Dalbergia sissoo*, *Gmelina arborea*, *Bombax ceiba*, *Hibiscus rosa sinensis*, *Magnifera indica*, *Litchi chiensis*, *Malus pumila*, *Calotropis procera*, *Tanacetum dolichophyllum*, *Cosmos bipinnatus*, *Delonix regia*, *Helianthus annus*, *Centaurea cyanus*, *Althea rosea*, *Ageratum conizoides*, *Cassia fistula*, *Cassia occidentalis*, *Butea monosperma*, *Toona ciliata*, *Pongaamia pinnata*, *Acacia nilotica*, *Albezia lebbeck*, *Azadirachta indica*, *Eucalyptus spp* etc are the some of the reported bee pasturage.
Insects and Plant Families

Ranunculaceae, Brassicaceae, Papaveraceae, Malvaceae, Caryophyllaceae, Rutaceae, Papilionaceae, Rosaceae, Cucurbitaceae, Cactaceae, Umbiliferae, Apocynaceae, Asclepiadaceae, Boraginaceae, Convolvulaceae, Solanaceae, Scrophulariaceae, Orobanchaceae, Labiatae, Euphorbiaceae, Moraceae, Orchidaceae and compositae are the families in which pollination occurs mainly by insects. Amaranthaceae, Chenopodiaceae, Polygonaceae, Crassulaceae, Cyperaceae, Gramineae are the families in which pollination occur by the wind. Low pollen production, small inconspicuous flowers, dry pollen, feathery stigma, absence of nectar and scent due to which insects are not attracted to the plants. As a source of honey no other family compares with Papilionaceae. Plant species of this family are most preferred for artificial culture of honey bees. Compositae is the largest family of most of the countries of the world. This remarkable success is due to perfection in pollination mechanism.

Interaction between insects and flowering plant is needed for survival of both, increasing productivity of crops and improvement of livelihood of people. This is only to the honey bees which are able to harness the major portion of nectar and pollen in the form of honey from plant kingdom which otherwise go waste. Hence insects and plant relationship is very necessary for ecological balance and to fulfil human needs.
Soils of India
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As early as 5000 B.C. the Vedas, Upanishads as well as other ancient Indian documents mention soil as synonymous with land – the mother – supporting and nourishing all life on the earth. To the farmer, soil is that portion of the earth surface which he can plough and grow crops. To the poor man soil forms the major ingredients of the mud walls of his house. To the rich man the same soil is used for making bricks to be used as building materials.

Origin of Soil
Soils are formed as a result of weathering of rocks and minerals. Weathering is the disintegration and decomposition of rocks and minerals by physical and chemical process.

The soil is defined as
• The unconsolidated mineral or organic material in the immediate surface of the Earth that serves as a natural medium for the growth of land plants.
• The uncemented aggregate of mineral grains and decayed organic matter with liquid and/or gas in the pores between the grains.

The soil is characterized by varying types when the unconsolidated mineral or organic matter on the surface has been subjected to and shows effects of formation and environmental factors of climate, macro- and microorganisms acting on parent material over a period of time.

Components of soil
Soil contains 45% mineral matter, 25% water, 5% organic matter and 25% air.

SOIL GROUPS OF INDIA
The major soil groups are black soils, red soils, laterites and lateritic soils and alluvial soils.

Regur Soils
• These soils are black in color and are also known as black soils.
• Since, they are ideal for growing cotton, they are also called cotton soils, in addition to their normal nomenclature of regur soil.
• These soils are most typical of the Deccan trap (Basalt) region spread over north-west Deccan plateau and are made up of lava flows.
• They cover the plateaus of Maharashtra, Saurashtra, Malwa and southern Madhya Pradesh and extend eastwards in the south along the Godavari and Krishna Valleys.
• These soils are dark Gray to black color, have high clay content, high swelling and shrinkage plasticity, and deep cracks during summer.
• These soils are calcareous, neutral to slightly alkaline, high CEC, poor in organic matter, nitrogen and phosphorus.
Species found are *Acacia nilotica*, *Aegle marmelos*, *Ailanthus excelsa*, *Albizia lebbeck*, *Albizia procera*, *Artocarpus integrifolia*, *Azadirachta indica*, *Eucalyptus hybrid*, *L. leucocephala*, *Mangifera indica*, *Sesbania grandiflora*, *Syzygium cummini*, *Terminalia chebula*, *Zizyphus jujuba* and *Pongamia pinnata*.

