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Van Sangyan

Editoriral Board

Note to Authors:

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

by e-mail to vansangyan_tfri@icfre.org

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

The articles can be in English, Hindi, Marathi, Chhattisgarhi and Oriya, and should contain the writers name, designation and full postal address, including e-mail id and contact number.

TFRI, Jabalpur houses experts from all fields of forestry who would be happy to answer reader's queries on various scientific issues. Your queries may be sent to The Editor, and the expert's reply to the same will be published in the next issue of Van Sangyan.

From the Editor's desk

Climate change is already beginning to transform life on Earth. Around the globe, seasons are shifting, temperatures are climbing and sea levels are rising and meanwhile, our planet must still supply us – and all living things – with air, water, food and safe places to live. If we don't act now, climate change will rapidly alter the lands and waters, we all depend upon for survival, leaving our children and grandchildren with a very different world. Most people know how important forests are – they soak up carbon dioxide and help to regulate the global climate. They also tend to be particularly rich in plant and animal species. Impacts vary in different kinds of forests. Sub-arctic boreal forests are likely to be particularly badly affected, with tree lines gradually retreating north as temperatures rise. Many of the world's threatened species live in areas that will be severely affected by climate change. Climate change is happening too quickly for many species to adapt. Dendrochronology is the study of tree rings and of environmental conditions and events of the past that tree growth can reflect. The beginning of scientific study of tree rings is generally ascribed to an astronomer named Andrew Ellicott Douglass, who in the early 1900s noticed not only variation in tree-ring width but also that this variability was similar between multiple trees. Dendrochronology subsequently expanded worldwide, and now over 3000 of the 12,000+ publications on dendrochronology can be classified as dendroclimatology. As a subfield of tree-ring analysis, dendroclimatology estimates climate back in time beyond the start of recorded meteorological measurements. Dendroclimatology starts with site and tree selection and continues with dating, measuring data, quality control, and chronology construction.

This issue of Van Sangyan contains an article on Recents trends in Climate change, Dendroclimatology: present and future prospects. There are also useful articles on Curly symptoms of mulberry leaves, Bamboo (in Marathi), Fruit plant based inter-cropping system for undulating barren upland of Jharkhand, Neem (in Marathi), Combating desertification in India, Pipal (in Hindi), Preparation of vermicompost (in Odiya) and biodiversity of Spilopelia chinensis and Nicandra physaloides.

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

Looking forward to meet you all through forthcoming issues.

Dr. N. Roychoudhary

Scientist G & Chief Editor

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Recent trends in climate change: causes, impacts and future risks

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Introduction

Anthropogenic influence on the climate system is significant, and recent emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems. Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen.

Argentina's Upsala Glacier (South America) disappearing at a rate of 200 metres per year

Since 1850 the last three decades have been successively warmer at the Earth's surface than any preceding decade. The period from 1983 to 2012 was the warmest 30 year period of the last 1400 years in the Northern Hemisphere. However, the rate of warming over the past 15 years (1998–2012) with an average increase of 0.05°C per decade (varying from – 0.05 to 0.15°C per decade), which begins with a strong El Niño, is smaller than the rate calculated since 1951 (1951–2012) with an average

increase of 0.12° C per decade [varying from 0.08 to 0.14 °C per decade). Ocean warming is the largest near the surface and the upper 75 m warmed by 0.11 [0.09 to 0.13] °C per decade during 1971 to 2010.

Oceanic uptake of CO_2 has resulted in acidification of the ocean and the pH of ocean surface water has decreased by 0.1 corresponding to a 26% increase in acidity measured as hydrogen ion concentration since the beginning of the industrial era.

The Greenland and Antarctic ice sheets have been losing mass during 1992-2011 but at a faster rate during 2002-2011. Glaciers have continued to shrink almost worldwide. Northern Hemisphere spring snow cover has continued to decrease in extent. Permafrost temperatures have increased in most regions since the early 1980s in response to increased surface temperature and changing snow cover. The Arctic sea ice extent decreased during 1979 to 2012, with a rate of 3.5 to 4.1% per decade. The global mean sea level rose by 0.19 [0.17 to 0.21] m during 1901 to 2010. The rate of sea level rise since the mid 19th century has been larger than the mean rate during the previous two millennia.

Causes of climate change

The greenhouse gas emissions due to human activities have increased since the pre-industrial era, which are mainly due to economic development and population growth throughout the world. This has resulted atmospheric carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) to the maximum level during last 8 lakh years.

Cumulative anthropogenic CO_2 emissions to the atmosphere were found to be 2040 $GtCO_2$ between 1750 and 2011. About 40% of these emissions have remained in the atmosphere (880 GtCO2); the rest was removed from the atmosphere and stored on land (in plants and soils) and in the ocean. The ocean has absorbed about 30% of the emitted anthropogenic CO_2, causing ocean acidification. About half of the anthropogenic CO_2 emissions between 1750 and 2011 have occurred during last 40 years.

Total anthropogenic GHG emissions have continued to increase over 1970 to 2010 with maximum increase between 2000 and 2010, despite a number of climate change mitigation policies. Anthropogenic GHG emissions in 2010 have reached 49 ± 4.5 GtCO2-eq/yr. CO_2 emission from fossil fuel combustion and industrial processes contributed about 78% of the total GHG emissions increase from 1970 to 2010. The similar increase was observed during 2000 to 2010.

The economic and population growth continued to be the most important drivers

of increase in CO_2 emissions from fossil fuel combustion globally. The contribution of population growth between 2000 and 2010 remained almost similar to the last three decades, while the contribution of economic growth has risen sharply.

Projected changes in the climate system

Future climate will depend on warming caused by past anthropogenic emissions,

Shoreline at Cape Hatteras in North Carolina (USA) pictured in 1999 and 2004

as well as future emissions and natural climate variability. The temperature is projected to rise in the 21st century and the heat waves will occur more often and last longer. Extreme precipitation events will become more intense and frequent in many regions of the world. The ocean will continue to warm and acidify, and global mean sea level will rise.

The global mean surface temperature change for the period 2016–2035 will be in the range 0.3°C to 0.7°C relative to 1986–2005. This assumes that there will be no major volcanic eruptions or changes in some natural sources (e.g., CH_4 and N_2O), or unexpected changes in total solar irradiance. Global temperature change for the end of the 21st century (2081–2100) is projected to exceed 1.5°C relative to 1850–1900. The Arctic region will continue to warm more rapidly than the global mean. There will be more frequent hot and fewer cold temperature extremes over most land areas on daily and seasonal timescales, as global mean surface temperature increases.

Changes in precipitation will not be uniform. The high latitudes and the equatorial Pacific are likely to experience an increase in annual mean precipitation. In many mid latitude and subtropical dry regions, mean precipitation will decrease, while in many mid latitude wet regions, mean precipitation will increase. Extreme precipitation events over most of the mid latitude land masses and over wet tropical regions will become more intense and more frequent.

Mount Hood in Oregon (USA) at the same time in late summer in 1985 and 2002

The global ocean will continue to warm during the 21st century, with the strongest warming projected for the surface in tropical and Northern Hemisphere subtropical regions. The decrease in surface ocean pH will be in the range of 0.06 to 0.07 causing 15 to 17% increase in acidity. Reductions in Arctic sea ice round the year are projected in all the scenarios. A nearly ice free Arctic Ocean in the summer before mid century is projected. Ice free ocean means when sea ice extent is less than one million km^2 for at least five consecutive years.

Permafrost extent at high northern latitudes will be reduced as global mean surface temperature increases, with the area of permafrost near the surface (upper 3.5 m) projected to decrease by 37% to 81%. Any rock or soil remaining at or below 0^0C for 2 or more years is Permafrost. It is not defined by soil moisture content, overlying snow cover or location, but defined solely by

temperature. Permafrost underlies app. 22.79 million sq. km. (about 24% of the exposed land surface) of the Northern Hemisphere. Much of the Northern Hemisphere permafrost is overlain by evergreen boreal forest. The global glacier volume (excluding glaciers on the periphery of Antarctica and Greenland and Antarctic ice sheets) is projected to decrease by 15 to 55%.

Global mean sea level rise will continue during the 21st century at a faster rate than observed from 1971 to 2010. For the period 2081–2100, the rise will be in the range of 0.26 to 0.55 m relative to 1986–2005. Sea level rise will not be uniform across regions. By the end of the 21st century, sea level will rise in more than 95% of the ocean area. About 70% of the coastlines worldwide are projected to experience a sea level change.

Extreme events

The number of extreme weather and climate events has increased since 1950 and part of this increase has been linked to human influences, including a decrease in cold temperature extremes, an increase in warm temperature extremes, an increase in extreme high sea levels and an increase in the number of heavy precipitation events in a number of regions.

The number of cold days and nights has decreased and the number of warm days and nights has increased on the global scale. The frequency of heat waves has increased in large parts of Europe, Asia and Australia. The observed warming has increased heat related human mortality and decreased cold related human mortality in some regions.

Heavy precipitation events have increased on more land regions and increasing trends in extreme precipitation and discharge in some catchments implies greater risks of flooding. Extreme sea levels have increased since 1970, being mainly a result of rising mean sea level.

Future risks and impacts caused by climate change

Climate change will amplify existing risks and create new risks for natural and human systems. The risks will not be evenly distributed and will be higher for poor people and communities in countries at all levels of development. With the increase in temperature and other changes in climate system. including ocean acidification, there will be severe, pervasive and in some cases irreversible detrimental impacts on regional as well as global scale. The risks of future climate change impacts can be mitigated by reducing the rate and magnitude of climate change.

A large number of species faces increased risk of extinction due to climate change

during and beyond the 21st century. Most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change in most landscapes. Similarly, most small mammals and freshwater molluscs will also not be able to keep up in flat landscapes in this century. Marine organisms will face progressively lower oxygen levels and high magnitudes of ocean acidification, with associated risks created by rising ocean temperature. Coral reefs and polar ecosystems are highly vulnerable. Coastal systems and low lying areas are at risk from sea level rise, which will continue for centuries even if the global mean temperature is stabilized.

One more future risk created due to climate change is food security. By the mid 21st century and beyond, marine species distribution will be disturbed and marine biodiversity will be drastically reduced in sensitive regions throughout the world due to projected climate change. This will challenge the sustained provision of fisheries productivity and other ecosystem services. Wheat, rice and maize production in tropical and temperate regions will decrease, if the temperature rise takes place for more than 2^0 C above late 20th century levels, which in combination with increasing food demand would pose large risks to food security globally.

In the 21st century, climate change is expected to increase ill health in many regions and especially in low income developing countries, as compared to a baseline without climate change. In urban areas, climate change is projected to increase risks for people, assets, economies and ecosystems, including risks from heat stress, storms and extreme precipitation, inland and coastal flooding, landslides, air pollution, drought, water scarcity, sea level rise and storm surges.

Climate change beyond 2100

Many aspects of climate change and associated impacts will continue for centuries, even if anthropogenic emissions of greenhouse gases are stopped. The risks of abrupt or irreversible changes increase as the magnitude of the warming increases. Warming will continue beyond 2100 and surface temperatures will remain approximately constant at elevated levels for many centuries after a complete cessation of net anthropogenic CO_2 emissions.

Stabilization of global average surface temperature does not imply stabilization for all aspects of the climate system. Shifting biomes, soil carbon, ice sheets, ocean temperatures and associated sea level rise all have their own intrinsic long

timescales which will result in changes lasting hundreds to thousands of years after global surface temperature is stabilized.

Ocean acidification will increase for centuries if CO_2 emissions continue, and will strongly affect marine ecosystems. Global mean sea level rise will continue for many centuries beyond 2100, with the amount of rise dependent on future emissions. Abrupt and irreversible ice loss from the Antarctic ice sheet is possible, but current evidence and understanding is insufficient to make a quantitative assessment. Abrupt and irreversible change in the composition, structure and function of marine, terrestrial and freshwater ecosystems, including wetlands. A reduction in permafrost extent is expected with continued rise in global temperatures.

Conclusion

The human influence on the climate system is clear and growing, with impacts observed across all continents and oceans. Many of the observed changes since the 1950s are unprecedented over decades to millennia. The Intergovernmental Panel on Climate Change is now 95 percent certain that humans are the main cause of current global warming. It is sure that the more human activities disrupt the climate, the greater the risks of severe, pervasive and irreversible impacts for people and ecosystems, and long-lasting changes in all components of the climate system. We have to limit climate change and its risks, with many solutions that allow for continued economic and human development. However, stabilizing temperature increase to below 2°C relative to pre-industrial levels will require an urgent and fundamental departure from business as usual. Moreover, the longer we wait to take action, the more it will cost and the greater the technological, economic, social and institutional challenges we will face.

Dendroclimatology: present and future prospects

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It is well known that the approximate age of a temperate forest tree can be established by counting the growth rings in the lower parts of the stem. Growth rings records would be of much promise to retrieve past climatic information in time scale of annual resolution. The pattern of radial growth in trees depends largely on the climatic conditions of different localities and the yearly sequence of favorable and unfavorable climate (wet and dry, warm and cold) is faithfully recorded by the sequence of wide and narrow rings in large numbers of trees. These patterens of wide and narrow rings are observable not only in living trees in an area, but also in stumps and the wood of trees that have grown in nearly areas. The procedure of matching ring patteren among trees and wood fragments in a given area is referred to as *crossdating*. When the ring patterns are matched carefully enough to identify the problem rings, the date of the outermost ring of a tree indicates exactly when it died or was sampled and the innermost one when the tree was seedling. The matching is necessary to identify special case where rings may be absent or where twop or more apparent rings have been formed during one year. In addition, an old tree used as a construction timber can be crossdated with the early record in a living tree of the same areas, as long as their life spans overlap. The rings of the construction timber in turn can be crossdated with a beam from an older structure to extend the ring width sequences back in time.

Dendroclimatology, a branch of the board discipline dendrochronology (*Dendro* is Greek word means tree and *chronology* means deals with time), is the science of reconstructing past climate by use of tree rings. It involves the study of tree rings to infer past climatic conditions based on recent growth climate relations. In a changing environment, the analysis of how trees and forest ecosystems may react under scenarios involving changing climatic conditions is of major importance. A prerequisite for such analyses is the knowledge of how trees have reacted to past climatic and anthropogenic events and trends. Proxies, such as tree rings, enable the responses of trees to environmental changes to be reconstructed for many

regions. *Andrew E. Douglass* is the acknowledged father of dendrochronology.

The reconstruction of past climate is accomplished by taking the following steps:

I. Comparing modern meteorogical records with the widths of tree rings produced during the same period of time.

II. Established a statistical equation for the relationship between the two. and

III. Substituting the widths of the dated rings in the euation to obtaina statistical estimate of the climate for previous years.

Techniques for Dendrochronology:

1. Tree Coring, stumps, slabs
2. Ring Counting: Often false rings or missing rings in one tree. If precision (repeated counting) and accuracy (true date).
3. Crossdating: Process of matching rings of trees in an area based on patterns of ring widths produced by regional climate.

