



# CGES Newsletter

CLEAN AND GREEN ENVIRONMENTAL SOCIETY

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## SPECIAL ISSUE

### VISION

Clean and Green Environment for Healthy Life

### MISSION

To Strive for A Clean and Healthy World

### In This Issue

President's Message	1
CGES New Life Members	2
Donation to UP CM Covid-19 Relief Fund	2
CGES-Enhancing Awareness for Clean and Green Environment	2
Dr. C.R. Bhatia	
Agro-climatic Conditions and Economic Wealth in Changing Climate	3
P. Pushpangadan	
Environment Education and Awareness	7
Dr. Amrita Dass	
Spider Plant, <i>Chlorophytum comosum</i> L. as an Effective Phyto-remediator for Indoor Pollution due to Cigarette Smoke	8
Dr. Seemaa Ghatge	
Rice ( <i>Oryza sativa</i> L.) Landrace Kalanamak of Uttar Pradesh Improved to protect Health, Wealth and Environment	10
R. C. Chaudhary, Sunil Kumar, S. B. Mishra, R. Kumar and Anjali Sahani	
Infollution and Mental Health of Adolescents	11
Dr. Rashmi Soni	
Applications of Plastics Components in Medical Devices, Personal Protective Equipments: Preparedness for Pandemics to Disasters and other Allied Emergencies	13
V.P. Sharma, Y.K. Sharma and S.C Sharma	
Role of Plant Micronutrients in Cellular Metabolism	15
S.N. Pandey	
Vertical Farming: A Step to Combat Environmental Pollution	17
Dr. Prerna Mitra	
CGES Activities	19
Felicitations	23
New Publication	23
Forthcoming Events	23
CGES Executive Body	23

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### PRESIDENT'S MESSAGE



प्रिय सदस्यगण, नमस्कार 🙏

During these difficult days, due to the Pandemic COVID-19, everybody is facing some problem or the other. On behalf of the Clean and Green Environmental Society (CGES) and on my own behalf, I send my best wishes for your well being and good health.

बहुत अजीब कर दिए हालातों ने ये रिश्ते आजकल,  
सब फुरसत में हैं, पर मुलाकात किसी से नहीं।

You will be glad to know that CGES will be successfully completing 5 years in July 2020. This has been possible due to your active participation and support in the various activities of our society for good and healthy living. At present, CGES has more than 200 life members from all over the country and abroad, of which 30% are ladies. CGES is proud to be in the vanguard of spreading knowledge about the environment, healthy living and their importance in our daily life. I would like to express my appreciation for the efforts of all the members, especially over the last one year. You will appreciate that in spite of the testing times, when the Novel Corona Virus is raging all over the world, the environment and air quality around us has very much improved. This is due to less pollution, cleaner air and one can now visualize the clear sky above and also the humming of the birds.

On 22-23 Feb 2020, Clean and Green Environmental Society (CGES) in collaboration with the premier institute of CSIR-National Botanical Research Institute (NBRI), Lucknow organized a National Conference on Climate Change, Agriculture, Biodiversity and Human Health (CABH-2020), in which nearly 200 delegates from Kashmir to Kerala shared their views and its impact on Agriculture, Biodiversity and Human Health. CGES members have donated a sum of Rs. One Lakh, to the UP CM relief fund, for assistance for the needy. This has been possible due to the timely help and contribution from the CGES family members. On behalf of the CGES, I would like to profusely thank the donors for this noble gesture.

Even under today's severe environmental problems and lockdown, we shall be organising Webinars on Environment, Health and Plantation Drives. CGES will also conduct lectures, training programs / workshops by our Eco-Garden Club. We are regularly publishing CGES-Newsletter, which provides interesting and informative articles on various topics for spreading the message of Clean, Green and Healthy India.

I would like to express my sincere thanks to the Editorial team: Dr A.K. Singh, Prof. Y.K. Sharma and Dr. S.C. Sharma for their dedication in making it a significant publication. My heartfelt thanks and gratitude to Dr. S.C. Sharma, who is the driving force in making the CGES, a vibrant and sustainable society. I also thank the Organizing Secretaries and Team members of the CABH-2020 for organizing the CGES-NBRI National Conference in a well planned manner, which resulted in a grand success. I am grateful to the CGES Advisors, Executive Councilors and Life members for their constant advice, cooperation and support. My profound thanks to Prof. S.K. Barik, Director CSIR-National Botanical Research Institute, Lucknow for his whole hearted support to the CGES. Last but not the least; I deeply appreciate the efforts of Col. Ajay Gupta, Advisor, Information Technology for preparing the Directory of the CGES members. The directory will be very useful for sharing day to day activities of the Society.