**Red Soils**
- These soils are developed on old crystalline rocks under moderate to heavy rainfall conditions.
- They are deficient in phosphoric acid, organic matter and nitrogenous material.
- Red soils cover the eastern part of the peninsular region comprising Chhotanagpur plateau, Orissa, eastern Madhya Pradesh, Telangana, the Nilgiris and Tamil Nadu plateau.
- They extended northwards in the west along the Konkan coast of Maharashtra.
- They are red or reddish brown in color, slightly acidic to alkaline, medium CEC, poor in organic matter and mineral and nutrients.

Species found are *Aegle marmelos*, *Bauhinia spp*, *Delonix regia*, *Emblica officinalis*, *Ailanthus excelsa*, *Albizia lebbeck*, *Albizia procera*, *Artocarpus integrifolia*, *Azadirachta indica*, *Eucalyptus hybrid*, *L. Leucocephala*, *Mangifera indica*, *Sesbania grandiflora*, *Syzygium cummini*, *Terminalia chebula*, *Terminalia arjuna*, *Morus alba*, *Madhuca latifolia* and *Pongamia pinnata*.

**Laterite Soils**
- The laterite soils are the result of intense leaching owing to heavy tropical rains.
- They are found along the edge of plateau in the east covering small parts of Tamil Nadu and Orissa, a small part of Chhotanagpur in the north and Meghalaya in the north-east.
Laterization is a dominant soil forming process and develops on basic rocks. They have low pH, poor in nutrients, poor in calcium and magnesium, low CEC. Species found are *Artocarpus integrifolia, Mangifera indica, Syzygium cumini, Terminalia argjuna*.

**Alluvial Soils**
- This is the most important and widespread category. It covers 40% of the land area.
- In fact the entire Northern Plains are made up of these soils.
- They have been brought down and deposited by three great Himalayan rivers—Sutlej, Ganga and Brahmaputra— and their tributaries.
- Through a narrow corridor in Rajasthan they extend into the plains of Gujrat. They are common in eastern coastal plains and in the deltas of Mahanadi, Godavari, Krishna and Kaveri.

**OTHER SOIL GROUPS**
- Desert Soil
- Brown Hill Soil
- Tarai or Foot Hill Soil
- Peaty Soil
- Mountain Medow Soil
- Salt Affected Soil

**Desert Soils**
- The geographical area covered by desert soils is 1,54,432 sq km.
- Found in States: Rajasthan, southern part of Haryana and Punjab and northern part of Gujrat.
- The temperature regime is very high throughout the year.
- Built up organic matter status is very low.
- Soil contains soluble salts but the concentration is not at toxic level.
- Nitrogen content is very low but level of nitrate nitrogen is high.
- Presence of phosphate and nitrate make the desert soil fertile and under moisture supply.
  - Species found are *Azadirachta indica, Cassia siamea, Acacia tortolis, Acacia nilotica, Prosopis juliflora*.

**Tarai Soils**
- The soils cover an area of 28,919 sq km in UP, Uttarakhand, Sikkim, Assam, Bihar, Andman and Nicobar and West Bengal
- The soils have wet regime and high water table condition most of the year.
• Soil color is deep black and grey black.
• The texture of soil is sandy loam to silty loam. The soils are fertile and with proper drainage.
• Soils are acidic (pH 4.7-5.8), poor in bases and available plant nutrients.
  Species found are Albizia procera, Bauhinia spp., Shorea robusta, Pinus roxburghii, Populus deltoides and Dalbergia sissoo.