More accurate age than ring counting

Methods of Crossdating:

a. Sample with increment borer, core glued to board.

b. Count rings under dissecting scope.

c. Skeleton plotting: Graphical technique for matching

- Plot small rings as wide lines on paper.
- Paste graph paper strips together and pattern match.

d. Prepare local chronology by matching trees.

e. Standardization: De-trending individual growth curves.

f. Calibaration and verification: producing a climatic history.

g. Combine local curves to produce regional chronology.

Tree Ring Growth Model for Dendrochronology:

Rt = f(Gt, Ct, D1t, D2t, Et)

Gt = Age-related growth trend

Ct = Climate-related growth *i.e* Dendroclimatology: precipitation, temperature, atm. pressure, runoff. e.g., Large forest fires in amazon forest and New Mexico after dry springs associated with El Niño events (Swetnam and Betancourt, 1990).

D1t = Disturbance-ralated growth due to local factors within the stand *i.e* Dendroecology: pollution insects (e.g., tussock moth, spruce budworm), air pollution

D2t = Disturbance-ralated growth due to regional factors outside the stand *i.e* Dendrochronology Dating fires, floods, earthquakes, volcanism, erosion and deposition rates.

Et = "Error" Variations due to factors other than Gt, Ct, D1t, D2t.

Some basic principles and concepts of Dendroclimatology

1. ***Uniformitarian principle*:** 'Uniformity in the order of nature' proposed by James Huttom in 1785. The relationship between variations of tree growth and variations in present day climate and infer from past rings the nature of past climate. Lilkewise, the types of weather variations and climatic patterns observed today also must have occurred in the past.

2. ***Principle of limiting factors*:** The plant processes can change markedly throughout the year, so that one particular climatic factor may be directly correlated with ring width at one time, inversely correlated with it at another time, and totally uncorrelated at still other times. Liebig (1843), proposed 'Law of the Minimum', "When a process is conditioned as to its rapidity by a number of separate factors, the rate of the process is limited by the pace of the slowest factor".

3. ***Concept of ecological amplitude*:** Species depending upon hereditary factors which determine its phenotype, may grow and reproduce over a certain range of habitats is known as ecological amplitude. It may be limited by the same climatic factor if the individual trees are growing in comparable habitats within their own ecological amplitudes. These factors as length of the daylight period, shade and low amout of soil minerals can limit plant distribution and little variability in ring width. Other nonclimatic factors such as fire, insect attack or disease can also affect the plant distribution and variability in ring width.

4. ***Site selection*:** Dendrochronology must apply the law of limiting factors and the concept of ecological amplitude when they obtain their research materials in order to assure selection of trees which will give them the information they desire. This selection is referred to as site selection.

The tree growing on sites where climate seldom limits growth process produce rings that are uniformly wide in plain area. The ring widths provide little or no record of variations in climate and it termed complacent but when tree growing on site where climatic factors are frequently limiting produce rings that vary in widthfrom year to year depending upon how severely limiting climate has been to growth, known as sentitive.

5. ***Sensitivity*:** The dendrochronologist refers to this variability in ring width as *sensitivity* and to the lack of width variability as *complacency*. Such fluctuations in ring width can be calculated from measurement

of width and expressed as a statistic called *mean sensitivity*, which is measure of the relative differences in width between adjacent rings.

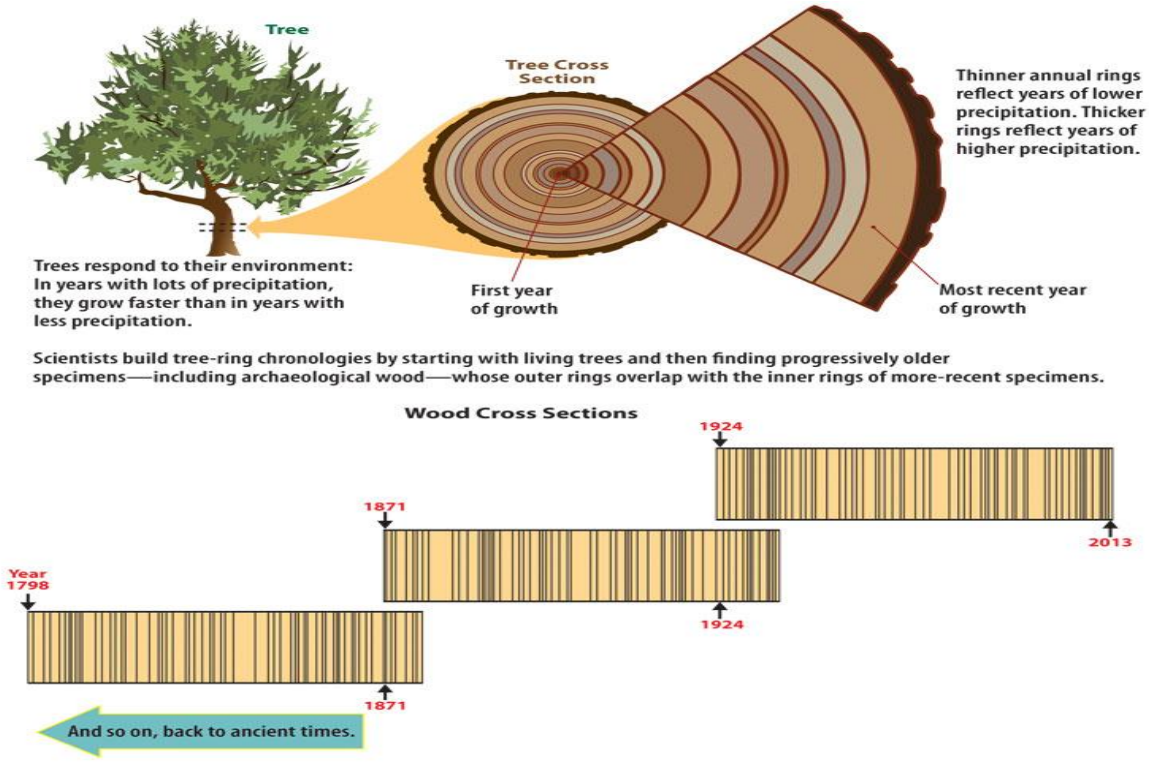

Figure 1: Diagram illustrating crossdating and the extension of a dated ring width chronology backward in time.

6. ***Crossdating*:** It is most important principle of dendrochronology. The yearly ring widths must be crossdated among all radii within a stem andamong different trees in a given stand, as well as among ring-width patterens of neighboring stands. The crossdating can be obtained itself is evidance that there is some climatic or environmental information common to the sample trees.

Sometimes during ayear of extreme climate a tree may not form a ring on all portionss of the stem. The ring is then said to be partial, locally absent or missing along certainstem segments or radii. At other times a change in cell structure will occur within an annual growth increment so that the layer resembles the boundary of a true annual rings. Such features are called intra annual growth bands or False rings.

Crossdatingincludes matching of ring-width patterens among specimens, examining the synchrony, recognizing any lack of coincidences, inferring where rings may be absent, false or improperly observed, testing the inference by examining carefully the ring structure in other specimens and finally arriving at the correct regional chronology with

agreement among the growth sequences of trees in neighboring stands (Figure 1).

1. ***Repetition*****:** A number of specimens must be examined or the average of replicated measurement from a large number of tree provides the best estimate of climate from any given sites to avoid the possibility that all collected specimens could be missing a ring for any one year or could have an intra annual growth band appearing like a true annual ring. The growth variation that is associated with climatic variation, which is common to all trees are retained when such average are made. A large portion of the effects of nonclimatic factors which differ among individuals and from site to site is minimized by the averageing process.
2. ***Standardization*****:** Ring width variability associated with climate, it is usually most convenient to estimate the systematic changes in ring width associated with age and to remove them from the measurements. This correction of ring width for the changing age and geomertry of the tree is known as standardization and the transformed values are called ring width indices. The standardized indices of individual trees are averaged to obtain the mean chronology for a sample site.
3. ***Modeling growth*** (Environment relationships)**:** A model may be a statement,equation or diagram which represents a basic set of facts and their interrelationships.
4. ***Calibration and verification*****:** Its is direct relationship between ring width and the environmental variables. It established a statistical model, the value for the statistical coefficients of model and then applying the coefficients to tree ring indices to reconstruct climate for early time periods where ring width indices are available but no record of past environments exists. The cause and effect relationship between tree growth and climate, or it may represent purely correlated effects. This relationships are useful for reconstructioning past climatic variations even though it may be impossible to determine the actual chain of cause and effect.

Methodology for Dendroclimatology:

First of all, collect data from a selected site, perhaps a relatively undisturbed and open forest where the climati factor of interest (example, drought) is most limiting to tree growth. It is also neccesary to collect the particular weather record of sampling area, if any whether station has maintained climatology data for a number of years. The sampled trees would need to be of the sensitive type and located at the

lower elevational or drier limitts for the particular species. The form and structure of tree often provide clues as to its age and the quality of the ring width record. Within these restrictions of site, the researcher could select tree randomly, though most workers search for the oldest trees with most ring width variability to maximize the amount of information on climate that can be obtained.

The increment corer measuring machine can be used to precisely data for samples and measure ring widths, which is used to extract a thin cylinder of wood from the stem. The corer usually does not harm the tree and exuded resin from conifers. Some cases simple precautions such as sealing the hole, using a disinfectant or not sampling during the times of infection may be advisable. Ring width and the size of vessels in dated tree-ring sequences of teak has been found suitable for climatic analysis (Bhattacharyya *et al.*, 2007). The teak ring-width and vessel parameters can be studied by non-destructive methods like increment-borer samples (Figure 2) or basal discs obtained from felled, wind fallen trees and dead trees which are removed from the plantation (Figure 3). Measurement of tree ring width (Tree Ring Station, LINTAB 6) and vessel area (Stereo microscope, Moticam) instrument for core sample of teak (Figure 4) and basal disk sample of teak (Figure 5).

Figure 2: Core sample obtained by non-destructive methods through increment borer.

Figure 3: basal discs obtained from felled, wind fallen trees and dead.

DENDROCLIM 2002 *etc* (Biondi and Waikul, 2004). Tree mean vessel area (MVA) measurements can be found out by image analysis system (Labomed Digi pro2). The averaging scheme method minimizes a large portion of the effects of nonclimatic factors that occur in the various sites. Also the computer program

Figure 4: Measurement of tree ring width and vessel area in core sample of teak.

Figure 5: Measurement of tree ring width and vessel area in basal disk sample of teak

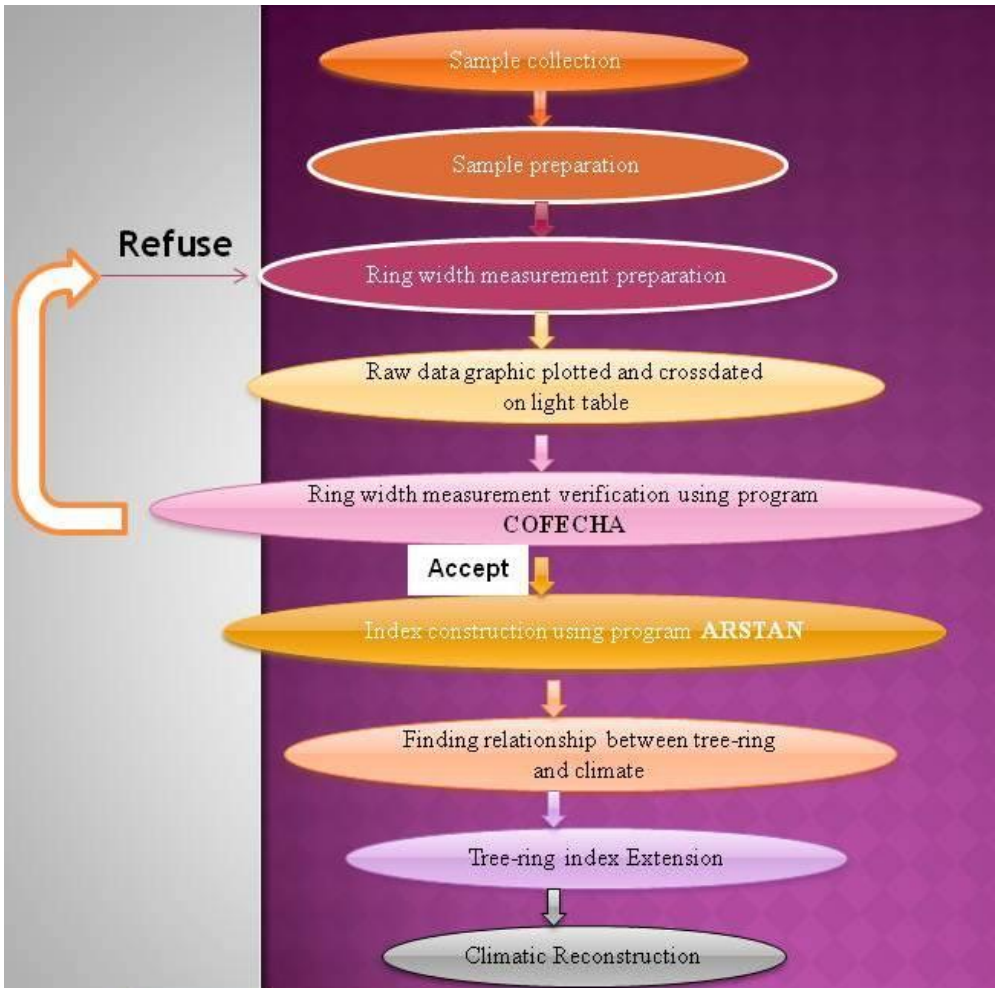

Figure 6: Dendroclimatological work procedure

ARSTAN (Cook, 1985) can be used to filter out the non climatic signals (age, genetic, site conditions) from the tree-ring chronology. These two characters viz.

ring width and MVA then need to be correlated to existing climate data collected from near by meterological stations and then analysed for significant relationship. This relationship can then be used to predict the climt existed in the past. The procdures of dendroclimatology has given (Figure 6).

Present and future prospects:

Growth of the tree has been shown to fluctuate in many ways, depending upon physical, physiological and age variations of plant tissues as well as genetic, soil and microclimatological variation among tree. These variations can affect growth only by limiting the rates of plant processes in one or more organs of the tree. The accuracy of the climatic reconstructions at any given location or time period is expected to improve as more diverse tre ring data sets are obtained from a wider variety of species, sites, regions and continents. Short period tree ring analyses of teak from Kerala have great potential in sustainable management of teak plantations as it reveals new information about age, climate and locality related variability in the growth of teak (Babu *et al.*, 2015).

Usable tree ring information appears to be available from temperate climates of both the Northern and Southern Hemispheres. The investigator must examine the appropriate species and sites for the older climatically affected trees and look for the contorted stem forms indicating general stress and old age. Of course , the ultimate test of any sample is the crossdating and the resultant amount of calibration possible with variations in climatic factors.