The central question of today is: "How can we live better?"

The answer to the question is: "Take care of your beloved ones and yourself. Stay home, Stay healthy and Stay happy!"

माना कि अंधेरा घना है, लेकिन दिया जलाना कहाँ मना है।  
हार्दिक शुभकामनाओं सहित।

सुमेर अग्रवाल  
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## CGES New Life Members

Er. Dileep Kumar, Er. Sunil Gupta, Chowdhary Mohammad Asif, Mrs. Ruma Sinha, Er. R.S. Sinha, Dr. Shashi Sharma, Mrs. Pushpanjali Sharma, Mr. Ajay Mitra, Dr. Panzy Singh, Mr. Tony Joy.

## Donation to UP CM Covid-19 Relief Fund

CGES members donated a sum of Rs 1,00,000/- (Rupees One Lakh) for contribution to UP Chief Minister's Covid-19 Relief Fund. A cheque of Rupees One Lakh was handed over to Chief Secretary, UP Shri R.K. Tiwari by the President CGES, Er. Sumer Agarwal, Secretary General CGES, Dr S.C. Sharma and IT Advisor CGES, Col. Ajay Gupta on 19<sup>th</sup> June, 2020.



Following members have donated for the purpose:

Dr. S.C. Sharma (Rs. 5,000/-), Dr. Mansoor Hasan (Rs. 5,000/-), Dr. Amrita Dass (Rs. 5,000/-), Dr. Perna Mitra (Rs. 5,000/-), Dr. R.P. Bansal (Rs. 5,000/-), Er. Sumer Agarwal (Rs. 4,000/-), Smt. Sunita Agarwal (Rs. 4,000/-), Shri L.K. Jhunjhunwala (Rs. 4,000/-), Er. Anil Sharma (Rs. 4,000/-), Shri Vasant R. Pusalkar (Rs. 4,000/-), Er. M.S. Gulati (Rs. 4,000/-), Er. V. K. Agarwal (Rs. 4,000/-), Prof. S.K. Barik (Rs. 3,000/-), Er. Uday Pandey (Rs. 2,500/-), Col. Ajay Gupta (Rs. 2,500/-), Er. M.L. Sharma (Rs. 2,001/-), Er. Kamresh Srivastava (Rs. 2,000/-), Mr. Prem Chandra (Rs. 2,000/-), Smt. Parvati Sharma (Rs. 2,000/-), Ms. Gauri Sharma (Rs. 2,000/-), Justice K.L. Sharma (Rs. 2,000/-), Prof. P. Pushpangadan (Rs. 2,000/-), Prof. Y.K. Sharma (Rs. 2,000/-), Shri Tilak Basu (Rs. 2,000/-), Er. N.K. Trivedi (Rs. 2,000/-), Smt. Ranjana Trivedi (Rs. 2,000/-), Er. Sunil Gupta (Rs. 2,000/-), Er. N.K. Kanodia (Rs. 2,000/-), Prof. Rana Pratap Singh (Rs. 2,000/-), Dr. Ramji Prasad (Rs. 2,000/-), Dr. Rajiv Kumar (Rs. 2,000/-), Er. U.C. Sharma (Rs. 2,000/-), Prof. P.K. Seth (Rs. 2,000/-), Shri Sunil Sharma (Rs. 2,000/-), Dr. S.R. Singh (Rs. 2,000/-), Dr. S.N. Pandey (Rs. 2,000/-), Dr. Brij Lal (Rs. 1,500/-), Dr. A.K. Singh (Rs. 1,000/-), Dr. Virendra Nath (Rs. 1,000/-).

## Articles

### CGES - Enhancing Awareness for Clean and Green Environment

**C.R. Bhatia**

Water, food and energy security with pollution free environment and clean air to breathe are indispensable for good health, happiness and prosperity of the society. The Clean and Green Environmental Society (CGES), since its inception just five years back, has made immense contributions towards this goal. First of all, CGES has considerably enhanced the awareness for clean and green environment. Its tree plantation drives in schools, parks and gardens around Lucknow has converted the awareness into action oriented program that will make the area green as the foliage grows in years to come. All this was possible due to painstaking efforts of Dr. S. C. Sharma, Secretary General, CGES. I wish that all the urban and rural areas can have replica clones of Dr. Sharma for motivating them to follow the outstanding example of the CGES. My best wishes to all the CGES members for contributing greenery, trees and affluence.