Brown Hill Soils
• The geographical area covered is 81,242 sq. km.
• States : UP, Uttarakhand, Himachal Pradesh, Kerala and west Bengal
• Acidic, decrease in pH with the increase of altitude is the trend in north Himalayan forest.
• Soil organic matter, CEC and Nitrogen increase with increasing altitude

Peaty soils

Mountain meadow soils
• The soil covers an area of 2,720 sq.km.
• Found in coastal tracks of Orissa, sundarbans of West Bengal, central portion of north Bengal and south east coast of Tamilnadu.
• Occurs in humid region; accumulation of high organic matter.
• Black, clayey and highly acidic.
• Found in basins filled with river deposits interstratified with remains of vegetation giving rise to peat deposits.

Salt affected soil
Saline or Alkali soils contain excess of neutral soluble salts dominated by chlorides and sulphates.

- Sodic soils contain high exchangeable Sodium percentage.

**Nutrient deficiencies**

- Availability of micronutrients such as Cu, Zn, Fe, Mn, and B are influenced by soil pH.
- The lower the pH the more soluble and available they are. So in alkaline conditions, plant growth may be limited by deficiencies of these metals.
- Phosphorus is commonly deficient in alkaline soils because it is tied up with Ca or Mg phosphate.
- Only few micronutrients like Mo are more available in alkaline conditions.

**Cation exchange capacity:** Alkaline soils have higher cation exchange capacity because their high pH stimulates pH dependent charge on the soil colloids.

**Calcium accumulation in subsurface layers:** Alkaline soils in low rainfall regions commonly have layers of CaCO₃, CaSO₄ or other such layers that can inhibit plant growth.

**Soil water supply:** The subsoil layers are always drier than in humid regions resulting in much competition for water by native plants. These soils therefore require greater water management if cultivation is a priority.

**Classification of Salt-Affected Soils:** This classification is based on Ec, ESP, pH

1. **Saline Soils**
   - High dissolved salts in soil solution (affects plant growth)
   - EC ≥ 4 dS/m (saturated)
   - Exch. Na < 15%
   - pH < 8.5

2. **Saline-Sodic Soils**
   - Same as saline soils except Exch. Na > 15%

**Management of salt affected soil (land reclamation)**

1. **Saline soils:** Establish drainage; Leach with water.
2. **Saline-sodic soils:** Add Ca (usually gypsum-CaSO₄) to remove exchangeable Na; Leach with high quality water to remove excess salts; Leach with high Ca irrigation water.
3. **Sodic soils:** Add gypsums; Deep tillage; Leach with high quality water when possible.

### Characteristics of Alkaline Soils

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>pH</th>
<th>EC (dS/m)</th>
<th>ESP</th>
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<tbody>
<tr>
<td>Normal soils</td>
<td>6.5-7.2</td>
<td>&lt;4</td>
<td>&lt;15</td>
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<tr>
<td>Acid soils</td>
<td>&lt;6.5</td>
<td>&lt;4</td>
<td>&lt;15</td>
</tr>
<tr>
<td>Saline soils</td>
<td>&lt;8.5</td>
<td>&gt;4</td>
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<tr>
<td>Sodic soils</td>
<td>&gt;8.5</td>
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<tr>
<td>Saline-Sodic</td>
<td>&lt;8.5</td>
<td>&gt;4</td>
<td>&gt;15</td>
</tr>
</tbody>
</table>
Know your Biodiversity

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Gyps bengalensis

Gyps bengalensis is a critically endangered species in India and adjacent countries, commonly known as Orientale white backed vulture. It has white neck ruff and white patch of fathers on lower back and upper tail from which its common name is derived. It is distributed in India, Bangladesh, Nepal, Bhutan, Myanmar, Pakistan, Thailand, Cambodia and Southern Vietnam. By mid 2000 these vultures were found dead in Pakistan, Nepal and throughout India. In India its decline was first noticed in Keoladeo National Park Rajasthan. It occurs mostly in plains and less frequently in hilly regions. It breeds on tall trees and breeding season is October to March. These are social animals and lives in flocks. It lays only one egg at a time.