Not all climaticdata are equally useful in calibration, for there may be large errors and inconsistencies in poorly collected and prepared data. Many climatological, hydrological and other environmental records now used for calibration can be averaged over space and time, or treated in some other fashion which facilitates and improves the climatic calibration. New and improved statistical procedures will undoubtedly become available as well as new cliimatological methods for attacking problems of climatic variation. Work has hardly begun on estimating future probabilitues of climate or on attempts to forecast future climate.

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Curly symptoms of mulberry leaves: search for causative agent and possible management

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Mulberry (*Morus* spp.) (family Moraceae) is the principal food plant of silkworm, *Bombyx mori* Linn. (Lepidoptera: Bombycidae), commonly known as mulberry silkworm. Several insect pests are known to infest mulberry plants and cause quantitative as well as qualitative loss to the food plant, which ultimately decline the silk production. Appropriate knowledge about the insect species, pest status and their management can enhance productivity of mulberry plants and concomitant improvement in terms of quantity and quality of silk production and economy.

Mulberry, like most of the economic plantations and field crops, is also subject to the attack of a vast complex of insect fauna belonging to different insect orders and acarids that includes mites. The damage caused by insect pest is quick and extensive. Though the frequent leaf picking and pruning of the shoot restrict the attack of insect pests, many of them still find enough time for feeding and breeding on it. The major insect orders known to be the pest of mulberry in order of number of species attacking the mulberry are: Lepidoptera, Hemiptera, Coleoptera, Thysanoptera, Othoptera and Isoptera, besides acarids. The insects belonging to these orders often hampered the production of appreciable quantity and quality of mulberry leaf by infestation of mulberry garden. More than 100 species of insects have been reported to attack mulberry and only a few of them have attained major pest status. They are: pink mealy bug, *Maconellicoccus hirsutus* (Green) (Homoptera: Pseudococcidae); jassid, *Empoasca flavescens* Fabricius (Homoptera: Cicadellidae); black scale insect, *Saissetia nigra* (Nietm.) (Homoptera: Coccidae); thrips, *Pseudodendrothrips mori* Niwa (Thysanoptera: Thripiidae); Bihar hairy caterpillar, *Spilosoma obliqua* (Walker) (Lepidoptera: Arctiidae) and wingless grasshopper, *Neorthacris acuticeps nilgriensis* Uvarov (Orthoptera: Acrididae). Among all these, the insects belonging to the order Thysanoptera of family Thripiidae are commonly known as thrips, which are exclusively responsible for inducing curly symptoms in mulberry leaves. Most of the members of this family are plant feeders, although some species act as vectors of viral diseases of plants.

Thrips cause great damage to the mulberry leaves under rainfed conditions and proved to be a serious pest attacking the leaves of new shoots growing after pruning in early winter. Some members cause serious damage to mulberry especially during summer months. They attack on the ventral side of the leaf and produce characteristic secretions. The present article deals with these aspects.

Fig. 1. Curly symptoms of mulberry leaves, *Morus alba* var. V1, due to the infestation of thrips.

A survey was made during the month of December, 2005 at Mulberry Farm, Mendrapara, Bilaspur (Chhattisgarh), to investigate the problem of curly leaf production in mulberry and to find out its remedial measures. It was found that four varieties of mulberry, *M. alba*, viz. S13, S36, S1635 and V1 were planted and healthy growth of most of the plants observed. However, it was recorded that production of curly leaves in the growing shoot of mulberry and some immature stages of insects (nymphs) in all the varieties. Further, it was noticed to be very severe in the variety V1 (Fig. 1).

Detail laboratory examination of curly leaves of mulberry revealed the presence of thrips identified as *Taeniothrips* sp. (Thysanoptera: Thripiidae), attacking mulberry leaves. The identification was done after comparing the morphology of the insect with that of published literature. The attack of this thrip to mulberry leaves is known from India and Sri Lanka. The damage caused by thrips affect the leaves of the mulberry shoot. They injure epidermal tissue and affected leaves show

early maturity, depletion of moisture, reduction in crude protein and total sugars. Leaves become unsuitable for healthy silkworm rearing. Thrips affected leaves generally show streaks in the early stage of attack whereas blotches are observed at the advance stage and ultimately become yellowish-brown on maturity. The period of occurrence of this pest is throughout the year, but the infestation is very high in summer months.

In nature, the nymphs of thrips are eaten by the grubs and beetles of coccinellids, which are commonly known as ladybird beetles. A large number of the immature stages and adults of coccinelds were observed on curly leaves of mulberry and identified as *Illeis indica* (Coleoptera : Coccinelidae) (Fig. 2). The insect was identified after comparing the adult

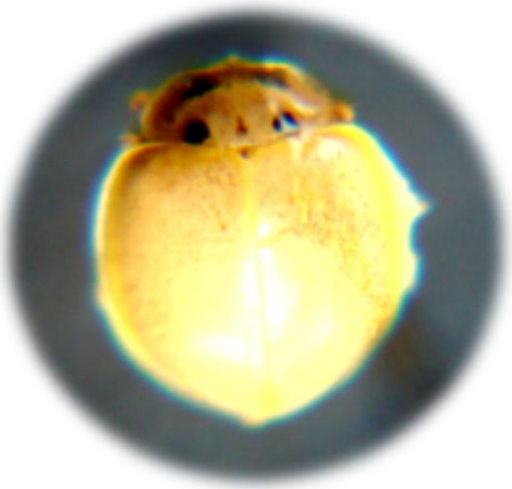

Fig.2. Ladybird beetle, *Illeis indica*

morphology of the species with that of determined specimen preserved under the Accession No. 268, at Forest Entomology Division, Tropical Forest Research Institute, Jabalpur (Madhya Pradesh). This is the first report of occurrence of ladybird beetle feeding on thrips of mulberry. This is an insect predator of biological importance that plays an important role in minimizing the population density of thrips in mulberry.

Management of thrips

The possible control measures can be applied for management of thrips which are as follows:

Cultural control

Sprinkler irrigation can be used only to disperse the population of nymphs and adults of thrips.

Chemical control

Although several of the commonly available commercial insecticides are found effective against thrips, such as foliar spraying of 0.003% synthetic pyrethroids, such as alphamethrin 10 EC (0.3 ml of insecticide in 1 litre of water) or cypermethrin 10 EC (0.3 ml of insecticide in 1 litre of water) or fenvalerate 20 EC (0.15 ml of insecticide in 1 litre of water) can be used to control the thrips. The foliage can be plucked for larval feeding after seven days of spray. But, spraying of dichlorvos 76 EC (commercially available in the market as Nuvan) is most preferred owing to the fact that it is harmless to the natural enemies, especially the ladybird beetles, which play an important role in the suppression of thrip population in the

field. As such, 0.02% dichlorvos prepared in water (0.3 ml of insecticide in 1 litre of water) is required to be sprayed on mulberry plants twice at weekly intervals to kill the nymphal and adult stages of thrips with a safe period of seven days.

Biological control

Ladybird beetle, *I. indica*, as recorded during the present survey may have an immense potential in the field. It is predacious in habit. The adults of this beetle after mass multiplication in laboratory are to be released in the field of thrips infested mulberry garden. This biological agent will serve as a permanent regulatory force on the part of thrip population as it can perpetuate its generations continuously in the field environment to bring about an effective suppression of the pest.

Thus, it is necessary to adopt an integrated approach comprising biological and chemical control measures to protect the mulberry gardens and free from the infestation of thrips.

बंस (बॉम्बू) – जीवनांचा आधार

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भारतीय संस्कृति मधे बांसाला फार मोठा महत्व आहे. भारताच्या उत्तर–पूर्वे क्षेत्रात बाळ जेव्हा जन्माला येतो तेव्हा त्याची नाळ बांसा ने बनलेल्या चाकूने कापल्या जाते. मनुष्य जेव्हा म्हातारे होतात तेव्हा त्यांना चालण्या फिरण्यासाठी काठीचा आधार लागते ती पण बांसने बनलेली असते. लोक हे जग सोडून जातात तेव्हा पण त्यांच्या अंत्योष्ठीसाठी पण बांसाची लाकडे लागतात. बांसाचा उपयोग माणसांच्या जीवनात पदोपदी येते, यावरून असे कळते कि बांसचा माणसांच्या जीवनात किती महत्वपूर्ण स्थान आहे. म्हणुनच बांसा ला जीवनांचा आधार म्हटले पाहिजे. आधुनिक तंत्रज्ञान व विज्ञानाचा विकासाचा बरोबर बांसाने बनविल्या गेल्या विविध वस्तूची संख्या आज शंभरात नाही तर हजारोंच्या घरात पोहचलेली आहेत. या वस्तू मधे महिलांसाठी आभूषण, घर सजविण्यासाठी विविध प्रकारचे सामान, फर्निचर, शेतीचे विविध औजार बनविण्यासाठी, घराची छप्पर बनविण्यासाठी लागणारे विविध वस्तू आणि विविध प्रकारचे व्यंजन बनवण्यासाठी व ठेवण्यासाठी आजकाल बांसाचा लाकडांच्या भरपुर उपयोग करण्यात येत आहे ।

वन रोपवाटिका मधे बांस चे रोपे

आतापर्यंत बांसाच्या 1500 च्या वर उपयोग करण्यात येतो अशी नोंद आहे. बांस एक अकाष्ठ वन उत्पाद (Non-Wood Forest Products) आहे, जो देशांच्या वनांत किंवा वनांचा बाहेर मोठ्या प्रमाणात आढळतो. बांसाच्या भारतात नाही तर अन्य आशिया देशात आर्थिक, सामाजिक, कला जगत आणि सांस्कृतिक जीवनांत फार मोठा महत्व आहे. बांस एक जलद गतीने वाढणारी व कमी खर्चात उगवणारी गवताची एक प्रजाती आहे. बांसाचे लाकूड मजबुत, टिकाऊ, मुलायम

व लवचिक असते. याचा उपयोग ईमारत

बांसाच्या प्रजाती

बनविण्यासाठी, कुपंण लावण्यासाठी, संगीताचे विविध उपकरण बनविण्यासाठी, खाण्या पिण्यांचा व हॅंड़ीक्राप्टच्यां वस्तु, कागद व पॅकेजिंगच्या वस्तु बनविण्यासाठी उपयोग करण्यात येतो. याचा विविध प्रकारचा मुल्यवान वस्तू बनविण्यासाठी उपयोग आणल्या जात असल्यामुळे याचे मुल्य सोन्यासारखे आहे, म्हणुन बांसाला जगात हिरवं सोंन (Green Gold) म्हटल्या जाते. बांसाचे लाकुड स्टीला सारखी मजबुत, टिकाऊ, मुलायम व लवचिक असते आणि 3656 किमी/सेमी^{2} चा दबावाला सहन करू शकते त्यामुळे बांस ला बायो–स्टील (Bio-Steel) म्हणुन ओळखल्या जाते. बांसाच्या उपयोग गरीब माणूस आपल्या दैनंदिन गरज्यानुसार, आार्थिक दृष्टया परवडणारे असल्यामुळे मोठ्या प्रमाणात करतात यामुळे याला गरिब माणसांचे लाकुड (Poor man's Timber) म्हणुन पण संबोधल्या जाते ।

जगात भारत, चीन व म्यामांर मधे 19.8 मिलियन हेक्टर म्हणजेच 80 टक्के बांसाचे जंगल आहे, हयामधे भारताचा 45 टक्के वाटा येतो. चीन नंतर भारताचा बांसाचा संसाधनात दुसरा क्रंमाक लागतो. बांस गवत प्रजातीचा ग्रमीनीई कुटूबांचा एक प्रमुख सदस्य आहे, या कुटूबांत गहु व भाता सारखे महत्वाचे पीक पण येतात. ही जगात सगळयात जलद गतीने वाढणारी वनस्पती आहे. याची काही जाति तर एका दिवसात (24 तासात) 121 सेंटीमीटर पर्यंत वाढण्याची नोंद आहे. बांसाला त्याच्या जीवनात एकदाच फुले येतात. बांसाला मोहोर येण्याची किंवा फुलण्याची वेळ ही वनस्पती जगातली एक रहस्यमय घटना आहे. ज्याची कुणालाही पूर्णपणे माहिती नाही. कालांतराने बांसाला मोहोर येणे म्हणजेच दुष्काळ पडणे पण होतो असा लोंकाचा समज आहे ।

जगात बांसाची (बॉम्बूची) 1200 जाती–प्रजाती आढळते. आशिया खंडात याची विविध प्रजातीची जैव विविधता

आढळते आणि जवळ जवळ 900 प्रजातीचे व 65 जेनेरा आढळते. हयामधे 14 जाति–प्रजाती स्थानिक आहेत. भारतात सर्वत्र याची 125 स्थानिक व 11 बाहेरची एकूण 136 प्रजाती व 23 जेनेरा आहेत. भारताचा पुर्वोत्तर राज्ये बांसाची मोठ्या प्रमाणात जैव विविधता साठी जगात फारच प्रसिद्ध आहे. इथे एकूण आठ प्रदेशात ज्यांमधे आसाम, नागालैंड, अरूणाचल प्रदेश, मेघालय, मिजोरम, मणिपुर, सिक्किम आणि त्रिपुरा आहेत. या प्रदेशात बांस जीविकेचा एक मुख्य साधन आहे. या प्रदेशात बांस आर्थिक, सामाजिक, कला जगत आणि सांस्कृतिक जीवनांत फार महत्वाची भूमिका बजावते. इथे वनांत, सीमावर्ती वनांत, पडीत जमीन, शेती योग्य जमीन व घर–बगीचात बांस मोठ्या प्रमाणात आढळते किंवा उगवले जातात. हया प्रदेशाला भारताचा बांसाच्या स्वर्ग म्हणुन ओळखल्या जाते. इथे देशाचा एकूण बांसा पैकी 66 टक्के आढळते ।

भारतात बॉम्बूची मुख्य जाति–प्रजाती आहे, बैंबूसा बम्बूस, बैंबूसा बालकोआ, बैंबूसा टूल्डा, बैंबूसा वलगैरिस, बैंबूसा न्यूटन्स, बैंबूसा पैलिडा, डेंड्रोकैलेमस स्ट्रीक्ट्स, डेंड्रोकैलेमस हेमलटोनाई, डेंड्रोकैलेमस जाइगैटियस, डेंड्रोकैलेमस ब्रॅडनीसी, डेंड्रोकैलेमस गिगटॉसस्, मैलोकेना बैसिफेरा, गिगॉनटोचला रोष्ट्रॉटा, सिजोस्टॉकम पेरग्रॅसिल, सासा फॉरचुनाई, गुआडुया अंगुस्टीफोलिया आणि

बांसाच्या प्रजाती

ऑक्सीटेनथेरा पारवीफोलिया इत्यादी प्रजाती आढळते. यामधे बैंबूसा प्रजाती देशात सर्वात जास्त प्रमाणात आढळते. ही प्रजाती विविध प्रकारच्या हवामानात व कठीण परिस्थिती सहन करू शकते आणि पानझडी क्षेत्रांपासुन ते समशीतोष्ण कटिबंधीय किंवा अर्ध हरीत क्षेत्रांपर्यंत 1000 से 6000 मी.मी. पेक्षा जास्त पावसाळी भागापर्यंत आढळतो. बॉम्बूची दुसरी प्रजाती डेंड्रोकैलेमस दक्षिण भारताचा मैदानी व मध्य भारतात मोठ्या प्रमाणात आढळते, ही प्रजाती 750 से 1000 मी.मी. पेक्षा कमी पावसाळी भागात

आढळते. जगात बांस सगळयाच खंडात आढळतो, पण हा युरोप व पश्चिम आशिया खंडात आढळत नाही.