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# Agro-climatic Conditions and Economic Wealth in Changing Climate

P. Pushpangadan

## Introduction

Earth is the only one place in this Universe where life in the forms we know is possible. The unique position of Earth in the Solar system made it possible for the evolution of life. Air, Water, soil, sunlight and biodiversity are the life support systems of Earth. Disturbance in any one of them may upset/disturb this normal life system on Earth. It may lead to extinction of even humans. Approximately 13.5 million living organisms/species now exist on Earth. But hardly 1.3 million have been named and described so far. Man is just one of such life forms evolved on Earth.

Man is considered to be the most successful organism evolved on Earth but has become a great liability to Earth as he has become the main reason/agent in upsetting the normal course of evolution of life on Earth-an agent of destruction and destabilization.

Biodiversity or bio-resources is the sum total of life on Earth – it covers micro organisms to mammoth animals like elephant and man. The UN-Convention on Biodiversity (CBD) describe biodiversity is “the variability among all living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part; this include diversity within species, between species and of ecosystems”. Biological diversity is the central tenet of nature, one of its key defining features. Evolution has produced an amazing variety of plants, animals and micro-organisms, intricately interconnected, and worthy of respect and conservation in their own right. Biodiversity is also the basis for the continuous evolution of species. This diversity is also the backbone of human societies and cultures, in terms of the ecological functions it provides and the myriad survival and livelihood it meets.

## Genesis of the Global Concern on Biodiversity Conservation

Industrial revolution and its adverse impact on environment (The great London smog 1952, The Silent Spring by Mrs. Rachel Carson 1962, Acid Rain 1960s & '80's S Arabia Global tender for fresh water) were first discussed in 1972 U. N. Conference Human Environment at Stockholm. U. N. General Assembly by a resolution on 15th December 1972 established UNEP. First Governing Council met in 1973 identified Conservation of Nature, Wildlife and

Genetic Resources as Priority areas. The World Commission on environment and Development (WCED) was constituted in 1983(Brundtland Commission). WCED submitted its report 'Our Common Future' in 1987 called for Conservation of nature/Biodiversity for Sustainable Development. UNEP constituted an ad-hoc Working Group of Technological and Legal experts to prepare an international legal instrument for conservation and sustainable use of Biodiversity which resulted in 'CONVENTION ON BIOLOGICAL DIVERSITY' (CBD). CBD came into force as an International Law On 29th Dec. 1993. India ratified CBD on 18th February 1994 and came into force from 19th May 1994. 188 countries are now parties to CBD (as on Feb 2008).

## According to Ayurveda

According to Ayurveda food and medicine are clearly related and at times it overlaps. Among the eight major clinical descriptions in Ayurveda 'Rasayana Tantra' and 'Vajikarana Tantra' are prescribed for rejuvenation and for restoration of vitality or sexuality, potency and power, power of expression (*Vagsamardhyam*). Rasayana treatment is also intended to promote and delay of ageing process. Rasayana therapy act as elixirs- enhance longevity, improve memory, intelligence, good health, promote youthfulness, improve the texture and lustre of the skin / body, improve complexion and voice, promote optimum strength of the body (*Ojovridhi*), sense organs (*Panchendriyams*), power of expression (*Vagsamardhyam*) and the personality becomes very attractive.

The Ayurvedic masters of ancient India had a clear understanding of the delicate cellular mechanism of the body and the deterioration of the functional capacity of human being. To arrest such deterioration of the functional efficiency and to revive and revitalize the body system, the Ayurvedic masters developed an elaborative rejuvenation therapy known as 'Rasayana therapy'. 'Rasa' in Sanskrit means the essence of nutrients and 'ayana' means to circulate in the body without any obstruction.

Rasayana is not a drug therapy, but a specialized procedure practiced to cleanse the body from the toxic or other microbial substances and then with the help of special diet and nutritional agents comprising

mainly highly powerful antioxidant rejuvenates the body by providing greater immunity, enhance vitality, longevity improve all faculties and attain youth fullness of the whole body. Rasayana therapy helps in prevention, promotion, correction and cure. Swasthasya ojaskaram, kunchit aarthasya roganudh (It helps to improve the mental, physical and spiritual faculty of the healthy individual and on other hand it relieves the patient from diseases).