Major decline in their number is primarily due to loss of habitats, nesting grounds and feeding on carcasses of animals treated with the veterinary drugs diclofenac. Diclofenac is a veterinary anti-inflammatory drug used to treat domestic livestock which leads to renal failure resulting in visceral gout of Gyps bengalensis. Recently another veterinary drug ketoprofen has also been identified to be lethal to the species in India. Now manufacture and distribution of diclofenac is banned in India and adjoining countries. Disease, pesticides, low food availability, predators, hunting, aircraft strikes are secondary causes of their decline. Felling of old and mature trees in urban areas which are nesting and roosting sites also contribute to population decline. Use of organochloride pesticide in agriculture promotes the decline of mother nature’s cleaners. Humans are also a threat to vultures because in some parts of India these are used as medicines.

These vultures are included in Schedule 1 of the Wildlife Protection Act 1972. Low reproductive rate and high longevity are also responsible for very slow increase in population. Conservation strategies should be formulated to save the Gyps bengalensis and its vanishing habitats. Identification of number and location of the vultures are needed to take suitable action for its conservation. Captive breeding programmes are also initiated to increase the number of individuals. If vultures are not conserved timely, we will lose the associated ecological services forever.
Bombax ceiba, the Indian Red Kapok Tree is one of the most important tree species that has medicinal, economic, ethnic and ecological importance. It is a very large deciduous tree found throughout India. Bombax malabaricum is synonym of Bombax ceiba. It belongs to family Bombacaceae. It is commonly known as Silk cotton tree, Red silk cotton tree, Semal. In Sanskrit it is known as Salmali. Due to the thorny appearance it is called “Tree of Yama”. The plant proved its existence from the time of Mahabharata. It is called as king of the forest due to massive size and showy flowers.

The bright red flowers appear in January to March on the leafless trees and forms the scarlet carpet on ground after dropping. The flowers are very showy, attractive and visible from long distances. It grows sporadically in mixed deciduous forest and often found growing in association with sal. It thrives best in moist tropical climate. Because of its beautiful and attractive flowers, people like to plant it as ornamental plant in the gardens, botanical garden, or as the avenue species but they avoid these trees near their houses. Vulture and bats prefers to live in the Semal tree. In Hindu custom, vulture and bats are considered as symbols of ill-fate; hence people do not like to keep the Semal tree in the vicinity.

All parts of Semal tree are medicinally and economically important. Wood is used for firewood, ply wood, packing case and also in manufacture of matchsticks. Fruits contain fibrous cotton like substance called “kapok”. The cotton is used for stuffing pillows and mattresses. Fruits are cooked eaten and pickled. Flowers and roots are used to treat diarrhea, dysentery, gastrointestinal disorders, bladder diseases, gynecological problems, diabetes, impotence in men and wounds. Paste of bark is used to cure skin problems.

Honey bees, squirrels, deer and other mammals feed upon Semal trees floral parts. It is favorite roosting and resting sites for the large birds especially the vultures, eagles and bats. Decline in Semal population is major cause of vulture disappearance in India. It has been exploited heavily for medicinal and commercial purpose due to which the availability of Semal trees is declining sharply. Throughout India this plant is burnt on the occasion of Holi festival as Holika dahan, particularly in the states of Rajasthan, Madhya Pradesh and Uttar Pradesh as whole tree or branches of the tree fixed on ground one month before the Holi festival. Every year thousands of trees are burnt on this day. The Bombax ceiba is a multipurpose tree which provides food, medicine, fodder, fiber and fuel. Hence formulation of sustainable conservation strategies and awareness among the people about its ecological benefits are needed to save this multipurpose tree.
खो न बैठे उर्वरा शक्ति धरा, हरी बात से डरते हैं।

उपयोग करो केचुंआ खाद तुम, समर्थन हरी का करते हैं।