बांसाचे वन

बांस एक अती प्राचीन औषधी वनस्पती, एक उत्तम नैसर्गिक खाद्य पदार्थ, आर्थिक, कला जगत, सामाजिक आणि सांस्कृतिक ओळख पटविणारी महत्वपूर्ण प्रजाती आहे. बांस अन्य त्रीव गतीने वाढणा–या वृक्षाच्या तुलनेत वातावरणात जास्तीत जास्त कार्बन संरक्षित करतो आणि दुस–या वृक्षांचा तुलनेत जास्तीत जास्त वातावरणात आक्सीजन सोडतो. चीन मधे बांसच्या मुलायम मुळापासुन (Clums) मनपसंत भाज्या बनवल्या जातात आणि तिथला एक लाजणारा प्राणी पांडा हयाचे तर बॉम्बू चे पांन प्रिय खाद्य पदार्थच आहे. भारतात बांसाच्या विभिन्न प्रजातीना पण विविध रोग व किटकांच्या प्रादुर्भाव होतो. रोपे, मूळ, खोड, फांद्या व पानांना 272 पेक्षा जास्त प्रकारचा विविध किटकांचा जाति–प्रजाती कमी जास्त प्रमाणात नुकसान करतांना आढळते. यामधे व्हाईट ग्रब्स, वाळवी किंवा उदई, रस शोषणारे व पांन खाणारे किट आणि बॉम्बू लीफ रोलर प्रमुख आहे ।

भारतीय वन सर्वेक्षण चा अनुसार भारतात बांसाचे वन जवळ जवळ 8.96 मिलियन हेक्टर मधे पसरलेले आहे. जे भारताचा 12.8 टक्के भाग होते. यामधे 28 टक्के भाग फक्त भारताचा उत्तर–पूर्वे राज्यात आढळते. मध्य भारताचे राज्य मध्य प्रदेश आणि महाराष्ट्रात क्रमशः 20.3 व 9.9 टक्के बांसाचे वन आढळतात. ओड़िशा राज्यात 8.7 व कर्नाटक राज्यात 7.4 टक्के बांसाचे वन आढळते. एक आकलनाचा अनुसार भारतात बांसाचे नैसर्गिक व वृक्षारोपणांचा क्षेत्र जवळ जवळ 11.4 मिलियन हेक्टर मधे पसरलेले आहे. जे भारताच्या एकुण 16.7 टक्के वनांचा क्षेत्रफळा एवढे व 3.4 टक्के भौगोलिक क्षेत्रफळा एवढे आहे ।

महाराष्ट्रात बॉम्बूला मराठीत "वेरू" पण म्हणतात. महाराष्ट्रात बॉम्बूच्या तीन महत्वाच्या प्रजाती आढळतात. बैंबूसा बम्बूस, डेंड्रोकैलेमस स्ट्रीक्ट्स व सूडाझॉन्टेनथरा आहेत व 0.85 मिलियन हेक्टर भाग बॉम्बूच्या वनांखाली येतो. बांस महाराष्ट्रात सर्वच जिल्हयात आढळतो.

विदर्भात नागपुर, अमरावती, गोंदिया, गडचिरोली, भंडारा, वर्धा, बुलढाना, अकोला चंद्रपुर, यवतमाळ व मराठवाडयात जालना, औरगांबाद, नांदेड, बीड, लातुर, अहमदनगर, धुळे आणि पश्चिम महाराष्ट्रात ठाणे, पुणे, नाशिक, सातारा, सांगली, कोल्हापुर, सोलापुर, रत्नागिरी, रायगड आणि सिंधदुर्ग या जिल्हयात मोठ्या प्रमाणात बांस आढळते. केंद्र सरकारने 2006 ला वन अधिकार कायदयाच्या अंतर्गत बांसाला वनोत्पाद (Minor Forest Products) च्या श्रेणी मधे टाकले आहेत. तरीही पुष्कळशे राज्य सरकार हया कायदयाला आपआपल्या राज्यात अंमलात आणले नाही आहे. पण महाराष्ट्र सरकारने हया कायदयाला अंमलात आणले आहे. आता महाराष्ट्रच्या आदिवासी शेतक–यांनी बांसाची मोठ्या प्रमाणात लागवड करत आहे व काही शेतक–यांनी बांसच्या औद्याोगिक व वाणिज्यिक स्तरावर उपयोग करू शकतात अशी महाराष्ट्र सरकार द्योषणा केली आहे ।

मध्या भारताच्या मध्य प्रदेश व छत्तीसगढ़ राज्यात बांसाचे वन 15,000 कि.मी. क्षेत्रात में पसरलेले आहे. जे देशाच्या बांस उगविणा–या राज्यांत दुसरा कमांक आहे. मध्य प्रदेशाचा विभिन्न जिल्हयांत जसे जबलपुर, मंडला, सिवनी, डिंडोरी, बालाघाट, बैतूल, हौशंगाबाद, नरसिंहपुर, छिंदवाड़ा, उमरिया, शहडोल, हरदा, खंड़वा, सिधी इत्यादी क्षेत्रांत बांस फार मोठ्या प्रमाणत आढळते. मध्य प्रदेशात

सुखलेले बांस

बांसाची मुख्य प्रजाती आहे, डेंड्रोकैलेमस स्ट्रीक्ट्स, बैंबूसा बम्बूस, गिगॉनटोचला रोष्ट्रॉटा, सिजोस्टॉकम पेरग्रॅसिल विविध क्षेत्रांत आढळते. यामधे डेंड्रोकैलेमस स्ट्रीक्ट्स प्रजाती आर्थिक, सामाजिक तसेच सांस्कृतिक रूपाने फारच महत्वपूर्ण आहे आणि मध्य भारताच्या सर्वच क्षेत्रांत फार मोठ्या प्रमाणात लोक उपयोगात आणतात ।

जगाचे बदलते पर्यावरण व मानवीय दबावामुळे जगात वनांचे संसाधनाचे स्त्रौत कमी होत आहे हयामुळे वन क्षेत्र पण कमी

होत विभिन्न प्रकारचा वृक्ष प्रजातीचा लाकडांची संख्या पण की कमी होत आहे व लाकडांची मांगणी वाढतच आहे पण ती पूर्ण होत नाही आहे. मागच्या काही वर्षोत बांसा वर विभिन्न संशोधकांनी संशोधन व विकास करून लक्षात आणले आहे की, बांसाच्या विभिन्न प्रजातीचे लाकडे दुस–या वृक्षांचा एक विकल्प होऊ शकते. बांसाचा परंपरागत उपयोग घर, इमारत व कच्ची सामुग्री बनविण्यासाठी आणि औद्योगिक आणि आधारभूत निमार्ण कार्योसाठी होतो, हया कारणाने बांसाची मांगणी जगात वाढतच आहे ।

बांसाची जगात वाढती मांगणी पूर्ण करण्यासाठी भारत सरकारच्या कृषी मंत्रालयाने राष्ट्रीय बॉम्बू मिशन (National Bamboo Mission) नावाची एक योजना देशाच्या विभिन्न राज्यांत चालवलेली आहे. या योजनेचा मुख्य उदेद्श बांसाचे विविध जाती–प्रजातीचां शास्त्रज्ञ पद्धती ने संशोधन करून उत्पादन वाढविणे, बांस चा जास्त पीक देणा–या प्रजातीना लावणे, शेतक–यांना बांसाचे पीक घ्यायला प्रेरित करणे, बांसाचे विविध उत्पादनांना बाजार मिळवुन देणे, बांसाचे लाकडांच्या हॅड़ीक्राप्ट व अन्य वस्तू बनविण्यासाठी युवकांना प्रशिक्षण देणे, कुशल व अर्धकुशल लोंकाना रोजगार देणे, कागद व अन्य वस्तू बनिवण्यासाठी कच्चा माल तयार करणे, बांसाचे महत्वपूर्ण उपयोगांचे प्रचार–प्रसार करणे आणि त्याचे संर्वधन व संरक्षण करण्यासाठी सरकारी व गैरसरकारी संस्थाना सम्मिलित करणे इत्यादी आहे ।

बांस भारताच्या नव्हेत तर दुस–या आशिया खंडातील देशांच्या आर्थिक, कला जगत, सामाजिक, सांस्कृतिक रूपाने आणि भोजन पद्वती मधे रचून–बसून गेलेला आहे. हयामुळे बांसाला जगात अन्यय साधारण महत्व आहे ।

Fruit plant based inter-cropping system for undulating barren upland of Jharkhand: alternate land use model

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Summary

A case study on Alternate Land Use (ALU) system has been made at Zonal Research Station, Chianki forcultivation practice in the barren undulating upland of Jharkhand with dryland suited fruit plants i.e. guava. The objective was to establish the dryland fruit orchard in the rainfed upland (barren and waste), with increasing cropping intensity by using suitable inter-cropping system in the early stage of orchard establishment; and making the land cultivable. The fruit plant guava has been found suitable in dryland situation and it may improve the financial condition of the farmers. The vegetative coverage is possible only through this technique for the sustainable development of these undulating upland. After making a little land work in the field, land becomes suitable for the plantation of dryland fruit plants of guava. In the first year of plantation of guava plants, farmers may cultivate some field crops as intercrops. The intercrops may be Pigeonpea+Rice or Pigeonpea+Maize in between the alleys of fruit plants in the same plot. These intercropping/sequence cropping may be taken only for 2-3 years. Later on the shade loving crops such as ginger, elephant foot yam and lastly turmeric may replace these crops in the subsequent year of orcharding as per the shading effect increases year to year. At this stage the soil properties may be sufficiently improved by addition of organic matter of the fruit plants and continuous intercrops in the field. This may also increases the biological activities of the soil. The improved physical and chemical properties of the soil will also increase the water holding capacity of the soil and become suitable for better cultivation in this plot.

Introduction

A large acreage of Jharkhand state comes under rainfed upland situation, parts of which are undulating and barren. The cultivation in this undulating land is still challenging. The river banks and nearby forest areas are generally comes under this category. Some of them are private and some are government land. These lands require vegetative coverage to support ecological balance of the region. Time to time some initiative has been taken to cover these lands by forest trees under

social forestry programme, but still a large area of these lands are unutilized. Considering these facts a case study on suitable model of Alternate Land Use (ALU) system has been made at Zonal Research Station, Chianki to cultivate in these lands with dryland suited fruit plants guava. The objectives of this model were as follows:

1. Establishment of dryland fruit orchard in the rainfed upland situation.
2. Increasing cropping intensity by using suitable inter-cropping system in the early stage of orchard establishment.
3. Making land cultivable with little land development work in the field *viz.*, levelling, bund and terrace making, cultivation of inter crops between the alleys of fruit plants.

Importance

The fruit plants like guava, aonla, custard apple etc. are suitable in dryland situation and these may improve the financial condition of the farmers reside surrounding these areas. These fruit plants are very much suitable in the agro-ecological situation of the State and require very less effort to manage the orchard because of,diseases and insect-pest are not a major problem in these fruit plants in the state of Jharkhand. Resulting, uses of pesticide are very less thus it becomes eco-friendly. The vegetative coverage is possible only through this technique for the sustainable development of these undulating uplands. The rural people enjoy these fruits in low price with pesticide free fruits for better health.

After making a little soil work in the field, land becomes suitable for the planting of dryland fruit plants *viz*., guava, aonla, custard apple etc. In the first year of planting of fruit plants, farmers may cultivate some field crops as inter-crops. The inter-crops may be Rice-Chickpea or Pigeonpea+Rice or Pigeonpea+Maize in between the alleys of fruit plants in the same plot. These inter-cropping/sequence cropping are suitableonly for 2-3 years. Later on, shade loving crops such as ginger, elephant foot yam and lastly turmeric may replace these crops in the subsequent year of orcharding as per the shading effect increases year to year. The guava based inter-cropping system should be first choice and then aonla and custard apple in order of preference. After 6-7 years of orchard establishment whole plot should be covered by guava plant. Generally after 15 years, theguava plants become declining. At this stage, the soil properties may be sufficiently improved by addition of organic matter by the fruit plants and continuous inter-cropping in the field. This may also increases the biological activities of the soil. It provides better micro-climate for crop/vegetable cultivation. The improved physical and

chemical properties of the soil will also increases the water holding capacity of the soil and better cultivation become possible in these plots.

Considering these facts a model has been designed at ZRS, Chianki, which needs popularized in large scale in the Jharkhand state in general and specific to Western Plateau of the State.

Methodology

With the help of little soil work in the plot and making terraces with 12-15 meter wide plot along with a bund was made after the levelling of 12-15 meter wide sub-plot and 2-3′ deep another sub-plot with similar width followed byleveling of plot in the same way. Another subplot wasmade as per availability of the plot size in the subsequent downward direction in similar way.

Water harvesting tank

One tenth of plot size wasleft for making a water harvesting tank by digging at the most downward position of the land where all runoff watercollected with the help of channel made from each sub plot. The tank may provide lining either by polythene sheet or by cement work to check percolation and infiltration loss of harvested water from the tank. This harvested water mayutilize for the lifesaving of fruit plantsand for inter-crops during drought period.

Plantation of fruit plant

Dryland suited fruit plants such as guava, aonla, custard apple etc. may be taken for the orchard establishment in such plot. In this case guava was selected. The recommended package of practices follows for the plantation of these fruit plants. For the guava plantation following package ofpractices wasfollowed:

Spacing: 5m x 5m for normal plantation and 2.5m x 2.5m for high density plantation.

Pit size: 2.5’ x 2.5’ x 2.5’

Time of pit digging: March to April

Pit filling: May to First fortnight of June

Fertilizers, compost, pesticide etc. well mixed in the soil before filling the pit:

DAP: 800 g/pit

MOP: 600 g/pit

Compost: 20 kg/pit

Lime: 1.5 kg/pit

Karanj cake: 1.0 kg/pit

Tricel/Radar (5%) dust: 150g/pit

Planting time

First week of July after setting of filled soil in the pit.

Variety

For guava Allahabad safeda

For Aonla: NA-7 and Chakaiya

For Custard apple: Sahebganj special

Plant sapling

Healthy true to type goottee/budded plantsprocured from reputed nursery for having disease and insect-pest free plants

and this will be helpful for the establishment of healthy fruit orchard.

Planting time

Before plantation of fruit plants, the whole plot was made well levelled and prepared for the sowing of inter-crops. The planting of goottee/budded plants were done at evening hour and light irrigation may be provided just after planting and thereafter (irrigation) as per need of the plants or at moisture stress condition. During summer season special care taken for first year of planting as frequent irrigation is needed for saving the plant. Two to three days after the plantation of fruit plants, the sowing of inter-crops were done as per recommended package and practices.

Inter-cropping

As per the experimental findings followingthree inter-crops/sequence crops were important for the cultivation in the inter space (alley) of fruit plants:

1. Rice-Chickpea (Rice variety- BVD 109; Chickpea variety- KPG 59)
2. Pigeonpea+Rice (Pigeonpea variety- Birsa Arhar-1;Rice variety- BVD 109)
3. Pigeonpea+Maize (Pigeonpea variety- Birsa Arhar-1; Maize variety- Suwan Composit-1)

Following recommended package of practices wasfollowed for the inter-cropping:

Spacing

Spacing for rice: 25 cm row space

Spacing for chickpea: 30cm row space

Spacing for Pigeonpea: 75 cm row space

Ratio of inter-crops:

Pigeonpea+Rice:: 1:2

Pigeonpea+Maize:: 1:1

NPK for different crops:

Upland Rice: 40:30:20 NPK kg/ha

Chickpea: 20:40:20 NPK kg/ha

Pigeonpea+Maize: 80:40:20 NPK kg/ha

Compost: 5.0 t/ha

Seed rate:

For rice 80 kg/ha

For chickpea 80 kg/ha

For pigeonpea 20 kg/ha

For maize 20 kg/ha

Seed treatment

All seeds must be treated with Carbendazim 2g/kg of seeds properly.

Intercultural operation

Two to three intercultural operations required for better growth and development of the inter-crops. Earthing up in the Pigeonpea+Maize inter cropping was followed.

Irrigation

Lifesaving irrigation must be provided from the water harvesting tank if inter crops shows moisture stress or wilting. Generally one or two dry spell is common during monsoon season in the Palamau region of Jharkhand and most of the upland crops are affected due to moisture stress.

Plant protection

Suitable plant protection measures were taken,as per the symptoms of diseases or insect-pest observed in the inter-crops or base crop (fruit crop).

Harvesting of inter-crops

To avoid shattering loss, harvesting were done in appropriate time of maturity to the corresponding inter-crops.

Economic Analysis

Cost of orchard establishment

Rs. 58,500.00 (5 m x 5 m) & Rs. 147,300.00 (2.5 m x 2.5 m) per Acre details are as follows:

Table 1: Economics for One acre of land (ALU Model) Cost for first year

S. No.	Particulars	Amount involved in different spacing of Guava plants (Rs.)	
		5m x 5m spacing	2.5m x 2.5m spacing
1	Land work (5 hrs of 2 tractors)@Rs.600/hr	6,000.00	6,000.00
2	Pit digging (@ Rs. 180/- labour charge)	5,400.00	21,600.00
3	Pit filling (@ Rs. 180/- labour charge)	1,800.00	7,200.00
4	Plant cost @ Rs. 35/-	5,600.00	22,400.00
5	Compost @ 20 kg/pit	3,600.00	14,400.00
6	Fertilizer cost @ DAP 800g+MOP 600g/pit	5,600.00	22,400.00
7	Lime 1.0 kg+Tricel(5%) 150g/pit	1,600.00	6,400.00
8	Planting cost @ Rs.180/- labour charge	1,800.00	7,200.00
9	Other management for 1st year	5,400.00	10,800.00
10	Irrigation cost	18,000.00	24,000.00
11	Plant protection	1,200.00	2,400.00
12	Miscellaneous	2,500.00	2,500.00
	Total	**58,500.00**	**147,300.00**

Table 2: Cost of cultivation for inter-crops for first year (Rs.)

S. N.	Particulars	Guava+ (Rice-Chickpea)	Guava+ (Pigeonpea+Maize)	Guava+ (Pigeonpea+Rice)
1	Land preparation cost @Rs.180/- labour charge	9,000.00	9,000.00	9,000.00
2	Compost @2.0 ton/ha	2,400.00	2,400.00	2,400.00
3	Fertilizer (NPK)	2,700.00	2,750.00	2,750.00
4	Seed cost	3,400.00	2,000.00	2,000.00
5	Intercultural operation	7,200.00	10,800.00	8,800.00
6	Plant protection cost	2,000.00	4,000.00	4,000.00
7	Harvesting threshing etc.	3,600.00	5,400.00	5,400.00
8	Miscellaneous	1,000.00	1,000.00	1,000.00
	Total	**31,300.00**	**37,350.00**	35,350.00

Table 3: Cost of cultivation and management of guava plants in second year (Rs.)

S. N.	Particulars	Guava+ (Rice-Chickpea)	Guava+ (Pigeonpea+Maize)	Guava+ (Pigeonpea+Rice)
1	Management of guava plant	29,460.00	36,550.00	36,550.00
2	Plant protection in guava plant	2,000.00	2,000.00	2,000.00
3	Irrigation in guava plant	9,000.00	9,000.00	9,000.00
4	Fertilizer management in guava plant	3,000.00	3,000.00	3,000.00
5	Cost in inter-cropping	31,300.00	37,350.00	36,350.00
	Total	**74,760.00**	**87,900.00**	**85,900.00**

Table 4: Cost of cultivation and management of guava plants in third year (Rs.)

S. N.	Particulars	Guava+ (Rice-Chickpea)	Guava+ (Pigeonpea+Maize)	Guava+ (Pigeonpea+Rice)
1	Management of guava plant	29,460.00	36,550.00	36,550.00
2	Plant protection in guava plant	3,000.00	3,000.00	3,000.00
3	Irrigation in guava plant	9,000.00	9,000.00	9,000.00
4	Fertilizer management in guava plant	4,500.00	4,500.00	4,500.00
5	Cost in inter-cropping	31,300.00	37,350.00	37,350.00
	Total	**77,260.00**	**90,400.00**	**88,400.00**

Table 5: Cost of cultivation for inter-crops and guava plants at the spacing of 5 m x 5 m

Year	Cost of Guava cultivation (Rs.)	Cost of cultivation (Rs.)		Gross income (Rs.)		Net income (Rs.)	
		Pigeonpea+Rice	Pigeonpea+Maize	Guava+ (Pigeonpea+Rice)	Guava+ (Pigeonpea+Maize)	Guava+ (Pigeonpea+Rice)	Guava+ (Pigeonpea+Maize)
1st	58,500.00	14140.00	14940.00	25452.00	24766.00	-47,188.00	- 48,674.00
2nd	20220.00	14540.00	15340.00	25662.00	25578.00	- 9,098.00	- 9,982.00

3rd	21220.00	14940.00	15740.00	47920.00	39832.00	11,760.00	2,872.00

Note: *From 4th year shade loving crops viz., turmeric, elephant foot yam etc. may be cultivated inside the guava orchard. Net returns increases year to year as yield of guava plants increases in the subsequent year.*

On the basis of economic analysis of different inter-cropping system in the guava orchard, Pigeonpea+Rice gave best net return followed by Pigeonpea+Maize. Initially, upto two years of orchard establishment net return was with negative values for all combinations of inter-crops. Because of high initial cost incurred in the orchard establishment and round the year management cost of newly planted fruit plants for two initial years. With the fruiting of guava plants from 3rd year of plantation, net return become positive and it will increases year to year as fruit yield/plant increases with the increasing canopy of guava plants in the subsequent year. After 3rd year, inter-crops to be changed by the shade loving crops *viz.*, ginger in the 4th year, Elephant foot yam in the 5th year and Turmeric in the 6th year. Turmeric cultivation may be prolonged upto the orchard life.

Rainy season fruiting of guava plants may be discouraged by manual de-blossoming in guava plants to enhance fruiting in the subsequent winter season for getting higher return during the winter season when high demand of guava fruits in the market with higher price as quality of guava fruits are better in the winter season as compared to rainy season.After 12-15 years of orcharding practices soil condition of the plot become improved by adding organic matter of plants and increasing biological activity due to shade and continuous cultivation of inter-crops inside the orchard. After decaying of guava plants the fallow land of this orchard become fertile because soil physical, chemical and biological properties increases due to rich in organic matter content in the soil which will ultimately increases water holding capacity of the soil and may be utilize for the cultivation of vegetable crops during rainy season and winter season also by providing irrigation facility.

कडूनिंब: पीक संरक्षणासाठी उपयुक्त वनस्पती

शालिनी भोवते
वानिकी अनुसंधान एवं मानव संसाधन विकास केंद्र, छिंदवाडा.

आज रासायनिक किटनाशकांचे दुष्परिणाम सतत दिसून येत आहेत तसेच त्यांच्या

कडूनिंब

वाढत्या किमती लक्षात घेता वनस्पतीपासून तयार केलेले किटनाशक जास्त उपयोगी आहेत. वनस्पतीजन्य किटनाशकांमधे अनेक महत्वाच्या वनस्पतींचा समावेश होतो. त्यातूनच कडूनिंबाचे झाड वेगवेगळया पिकांवरील किडींच्या व्यवस्थापनात भरभरून मदत करते।

कडूनिंबाची लहान मोठी झाडे संपूर्ण देशभर पाहायला मिळतात. कडूनिंबाचे शास्त्रीय नाव 'अझाडिरेक्टा इंडिका' आहे.या झाडाचा प्रत्तेक भाग जसे पाने, फूले, फळे, खोड, साल, मुळे विविध रूपाने उपयोगी आहेत. औषधी गुणधर्मान समृध्द असणार हे झाड मानवासाठी आणि पिकांसाठी एक परिपूर्ण कल्पवृक्ष आहे.

पूर्वी कडूनिंबाचा वापर औषधीसाठी आणि किटनाशकाच्या रूपाने केला जात होता परंतू हे तथ्य आता शास्त्रीय संशोधनाव्दारे सिध्द झाले आहे. कडूनिंबातील रासायनिक गुणांनी पीक उत्पादन क्षेत्रात एक नवीन क्रांति आणली आहे. कडूनिंबात अनेक प्रकारचे रासायनिक पदार्थ आढळतात त्यात 'अझाडिरेक्टिन' हें रसायन द्रव्य अतिशय महत्वाचे असून कडूनिंबाचा क्रियाशील घटक म्हणून ओळखल्या जातो. कडूनिंबातील किटनाशकाचा मुख्य स्त्रोत म्हणजे निंबोळयातील बियाणे आहे. एका पूर्ण वाढ झालेल्या झाडापासून ५० ते १०० किलोपर्यंत ताज्या निंबोळया मिळतात ५० किलो ताज्या निंबोळयापासून ३० किलो बियाणे मिळते व त्या पासून ५ किलो तेल आणि २५ किलो (seed cake) पेंडी/ढेप मिळते.

कडूनिंबापासून तयार केलेल्या किटनाशकाचा वापर करून पिकांवरील किडींवर फवारणी

कडूनिंब बिया

केल्यास लगेच कीट मरत नाहीत परंतू त्यांच्या वागणूकीमधे बदल होऊन त्यांच्या शरीर क्रिया

मधे घातक बदल घडून येतात आणि शेवटी ते कीट मरतात.

कडूनिंबामधील रसायनांचे किडींवर होणारे परिणाम -

१)

२) फवारणी केलेल्या पिकांवर किडींच्या मादा परावर्तित होतात व अंडे घालने टाळतात.

३) किडींची वाढ खुंटते व अपगत्व येते.

४) किडींचे जीवन चक्र छिन्न-भिन्न होते व किडींमधे नपुसंकता येते.

५) फवारणी केलेल्या झाडांवर किडी भक्षण करू शकत नाही.

६) किडींचे आयुष्य कमी होते.

कडूनिंबाच्या वनस्पती पासून बरीचशी व्यापारी किटनाशके सुध्दा विकसित करण्यात

कडूनिंब निंबोळया

आली आहेत. सेंद्रीय शेतीला, विषमुक्त भाजीपाल्याला आणि अन्न धान्न्याला कडूनिंबापासून बनवलेली सर्व औषधी उपयुक्त आहेत त्यामुळे त्यांचा वापर वाढू लागला आहे.

कडूनिंबयुक्त किटनाशके आर्थिक दृष्टया किफायती पर्यावरण मित्र, सुरक्षित आणि किटकांना खात्रिने नुकसान करणारी आहेत. फवारणी केलेल्या झाडांवर व होणारया उत्पादनामधे हानिकारक अवशेष आढळत नाही हें एक त्याच वैशिष्ट आहे म्हणूनच त्यांना एकात्मिक कीड व्यवस्थापनात (IPM) महत्वाचे स्थान आहे. मित्र जिवांचे रक्षण

कडूनिंब कर्नल

करणे, शत्रु जिवांना जास्त न मारता त्यांची संख्या कमी करणे, सूत्र कृमिंचा नाश करणे, विवीध रोगापासून झाड़ांचे रक्षण तसेच खाद रूपाने कार्य करणे असे अनेक गुण कडूनिंबात आहेत.

कडूनिंब पेंडी पावडर

उपयोग करण्याची पध्द्त

धान्य साठवणीत कडूनिंबांची पाने टाकून धान्याच किडींपासून संरक्षण करता येते.

पावडर तयार करून – कडूनिंबांची पाने, दाणे, बियाणे वाळवून त्यांचा पावडर तयार करून १-२ टक्के या प्रमाणात साठवणुकीच्या धान्यात मिसळल्यास धान्य किडींपासून सुरक्षित ठेवण्यास मदत होते

तेल - कडूनिंबाचे तेल अनेक प्रकारच्या किडींपासून पिकांचे संरक्षण करण्याकरिता वापरता येते.

पाण्यात अर्क काढून - पाने, बियाणे, साल तसेच दाण्यापासून पाण्यातील अर्क काढून किंवा सेंद्रिय द्रावके इथिल अल्कोहल, बेंझीन, ॲसीटोन यामधे अर्क काढून त्याचा पाण्यातील ५ टक्के फवारयाचा वापर पिकांवरील कीडींच्या नियंत्रणासाठी फायदेशीर ठरते.

निंबोळी पेंडी (seed cake) - हे नैसर्गिक खत असून यात किटनाशकाचेही गुणधर्म आहेत. पूर्णपणे वनस्पती उत्पादन असल्यामुळे यात नैसर्गिक NPK आणि इतर अत्यावक्षक सूक्ष्म पोषक तत्व असतात. निंबोळी पेंड शेतातील झाडांच्या मुळांचे निमेटोड्स, मातीतील ग्रब्स आणि पांढरया मुंग्या पासून रक्षण करते.हे गांढूळासाठी सुध्दा अपायकारक नाही ।

निंबोळी अर्क तयार करण्याची पद्धत

- हंगामात निंबोळया गोळा करून त्यांना चांगल्या वाळवा. जवळ पास आठ महीन्यापेक्षा जुन्या निंबोळया अर्क तयार करण्यासाठी वापरू नये.
- ५% निंबोळी अर्क तयार करण्यासाठी फवारणी च्या आदल्या दिवशी ५ किलो निंबोळया कुटून बारीक़ करा आणि १० लीटर पाण्यात भिजवा.
- दुसरया दिवशी सकाळी घोळ काठीने दुधाळ होईस्तोवर निट ढवळून कापडाने गाळून घ्या. २०० ग्राम साबणाचा पेस्ट तयार करून द्रावणात मिसळवा. हा घोळ एकूण १०० लीटर होईल एवढे पाणी मिसळा. आणि या द्रावणाचा फवारणी साठी वापर करावा.

अशाप्रकारे कडूनिंबाच्या निंबोळी / पानांचा अर्क तयार करता येतो परंतू तयार केलेला अर्क साठवून ठेवता येत नाही फवारणीच्या दिवशीच अर्क तयार करून वापरावा. हा अर्क कापूस, हरभरा, तुरीवरील शेंगा पोखरणारया अळया अशा विविध प्रकारच्या झाडांना नुकसान करणारया अळयांच्या नियंत्रणासाठी उपयुक्त आहे. तसेच पिकांवरील इतर किडींचे सुद्धा नियंत्रण करण्यास फायदेशीर ठरते.

असे हे कडूनिंबाचे झाड आपल्या आरोग्यासाठी, शेती व्यवसायासाठी व पीक संरक्षणासाठी साठी अत्यंत उपयुक्त आहे त्यामुळे त्यांची नव्याने लागवड करा आणि उत्पन्न वाढवा.

Combating desertification in India

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June 17 is observed worldwide as the World Day to combat Desertification. Given that this year the focus is on attainment of food security for all through sustainable food systems, the spectrum of policy level dialogues and research approach needs a thorough review. The goal of achieving food security for all is quite impractical without greater public awareness and participation. As the consequences of desertification are very serious and people across region, religion, age, caste and economic status will have to bear it, our common understanding and approach if engaged in a proper way may bring certain improvements in the lives of our present and future generations. This article is all about our understandings on desertification and how we can help individually and in a community to mitigate the impacts of desertification.

World Day to Combat Desertification 2015

With the slogan, 'No such thing as a free lunch. Invest in healthy soil', the 2015 observance calls for:

(1) A change in our land use practices through smart agriculture and adaptation to changing climate, especially in the dry fragile parts of the world where food shortages are becoming more and more severe

(2) Access to technology and land rights for small holder farmers who safeguard the environment and meet the food needs of millions of households, especially among the poorest households

(3) A balance in the land use for ecology and consumption, drawing on the best practices

(4) More investments in sustainable land practices so that sustainable food systems become the normal practice and

(5) More effective action on desertification whose effects on security, peace and stability are invisible yet real for the affected countries due especially to food and water scarcity and environmentally forced migration.

(Source: http://www.unccd.int/en/programmes / Event-and-campaigns/WDCD /wdcd %202015/Pages/default.aspx?HighlightID= 352)

The term desertification as defined by the United Nations Convention to Combat Desertification encompasses all types of land degradation in arid, semiarid and sub-humid areas resulting from various factors including climatic variations and human activities (UNCCD Art.1.a). Our

understanding on land degradation will be little helpful to have a clear idea about desertification.

Land degradation is anyshort term or long term reduction in the natural productive capacity of land (UNEP, 1992b).Land fragmentation, increased area of cultivable lands due to population pressure, unsustainable land use practices such as mono cropping, overgrazing etc. are the major causes of desertification.Loss of biodiversity, salinization, water erosion, sand dune encroachment, rangeland degradation and outmigration are key components of land degradation. Desertification affects us in both ways, directly by reducing the yields of crops and livestock and indirectly by declining the quality of natural resources like water.In the former case it threatens the baskets of food and nutritional security of developing and under developed countries. Given the lower purchasing power of these countries, a little imbalance and fluctuation in economic and ecological stability due to desertification impacts can bring in disastrous situation for especially the poor and marginalized who mostly rely on land based livelihoods. It has been estimated that land degradation costs US$40 billion annually worldwide, without taking into account hidden costs of increased fertilizer use, loss of biodiversity and loss of unique landscapes.

For India, which shelters 194 million hungry people, highest in the world as per the United Nations annual hunger report and also going to surpass china in a decade or two to become the most populous country in the world, maintaining stability and sustainability around ecological parameters is of paramount importance. As per the estimation of Government of India, about 32 percent of geographical (105.48 mha) area of India is undergoing the process of land degradation. In the recent years the symptom of desertification is quite evident almost in all parts of India and particularly in Odisha around 1.5 lakh hectare of land showing signs of desertification.Given India as an agrarian country which still provides livelihoods to 70 percent of its population and employment to around 50 percent of workforce, it needs to put in best investments around soil and other natural resource management. Besides, a major change in policies and implementation approach to ensure sustainability around land use practices through promotion of mixed cropping (cultivation of two or more agricultural units in the same piece of land where inclusion of livestock is a most), intercropping (raising one or more crops in proximity), agroforestry (raising agricultural crops and/or livestock in between tree alleys where woody perennial like forest/fruit tree is a most), controlled

grazing and wasteland reclamation measures and strengthening adaptation mechanisms as well as environmental conservation, more public debate and participation in the whole process of risk mitigation is quintessential and can contribute significantly in addressing desertification. Combating desertification is not the exercise of policy makers or planners, it is the duty of all of us as per the constitutional provisions/obligations laid under article 51A (g) of Indian Constitution which says that "it shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures".

Let's join hand together and save our planet.

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पीपलः एक महत्वपूर्ण वृक्ष

सौरभ दुबे

उष्ण कटिबंधीय वन अनुसंधान संस्थान

ज़बलपुर (म. प्र.)

पीपल हमारे देश का एक महत्वपूर्ण वृक्ष है, यह न केवल धार्मिक कारणो से वरन् अपने औषधीय गुणो के कारण भी बहुत उपयोगी है। आयुर्वेद में इसके चिकित्सीय गुणो के कारण इसे विशेष स्थान दिया गया है।

वृहत आकार का पीपल का वृक्ष

यह शीघ्रता से बढ़ने वाला पर्णपती वृक्ष है, जिसकी ऊँचाई 20 मी. से अधिक तक हो सकती है तथा तना असामान्य आकार का, शाखाएं फैली हुयी होती हैं, घना चंदोवा तथा छाल हल्के भूरे धूसर रंग की होती है। इसके फल बारिश में पकते हैं। मुख्यतः पीपल मध्य भारत, बिहार से लेकर हिमालयी क्षेत्रो सहित सम्पूर्ण भारत में पाया जाता है। यह अधिक आयु तक जीवित रहने वाला पेड है। इसे बीज व कलम दोनो माध्यम से लगाया जा सकता हैं। जंगल में इसके बीज का प्रसारण मुख्यतः इसके फल खाने वाले पक्षियो व जीवो द्वारा होता है। इस वृक्ष को लगाने के लिये किसी विशेष प्रकार की मृदा की आवश्यक्ता नही होती और इसलिये इसे हम मकानो की छतो, दीवारो व कभी- कभी अन्य पेडो के ऊपर आसानी से पनपते हुये देख सकते हैं।

इसके आसानी से बढ़त लेने के गुण के कारण ही इसे सड़को के किनारे व गाँव की चौपाल आदि में लगाया जाता है।

आयुर्वेदिक ग्रन्थ भाव प्रकाश में इसके बोद्रिध, अश्वत्थः, चलपत्र, गजाशन नाम बताये गये है तथा इसे कषाय, रसयुत्त, कठिनता से पचने वाला, शीतल, शरीर के वर्ण को उत्तम बनाने वाला, योनि का शोधन करने वाला, कफ, पित्त, रक्त विकार दूर करने वाला बताया गया हैं।

पीपल का वृक्ष जितना धर्मिक दृष्टि से महत्वपूर्ण

दीवार में पनप रहा पीपल का पौधा

हैं उतना ही अपने औषधीय गुणो के लिये भी जाना जाता हैं, इसके पत्र, फल, छाल, जड़, बीज आदि चिकित्सीय उपयोग में लाये जाते हैं।

औषधीय महत्व

पत्तियाँ

इसकी 3-4 पत्तियो का रस शक्कर के साथ लेने में पीलिया में आराम मिलता हैं। यह दस्त, नाक से बहते खून को बंद करने आदि में उपयोगी हैं तथा हृदय सम्बंधी बीमरियो में, गले की सूजन दूर करने में और त्वचा को मुलायम रखने में इसकी पत्तियो के रस का प्रयोग किया जाता है।

आम के वृक्ष पर पीपल का पौधा

फल

इसके फल पाचक होते हैं। फल को सुखाकर एवं पीसकर उसका प्रयोग अस्थमा के इलाज में किया जाता हैं। इनमें बंध्यता दोष दूर करने का गुण पाया जाता हैं तथा बीजो का प्रयोग मूत्र संबंधी विकारो को दूर करने में किया जाता है।

छाल

पीपल की छाल की राख को वमन के लिये पानी के साथ देते हैं तथा अल्सर व घावो को भरने में, फ़िस्टूला आदि में भी प्रयोग किया जाता है।

जड़

पीपल की कोमल जडो को चबाने से दाँतो व मसूडो की तकलीफ दूर होती है।

धार्मिक महत्व

हमारे देश में वृक्ष पूजा का इतिहास हजारो साल पुराना हैं। सिंधु घाटी की सभ्यता से लेकर आज तक वृक्षो की पूजा होती आ रही हैं। पूजनीय वृक्षो में बड, आँवला, पीपल, केला आदि हैं, जिनमें पीपल को हिन्दू व बौध्द धर्मो में विशेष महत्व दिया गया है। गीता में भगवान श्री कृष्ण ने पीपल को अपना स्वरुप बतलाया है एवं पुराणो के अनुसार देव व दानवो के युध्द में देवो के पराजित हो जाने पर भगवान विष्णु पीपल के वृक्ष मे समाहित होकर छिप गये थे। वैदिक यज्ञों में पीपल के पेड की लकडी से अरणि मंथन के द्वारा ही अग्नि उत्पन्न की जाती थी। शास्त्रो में इसे देव वृक्ष बताया गया हैं क्योकि इसमे भगवान विष्णु का वास होता हैं। इसके मूल में विष्णु, तने में केशव, शाखाओ में नारायण, पत्तो

हिन्दू मंदिर में पीपल

में श्री हरि तथा फलो में अच्युत भगवान निवास करते हैं इसी कारण ऐसा माना जाता हैं कि पीपल की पूजा करने पर सभी देवी- देवताओ की पूजा भी हो जाती हैं। शनिवार के दिन पीपल के

वृक्ष के नीचे दीपक जलाने से शनि का प्रकोप कम हो जाता हैं तथा उनकी कृपा प्राप्त होती है।

बौद्ध धर्म में पीपल के वृक्ष को बोधि वृक्ष के नाम से जाना जाता हैं क्योकि भगवान बुध्द को

पीपल के नीचे विराजमान बुद्ध

(स्त्रोतः www.studyblu.com)

पीपल के वृक्ष के नीचे ज्ञान प्राप्त हुआ था, वही बोधि वृक्ष आज भी बोध गया में लगा हुआ हैं। राजकुमारी संघमित्रा ने इस बोधि वृक्ष की एक शाखा को श्री लंका के अनुराधापुर में लगाया था। इसी कारण से बौध्द अनुयायी पीपल को पवित्र मानते हैं। पीपल की इसी धार्मिक महत्ता के कारण इसे बौध्द मंदिरो में लगाया जाता हैं।

अन्य महत्व

पीपल की पत्तियो को पशु चारे के रुप में भेड-बकरियो को दिया जाता हैं व ग्रामीण क्षेत्रो में लोग आज भी इसकी कोमल टहनियो का प्रयोग दातुन के रुप में करते हैं। इसकी छाल से रंग भी तैयार किया जाता हैं और यह लाख के उत्पादन के लिये भी अनुकूल वृक्ष हैं। माना जाता हैं कि पीपल का पेड रात्रि के समय में भी आक्सीजन प्रदान कर वातावरण को स्वस्थ रखने में मदद करता हैं। घना चंदोवा व टहनियो की अधिकता वाले इस पेड पर कई प्रकार के पक्षी और जंतु अपना निवास स्थान बनाते हैं व इसके फलो को खाते हैं, इस प्रकार यह वृक्ष वन्य जीवन को भी आश्रय प्रदान करता हैं।

संदर्भ ग्रंथ

Sacred plant and their medicinal uses by Anil Kumar Dhiman.

भावप्रकाश.

ଜିଆ ଖତ ପ୍ରସ୍ତୁତି

(Preparation of vermicompost)

ପ୍ରମୋଦ କୁମାର ବରେଠା *, ପୁଲକେଶ ଶାହା *, ସନ୍ଦିପ ପ୍ରାଜାପତ **

* କୃଷିତତ୍ତ୍ୱ ବିଜ୍ଞାନୀ, କୃଷି ମହାବିଦ୍ୟାଳୟ , ଓୟୁଏଟି ଭୁବନେଶ୍ୱର , ** ପି.ଏଚ୍.ଡି ସ୍କଲାର୍ , ଆନ୍ଧ୍ରପ୍ରଦେଶ କୃଷି ବିଶ୍ୱବିଦ୍ୟାଳୟ

ପୁରାତନ କାଳରୁ କୃଷି ପ୍ରଣାଳୀ ସାମ୍ପୁରଣ ଜୈବିକ ଥିଲା ଯାହାକି ପରିବେଶ କୁ ପ୍ରଦୁଷିତ ନକରୁଥିଲା . ଧିରେ ଧିରେ ଯେତେ ବଢେ ଲୋକ ସଂଖ୍ୟା ବଢି ବାକୁଲାଗିଲା ସେତେବେଳେ ଅଧିକ ଖାଦ୍ୟ ଦରକାର ପଡିଲା ଓ ନୁତନ ଜ୍ଞାନ ଜନ୍ମ ହେଲା ରାସ୍ତୁରସ୍ଟି ହେଲା . ଏହୁଜ ବିପ୍ଳବ ପରେ ପରେ ଆମେ ସାମ୍ପୁରଣ ଭାବେ ରାସାୟନିକ ସାର, କୀଟନାଶକ ଓ ରାସାୟନିକ ବସ୍ତୁ ଉପରେ ନିର୍ଭର ହେଲା ପଡିଲୁ. ଯାହାଫଳରେ ଖାଦ୍ୟ ଉତ୍ପାଦନ ରେ ବୃଦ୍ଧି ଘଟିଲା କିନ୍ତୁ ଅନ୍ୟ ପକ୍ଷରେ ମୃତିକା ର ଉତ୍ପାଦିକା ଶକ୍ତି ହ୍ରାସ ପାଇଲା .

ମାଟି ପରୀକ୍ଷା ରୁ ଜଣାଯାଇଛି କି ଆମ ରାଜ୍ୟ ର ଅଧିକାଂଶ ମାଟିରେ ଜୈବିକ ଅଙ୍ଗାର ଅଂଶ ବହୁତ୍ କମ୍ (ସେସେ ୦.୩ - ୦.୫ ଭାଗ) ଓ ନିମ୍ନମାନର . ବିନା ମାଟି ପରୀକ୍ଷା ରେ ଅସାନୁପାତିକ ସାର ପ୍ରୟୋଗ କରିବା ଯୋଗୁ ମାଟିରେ ଜୈବିକ ଅଂଶ ହ୍ରାସ ପାଇଛି . ଏହି ଜୈବିକ ଅଂଶ ର ପରିମାଣ ଆୟତନ ମାନକ ର ସଂଖ୍ୟା ବୃଦ୍ଧି କରିଥାଏ . ମାଟିରେ ଜୈବିକ ଅଂଶ କମ୍ ହେଲେରାସାୟନିକ ସାର ପ୍ରୟୋଗରେ ମଧ୍ୟ ଆଶାନୁରୂପ ଫଳ ମିଳେନାହିଁ.

ଜିଆ କୃଷକ ବନ୍ଧୁ ଭାବେ ଏହୁ ଗର୍ଗଂକ ପରିଚିତ ହୋଇଛନ୍ତି . ପୂର୍ବରୁ ମାଟିରେ ଏମାନଙ୍କ ସଂଖ୍ୟା ଅଧିକ ଥିବାରୁ ମାଟିର ଭୌତିକ ଓ ରାସାୟନିକ ଠିକ ରହୁଥିଲା ଓ ଭଲ ଉତ୍ପାଦନ ମଧ୍ୟ ହେଉଥିଲା . ରାସାୟନିକ ପ୍ରଣାଳୀ ଆମଦାନି ହେତୁ ମାଟି ରେ ଏମାନଙ୍କ ସଂଖ୍ୟା ଲକ୍ଷେ ପହଞ୍ଚିବାକୁ ବସିଲାଣି . ଏଣୁ ମାଟିରେ ଏମାନଙ୍କ ସଂଖ୍ୟା ବୃଦ୍ଧି କରିବା ନିହାତି ଆବଶ୍ୟକ . ଚିରାଚରିତ ପଦ୍ଧତିରେ କମ୍ପୋଷ୍ଟ୍ ତିଆରି କରିବାକୁ ୯-୧୨ ମାସ ସମୟ ଲାଗୁ ଥିଲା ସେସ୍ଥଳେ ଜିଆ ବ୍ୟବହାର କରିବା ଦ୍ୱାରା ଉନ୍ନତ ମାନର ଖତ ୩-୪ ମାସ ମଧ୍ୟରେ ତିଆରି ହେଲା ପରିବ. କମ୍ପୋଷ୍ଟ୍ ତିଆରି କରିବା ପଇଁ ଉପଯୁକ୍ତ ଜିଆ କୁ ନଥିବା ପ୍ରଥମେ ଖାଦ୍ୟ ରେଣୁ ଅଳ୍ପ ପରିମାଣରେ ପକାଇ କରି ବଂଶ ବୃଦ୍ଧି କରାଯାଏ . ଏହାକୁ ଜିଆ ଗଣ କୁହାଯାଏ. ଆବଶ୍ୟକ ପରିମାଣ ର ଏହି ଜିଆ ମାନଙ୍କୁ ବିଭିନ୍ନ ପ୍ରକାର ର ଜୈବିକ ପଦାର୍ଥ ର ଗଦା ରେ ଛଡିଲେ କମ୍ପୋଷ୍ଟ୍ ତିଆରି ହୋଇଥାଏ ଓ ଏମାନଙ୍କ ସଂଖ୍ୟା ମଧ୍ୟ ବୃଦ୍ଧି ହୋଇଥାଏ . କମ୍ପୋଷ୍ଟ୍ ବା ଜିଆ ଖତ ସଂଗ୍ରହ କାଳରେ ସହି ଜିଆ ଗୁଡିକୁ ପୁଣି ବାହାର କରି ପୁନଃବାର ମଧ୍ୟ ବ୍ୟବହାର କରାଯାଇପାରିଥାଏ .

ଏଥିପଇଁ ଏକ ଅଭିରର କାଠ ବାକ୍ସ ବା ପ୍ଲାଷ୍ଟିକ୍ ଟ୍ରେ ବା ସିମେଣ୍ଟ୍ କୁଣ୍ଡ (୬୦ ସେମି x ୪୫ ସେମି x ୨୦ ସେମି) କିମ୍ବା ସିମେଣ୍ଟ୍ ତିଆରି ନାଦ ବ୍ୟବହାର କରାଯାଇପାରିବ . ଏହା ଭିତରେ ୪ ସପ୍ତାହ ପୂର୍ବରୁ ପ୍ରସ୍ତୁତ ସାରିଥିବା ପ୍ରାୟ ୧୦ ସେମି ପୂର୍ବରୁ ପ୍ରସ୍ତୁତ ବିଛାଇ ୨୦୦-୩୦୦ ଟି ସଂଖ୍ୟା ଜିଆ ନୁକୁ ଛଡିଦେବା ଉଚିତ୍ ଏବଂ ସେଥିରେ ପାଣି ଛଞ୍ଚାଇ ଦିଆଯାଏ . ସିଧା ଗଣ ଖରା କିମ୍ବା ବର୍ଷା ପାଣିରୁ ରକ୍ଷାକରିବା ପଇଁ ଏହାକୁ ଏକ ଗଳିଆ ଘରେ ରଖିବା ଉଚିତ୍ . ଉପଯୁକ୍ତ ଆର୍ଦ୍ରତା

ପକ୍ଷରେ ଏହି ଜିଆ ମନରେ ଖୁବ୍ ଶିଘ୍ର ବଂଶ ବୃଦ୍ଧି କରିଥାନ୍ତି. ୨ ମାସରେ ଏହି କୁଣ୍ଡରୁ ପ୍ରାୟ ୧ -୧.୫ କେଜି ପର୍ଯ୍ୟନ୍ତ ଜିଆ ସଂଗ୍ରହ କରି ପରିବ. ବଂଶ ବୃଦ୍ଧି କୁ ସୁରକ୍ଷା ସମୟରେ ସେଥିରେ କିଛି ପୁରୁଣା ଚଟ୍ଟା (୧୦:୩) କିମ୍ବା ଗୋବର ବା ବୁଟ ଗୁଣ୍ଡ (୧୦:୨) ମିଶାଇଲେ ବଂଶ ଆହୁରି ଶିଘ୍ର ବୃଦ୍ଧି ହୋଇଥାଏ . ମୁଗା, ଜହ୍ନା, ପିମୁପର୍ଣ୍ଣୀ ଓ ବଂଶ ଇତ୍ୟାଦି ଜିନିଷରେ ଜିଆ ମାନଙ୍କ ବଡ ଶତ୍ରୁ. ଏମାନେ ଯେଉଁ ଜିଆ ନୂଆକୁ ଖାଇ ନ ଯାନ୍ତି ସେଥିପ୍ରତି ଦୃଷ୍ଟି ରଖିବା ଆବଶ୍ୟକ .

ଜିଆ ଖତ ପ୍ରସ୍ତୁତି

ଯେକୌଣସି ଜୈବିକ ଅବଶେଷର ପାରିପାର୍ଶ୍ୱ ରୁ ପ୍ରାୟ ୪୦୦-୫୦୦ କିଲୋ। ଜିଆ ଖତ ୩ ମାସ ମଧ୍ୟରେ ପ୍ରସ୍ତୁତ ହୋଇପାରିବ . ସାଧାରଣ ଖତ ଠାରୁ ଜିଆ ଖତର ମାନ ବହୁତ୍ ଉନ୍ନତ . ଜିଆ ଖତ ପାଇଁ ଦୁଇଟି ପଦ୍ଧତିରେ ପ୍ରସ୍ତୁତି ପ୍ରଣାଳୀ ଗୁଡିକ ହେଲା (୧) ବ୍ୟବସ୍ଥା ଜୈବି ବସ୍ତୁ (୨) ସିମେଣ୍ଟ୍ କୁଣ୍ଡରେ ଫିଲିପିନ୍ କୁଣ୍ଡ (୩) ଖତ ଗଦାରେ ଜିଆ

(୧) ବ୍ୟବସ୍ଥା ଜୈବି ବସ୍ତୁ

ଫସଲର ଅବଶେଷ , ଗଛର ଖସା ପତ୍ର , ଫିଟିବା ପରେ , ବାସ୍ତୁହରା ଜୈବିକ ଅବଶେଷ ପାରିପାର୍ଶ୍ୱ ଯଥା - କାଗଜ , କନା , ଗାଈ ଗୁହାଳର କୁଟା ଓ ମଳ , ଗବେଷଣା ଓ ଗୁମୋଟର ଇତ୍ୟାଦି , କାରଖାନାର ଜୈବିକ ବର୍ଜ୍ୟ ବସ୍ତୁ ଯଥା : ନିଡିଆ କଳା ଗୁଣ୍ଡ, ଚିନି କଳ ମଇଳା , ସହର ଓ ହାଟ ରୁ ବାହାରୁ ଥିବା ଅବଶେଷ ଜୈବି ବସ୍ତୁ ଇତ୍ୟାଦି ଖତ ତିଆରି ପାଇଁ ବ୍ୟବହାର କରାଯାଇ ପରିବ. ବର୍ଜ୍ୟ ବସ୍ତୁ ରୁ ବାହାରୁଥିବା ଲୁଣ ଓ ପ୍ଲାଷ୍ଟିକ୍ ଜାତୀୟ ପାରିପାର୍ଶ୍ୱ ବାଦ ଦେବା ନିହାତି ଜରୁରୀ . ଫସଲର ବଡ ବଡ ଖଣ୍ଡ ଅବଶେଷ କୁ ଛୋଟ ଛୋଟ ଖଣ୍ଡ କରି କାଟିଦେବା ଉଚିତ୍ .

(୨) ସିମେଣ୍ଟ୍ କୁଣ୍ଡରେ ଫିଲିପିନ୍ କୁଣ୍ଡ

ଜିଆ ଖତ ପ୍ରସ୍ତୁତି ପାଇଁ ବିଭିନ୍ନ ଧରଣର କୁଣ୍ଡ ବ୍ୟବହାର କରାଯାଇ ପରିବ. ବ୍ୟବହାର୍ଯ୍ୟ ବସ୍ତୁ ର ପରିମାଣ ଓ ସୁବିଧା ଅନୁସାରେ କୁଣ୍ଡର ଆୟତନ ନିରୂପଣ କରାଯାଏ . ଏଠାରେ ଆମେ ସାଧାରଣ ଭାବରେ ବ୍ୟବହୃତ ଏକ କୁଣ୍ଡ ବିଷୟରେ ବର୍ଣ୍ଣିତ ହେଉଛି . ଜିଆ ଖତ ପ୍ରସ୍ତୁତପାଇଁ ୨ ମି. x ୧ ମି x ୦.୭୫ ମି ଆୟତନ ବିଶିଷ୍ଟ ଏକ ସିମେଣ୍ଟ୍ ଓ ଇଟା ତିଆରି କୁଣ୍ଡର ତଳ ଭାଗରେ ୫ ସେମି ବହଳର ଜଙ୍ଗଲ ଘାସ ଓ ବାଲି ବିଛାଇ ଦିଆଯାଏ . ଏହା ଅଧିକ ସିଂଚିତପଣରୁ ସୁରକ୍ଷିତ ପାଇଁ ଏବଂ ଅତିରିକ୍ତ ପାଣି ବାହାରିବାରେ ସହାୟକ ହୋଇଥାଏ . ଏହି କୁଣ୍ଡ କୁ ଛାଇ ରେ ରଖାଯାଏ . ଫିଲିପିନ୍ କୁଣ୍ଡ ବ୍ୟବହାର କରୁଥିଲେ ଏହାକୁ ଭଲ ଭାବରେ ବାଉଁଶ ରେ ବାନ୍ଧି ମାଟି କିମ୍ବା ପକ୍କା ଉପରେ ରଖାଯାଏ . ଏହା ପ୍ରକାର ରେ ଅଧିକ ସୁବିଧା

(୩) ଖତ ଗଦାରେ ଜିଆ

କମ୍ପୋଷ୍ଟ୍ ତିଆରି ପାଇଁ ମାଟିରେ ଥିବା ଗାତରେ ନିର୍ଦ୍ଦିଷ୍ଟ ଜିଆ ବ୍ୟବହାର କରାଯାଇଥାଏ . କାରଣ ଏମାନେ ଭିତରେ ଖୁବ୍ ସିଘ୍ର ବଂଶ ବୃଦ୍ଧି କରି ଜୈବିକ ପାରିପାର୍ଶ୍ୱ କୁ କମ୍ପୋ ସମୟରେ ଭିତରେ କମ୍ପୋଷ୍ଟ୍ ରେ ପରିଣତ କରିବା ଶକ୍ତି ରଖୁଛି ଜିଆ ର ନଥାଏ . କମ୍ପୋଷ୍ଟ୍ ପ୍ରସ୍ତୁତି ପାଇଁ ଜିଆ ଗୁଡିକ ହେଲେ , ଏଭିନିଆ ଫେଟିଡା , ଲ୍ୟୁକିଆସ୍ ଏସିଆଟିକା , ପରିଜିକଲା ଏସୋଫେଗସ୍ . ଏହା ବ୍ୟତିତ ନିକଟତମ ସ୍ଥାନର ବା ଅନ୍ୟ ଯାଗାରୁ ରୁ ଜିଆ ସଂଗ୍ରହ କରି ଖତ ପ୍ରସ୍ତୁତ କରି ପରିବା .

ପ୍ରସ୍ତୁତି ପ୍ରଣାଳୀ

ସାଧାରଣତଃ ଭାରତରେ ଜିଆ ଖତ ପାଇଁ ଦର ସ୍ତରୀୟ ଜଙ୍ଗଲ ଉତ୍ପାଦ ବ୍ୟବହାର କରାଯାଏ . ଅଳିଆ କୁ ଅଧିକ ସାର କରିବା ପାଇଁ ଅନ୍ୟ ଏକ କୁଣ୍ଡ କିମ୍ବା ବାକ୍ସରେ ଏକ ଖତ ର ବ୍ୟବହାର କରାଯାଏ . ଏଥି ପାଇଁ ଅଳିଆ କୁ ଏକ ମାସ ପର୍ଯ୍ୟନ୍ତ ବାକ୍ସରେ କଂଚା ଗୋବର ସହ ୧୦:୩ ଅନୁପାତ ରେ ମିଶାଇ ଗଦେଇ ଦିଆଯାଏ ଓ ତାର ଆର୍ଦ୍ରତା ପରିମାଣ ୫୦-୬୦ ଭାଗ ମଧ୍ୟରେ ରଖାଯାଏ . ଅଳିଆ କୁ ଏକ ସ୍ତର ଦିଆଯାଏ ଓ ତା ଉପରେ ସ୍ତରରେ ଗୋବର ଓ ମାଟି ପ୍ରାୟ ୨ ସେମି ବହଳର ଏକ ଲେପ ଦିଆଯାଏ .

ଭଗା ଲଙ୍କା ଓ ବାର୍ଲି ସ୍ତର କିମ୍ବା ଫିଲିପିନ୍ସ ରେ ୫ ସେମି ବହଳ ର ଅଳ୍ପ ଆର୍ଦ୍ରତା ଥିବା ସ୍ତର ପରେ ସହିତ କିଛି ମାଟି ପକାଇ ଦିଆଯାଏ ଏହା ପରେ ପରେ ହୋଇଥିବା ଅଳିଆକୁ ୧୫ ସେମି ସ୍ତର ସ୍ତର କରି କୁଣ୍ଡଟିକୁ ଭର୍ତ୍ତି କରାଯାଏ . ପ୍ରତି ସ୍ତର ରେ କିଛି ମାଟି ପକାଇ ପରେ ପରିଣ ସିଂଚନ କରାଯାଏ . ପରେ ପରିଣ ସହ ୧୦୦ ଗ୍ରାମ୍ ନିମ୍ବପିଡିଆ ପରେ ଖତ ଉନ୍ନତ ମାନର ହେବା ସହ ଜିଆପିମ୍ପୁଡିଓ ଅନ୍ୟ ପାଖରୁ ରକ୍ଷା ପାଇଥାଏ . ଏହି ପରି ୪ ଟି ସ୍ତର ରେ ଅଳିଆ ପକାଇ ସବୁ ସ୍ତର ରେ କିଛି ପରେ ଖତ ବିଚ୍ଛାଇ ତା ରେ ୧-୧.୫ କିଗ୍ରା (୧୦୦୦-୧୫୦୦) ପର୍ଯ୍ୟନ୍ତ ସାର ଖତ ରେଣୁଗୋ ଜିଆ ଅଳିଆ ର ଓଜନ ଭାଗ ରେ ଛଡି ଦିଆଯାଏ . ଏହି ସମୟରେ ଅଳିଆ ଗଦା ର ତାପମାତ୍ରା ୨୫-୩୦ ଡିଗ୍ରୀ ସେଲ୍ସିୟସ୍ ରହିବା ଉଚିତ୍ . ଜିଆ ଛଡିବା ସମୟରେ ଯଦି ତା ରେ ଏକ ଗୋ ଅଳିଆ କୁ ଦୁଇ ଥର ପ୍ରତ କରି ଘୋଳାଇ ଦିଆଯାଏ . ଜିଆ ଛଡିବା ପରେ କୁଣ୍ଡରେ ଥିବା ଅଳିଆ ର ଜୈବିକ ଅଂଶ ପରିମାଣ ୫୦-୬୦ ଭାଗ ରହିବା ଉଚିତ୍ . କାରଣ ଜିଆ ଜୈବାଣୁ ଅମ୍ଳଜାନ ସାହାଯ୍ୟରେ ଶ୍ୱାସକ୍ରିୟା କରିଥାଏ . ଜଳ ଅଧିକ ହେଲେ କିମ୍ବା କମ୍ ହେଲେ ଶ୍ୱାସକ୍ରିୟା ବାଧା ପ୍ରାପ୍ତ ହୁଏ. ଉପର ସ୍ତର ରୁ କମ୍ପୋଷ୍ଟ ତିଆରି ଆରମ୍ଭ ହୋଇଥାଏ , ଯାହାକି ୨ ସପ୍ତାହ ପରେ ଆରମ୍ଭ ହୋଇ ପାରେ . ଅଳିଆ ସମ୍ପୂର୍ଣ୍ଣ କମ୍ପୋଷ୍ଟ ରେ ପରିଣତ ହେବା ପାଇଁ ପ୍ରାୟ ୨ .୫ ରୁ ୩ ମାସ ଲାଗିଥାଏ . ଏହା ବ୍ୟତୀତ ଜିଆ ଖତ ପ୍ରସ୍ତୁତ ପାଇଁ ମଧ୍ୟ ସହି ପରେ କୁଣ୍ଡ ରେ ଜବି ଅଳିଆ କୁ ପ୍ରାରମ୍ଭିକ ପଚେଇ କରି ୩-୪ ସପ୍ତାହ ପରିରେ ଜିଆ ଛଡି ପରିରୁ ଖତ ପ୍ରସ୍ତୁତ କରାଯାଇ ପାରିବ. ଏଥିପାଇଁ ୩-୩.୫ ମାସ ସମୟ ଲାଗିଥାଏ . ଖତ ପ୍ରସ୍ତୁତି ସମୟରେ ଶୁରୁଷ୍ଟି ହୋଇଥିବା ଜିଆ ବାକ୍ସର କରିଦେଲେ ଖତ ପ୍ରସ୍ତୁତି ତ୍ୱରାନ୍ୱିତ ହୋଇଥାଏ .

ନିରନ୍ତର ପଦ୍ଧତି ରେ ଖତ ପ୍ରସ୍ତୁତି ପାଇଁ ୨ କିମ୍ବା ୪ ଟି କୁଣ୍ଡ ଲାଗୁନାର୍ଦ୍ଦୀ କରି ତିଆରି କରି ପ୍ରତି ୨ କୁଣ୍ଡର କାନ୍ଥ ରେ ୬-୮ ଇଞ୍ଚ ଦୂର ରଖାଯାଏ . ପ୍ରଥମ କୁଣ୍ଡରେ ଉପର ବର୍ଣ୍ଣିତ ପଦ୍ଧତିରେ ପ୍ରଥମେ ଅଧା ସାର ଅଳିଆ ରେ ଆବଶ୍ୟକ ପରିମାଣ ର ଜିଆ ଛଡି ଉପଯୁକ୍ତ ବାତାବରଣ ରେ ରହିବାକୁ ଦିଆଯାଏ . ୨ ମାସ ପର୍ଯ୍ୟନ୍ତ କାନ୍ଥର ଖଣ୍ଡ କୁ ବନ୍ଦ କରି ରଖାଯାଏ . ୨ୟ କୁଣ୍ଡରେ ଅଧା ସାର ଅଳିଆ ର ଖତ ପ୍ରସ୍ତୁତ ପାଇଁ ଦୁଇଟି କୁଣ୍ଡ ମଧ୍ୟରେ ଥିବା କାନ୍ଥ ଗୁଡିକ ଖସେଇଦିଆଯାଏ . ପ୍ରଥମ କୁଣ୍ଡର ଖତ ଅମଳ ର ୪-୫ ଦିନ ପୂର୍ବରୁ ପନିପରିବା ବନ୍ଦ କରିଦେଲେ ପ୍ରତିକୂଳ ଅବସ୍ଥା ଯୋଗୁ ଜିଆ ମାନେ ଆପେ ଆପେ ୨ୟ କୁଣ୍ଡକୁ ଚାଲି ଯାନ୍ତି . ଏହିପରି ୨ୟରୁ ୩ ୟ କୁଣ୍ଡକୁ ଯାଇଥାନ୍ତି . ଏହା ଫଳରେ ଖତ ଅମଳ ସମୟରେ ଜିଆ ଆସିପ୍ରାପ୍ତ ହୋଇଥାନ୍ତି .

ବାହ୍ୟରେ ଅଳିଆ ସାଇ ଗଡ଼ିଗଲେ କୁଣ୍ଡରେ ବର୍ଷକୁ ୪ ଥର ଜିଆ ଖତ ପ୍ରସ୍ତୁତ କରାଯାଇପାରିବ . ୨ ମି. x ୧ ମି x ୦.୭୫ ମି ଆୟତନ ବିଶିଷ୍ଟ ଗଡ଼ିଲେ କୁଣ୍ଡରେ ଥରେ ୨-୨.୫ କୁଇଣ୍ଟାଲ୍ ଜିଆ ଖତ ପ୍ରସ୍ତୁତ କରାଯାଇପାରିବ .

ଜିଅଁତ ଅମଳ

କମ୍ପୋଷ୍ଟ ବା ଖତ ତିଆରି ସମ୍ପୂର୍ଣ୍ଣ ହେଲା ବେଳକୁ ଏହା ଏକ ଗାଢ଼ ବାଦାମୀ ରଙ୍ଗ ଧରିଥାଏ . କୁଣ୍ଡର ଉପର ଅଂଶରେ କେତେକ ଜିଆ ର ମଳ ଦେଖିବାକୁ ମିଳେ . ଓ ଜିଆ ମାନେ ଉପର ଭାଗରୁ ଅଳ୍ପ କରେ ଦମି ଗିଭରେ ରହିଥାନ୍ତି . ଉପରର ସ୍ତରର ଅଂଶକୁ ବେଳେବେଳେ ଜିଆ ମାନେ ଖାଇବା ପାଇଁ ଲାଗିଥିବା ମଧ୍ୟ ଦେଖା ଯାନ୍ତି . ଏହା କମ୍ପୋଷ୍ଟ ଅମଳର ପ୍ରକୃଷ୍ଟ ସମୟ . କମ୍ପୋଷ୍ଟ ଅମଳ କରିବା କୁ ହେଲେ ଜିଆକୁ ଅଲଗା କରିବାକୁ ୩-୪ ଦିନ ପୂର୍ବରୁ ପଣି ବନ୍ଦ କରିବା ଦରକାର . ଏହାଦ୍ୱାରା ଜିଆ ମାନେ ପଣି ନଥାଇ ନଥାଇ ତଳକୁ ଚଲି ଯାନ୍ତି . କୁଣ୍ଡର ଉପରିଭାଗ କମ୍ପୋଷ୍ଟ କୁ ସଫା କରି ଦୂରେଇ ରଖା ସ୍ଥାନରେ ଗାଦୀ କରି ୨-୩ ଘଣ୍ଟା ଯାଏ ଛାଡ଼ିଦେଲେ ଏଥିରେ ରହିଥିବା ୫ ଜିଆ ଗୁଡିକ ତଳକୁ ଚଲି ଯାଇ ସେଠାରେ ଏକାଠି ହୋଇଥାନ୍ତି . ଏହାକୁ ସୁଖାଇ ବସ୍ତାରେ ପୂରାଇ ଛାଡ଼ି ଦିଆଯାଏ . ବସ୍ତାରେ ଭର୍ତ୍ତି କରିବା ପୂର୍ବରୁ ଏହାକୁ ଚାଲୁଣି ରେ ଚାଲି ସେଥିରୁ ସର୍ତ୍ତମାନିଆ କାର୍ଡ ଓ ଅନ୍ୟାନ୍ୟ ପାର୍ଥ ବାହାର କରି ଦିଆଯାଏ .

ସାଧାରଣ ଖତ ଅପେକ୍ଷା ଜିଆ ଖତ ର ମାନ ଉନ୍ନତ . ଜିଆ ଖତ ରେ ନାଇଟ୍ରୋଜେନ , ଫସ୍ଫରସ୍ ଓ ପଟାସ୍ ଯଥାକ୍ରମେ ୧-୧.୫, ୦.୬-୦.୮, ୧.୨-୧.୫ ଭାଗ ଥାଏ . ଏହା ବ୍ୟତିତ ଏଥିରେ ହ୍ୟୁମସ୍, ହରମୋନ୍ , ଭିଟାମିନ୍ ଓ ଅଣୁସାର ର ପରିମାଣ ମଧ୍ୟ ଅଧିକ ଥାଏ . ଜିଅଁରେ ଥିବା ଜିଆ ଯୋଗୁ ଅନୁକୂଳ ପରିସ୍ଥିତି ରେ ଜିଆ ବାହାରି ସଂଖ୍ୟା ବୃଦ୍ଧି କରିଥାନ୍ତି ଓ ଉତ୍ପାଦନ ବଢାଇଥାନ୍ତି .

Know your biodiversity

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Spilopelia chinensis

Spilopelia chinensis is commonly known as Spotted dove, Mountain dove, Pearl necked dove and Lace necked dove. It is common resident bird of Indian subcontinent and Southeast Asia but it is also established in many areas outside their native range i.e. Australia, Mauritius and Hawaii. It belongs to order Columbiformis and family Columbidae. *Streptopelia chinensis* and *Stigmatopelia chinensis* are the synonyms of Spotted dove. It generally lives for 8 years. It is mostly seen in open areas, light forest, gardens, fields and urban areas. Spotted doves are generally seen in pairs or groups.

Spotted dove is small long tailed pigeon with white spotted black collar patch on the back and side of the neck. Head is pale pink to grayish with yellow to orange iris. It has pale brown under parts streaked with dark buff. Tail is long, brown with white tips. They have some special feathers on their body which disintegrates and produces powder which is used for cleaning and lubricate the other feathers.

It feed mainly on seeds, grains, fruits and occasionally on small insects. Both the parents take part in building nest, incubating eggs and feeding the young. Juveniles are dull in appearance and do not acquire the neck spots until they mature. Nests are generally seen on the branches of trees and bushes.

Spotted doves are monogamous and breeds year round. During the breeding season bowing display is seen which indicates male and female are close to each other. It generally lays 1-2 white glossy eggs and incubation period is 14-16 days. During the breeding season they produce crop milk. Special glands are present in crops of both male and female which enlarges and secrete thick milky substances. Chicks drink this milk by inserting their bills into parent's throat.

Migration is not seen in spotted dove but they disperse readily to colonies new area. It adapt easily in cultivated areas.

Although it is least concern in IUCN Red List but vulnerable to loss of habitat by human developments, trapping for pet trade, use of pesticide and herbicides in agriculture.

Nicandra physaloides

Nicandra physaloides is monotypic genus of Nightshade or Solanaceae family. It is know for its medicinal and insecticidal properties. The Genus name '*Nicandra'* is named after the Greek poet Nicander who wrote about poisonous plants in the second century B.C and the species name *'Physaloides'* is given because of its resemblance with *'Physalis'* species. It is native to Peru and known as Apple of Peru. It has achieved weedy status in many of the temperate and subtropical countries of the world. It is now widely naturalised in Tropics. It is also known as Shoo Fly Plant because it has potent insect repellent property due to the presence of nicandrenone as a main active chemical constituent.

It is erect fast growing annual herb, approximatly 1 meter tall. Stem angular and hairless and branches spreading. Leaves are ovate, large, alternate, toothed resembles like *Datura* leaves. Flowers soilitary, axillary, bell shaped, pale blue or violet and with white center. Stamens 5 with anthers yellow and single pistil. Berry green-brown or yellow. Seeds are pale brown. Flowering and fruiting season is October-February.

All parts of plant are poisonous. Alkaloids like withanolide, withaperuvin E and nicandrin B are isolated from this plant which is responsible for various pharmacological activities. It is used as analgesic, anthelmintic, antidiabetic, sedative, diuretic, antibacterial, anti-inflammatory and febrifuge. Whole plant is used in the treatment of contagious disorders, cough, toothache, intestinal pain from worms and impotence. Foliage is toxic to herbivores. In the southern states, the juices from the foliage and roots of this plant are mixed with milk in a dish, which is used to attract the flies and killing them. In many areas plant is used as an insect repellent by simply rubbing exposed skin with stem and leaves.

Apple of Peru is generally seen near fields and wastlands. Flowers of *Nicandra physaloides* are nector and pollen source for honey bees. It is also grown as ornamental plant. It is best propagated from seeds in partial sun and in loamy fertile soil. Seeds of this plant dispersed mainly by birds. It is now become

noxious weed of crops, waste areas, roadsides, river banks and forest margin and it can be controlled by use of herbicides.

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