### **Allopathy or Modern Medicine**

Allopathy is a glamorized discipline, Pursued by most (influenced and so called 'Literate') in India and, in western countries, Backed by technological advances – investigations, Based on sound scientific reasoning – experimental evidence; not anecdotal, Thus, Modern Medicine is an evidence-based, techno-savvy science that seems to provide ultimate care to sick patients. The Allopathy treatment is often symptomatic, costly, out of reach of most in developing countries. Except for infective pathologies, we do not have much to offer except palliation. Treatment of Chronic Lifestyle Disorders like neurodegenerative disorders is often very disappointing and limited by adverse events. It treats the Disease (symptomatic) and not the patient 'as a whole' (Holistic approach).

### **Drug Discovery – Problems**

It is notoriously inefficient. One in a hundred thousand or more compounds will enter the market as a drug. Pharma majors have NO interest in higher plant extracts for screening for biological activity. In NAPRALERT ethnomedical reports for 14,300 species (5.2% of all plant species) are there; But 58% of these species have never been examined biologically or chemically. Of these 74% are used in a manner which parallels their ethnomedical use.

Widespread belief that 'green' medicine is healthier than synthetic products. Leading to rapid spurt of demand for health products like herbal tea, ginseng and such products of traditional medicine. So rapid – sale of herbal products are staggering 100 billion dollars a year. After India and China, even the western world has started working on herbals. NIH has set up CAM center and working on St. John's wort and Gingko biloba.

### **High Throughput Bioassay**

Major feature of the drug discovery process over the last 30 years has been the introduction of small scale in vitro biological test systems. It can test multiple samples for activity within a short period of time,

providing data from replicate tests to enable sound statistical analyses. Based on cultured cells, isolated enzymes, or cloned receptors. Pharmaceutical industry now routinely uses such systems for large number of fractions for leads in drug development process.

Combinations of herbs are normal and are based on empirical observation and reasoning based on a particular patient, these herbal combinations may not be targeted to a particular organ (multi-targeted), cell, tissue or any biochemical system, making this synergy even more difficult to identify. Possibility of drug interactions and the adverse reactions arising out of these have to be checked before coming out with the drug.

Most of the effective phytomedicine in market are as whole extracts of plants. Practitioners believe that synergistic interactions between the components of individual or mixture of herbs are a vital part of therapeutic efficacy. Mechanism of action of many phytomedicine is still unknown and there are several instances where total extract shows better activity than an equivalent dose of isolated compound. Chemical and pharmacological evidence to demonstrate conclusively the concept of synergism.

### **Traditional Medicine: Threats**

Poor positioning on a global level, ignored by the global scientific community, very little scientific research validations, very little publications in peer-reviewed science journals and deliberate negative propagandas. Innovative, Effective and aggressive use of emerging technologies without Compromising the basic principles will be the main key towards the bright future

### **Some Features of Global Health Care in 21st Century**

Modern health care policies largely market driven by the pharmaceutical industry divert attention from health preservation to illness cure. Prevention and eradication of diseases undermines the economic basis of this industry. No satisfactory drugs available for most of the degenerative disorders characteristic of graying population and for re-emerging resistant infections. Many currently used modern drugs do not have valid proven clinical utility. USA has among the highest per capita annual expenditure on health care (\$3600) but still about 15% population is denied even basic health care facilities (the best Indian state like Kerala has an annual per capita expenditure ~ \$15). Ayurveda considers that an individual with

advancing age accumulates waste and toxic substances leading to decline in vitality and loss of resistance/ immunity. 'Dhatu Kshaya' weakening of the functional dynamics of the cell or tissue system of the body 'Ojas' the state of excellent health expressed in general strength vitality and luster of the individual – with 'Bala' = immunity against diseases 'Dhatuvridhi' i.e. rejuvenation of the whole tissue system is done by 'Ojasvardhaka Dravyas' – the substance that improves the functional efficiency and immunity of the individual. This therapeutic process is known as 'Rasayana Chikitsa' – Rejuvenation therapy.

Modern drugs can produce serious side effects. Iatrogenic diseases fourth leading cause of death in USA and other developed nations (JAMA, April 1998). Side effects of drugs kill more Americans annually than the World War II and Vietnam war combined (M. Rath N. Y. Times 28.02.2003) Around 2600 persons died in the Twin Tower tragedy on 11th September 2001 causing global repercussions. It is, however, not recognized that about the same number die in USA from side effects of prescription drugs every 10 days (JAMA, April 1998). The major challenge is quality control and standardization scientific validation of the therapeutic claims Safety Customer satisfaction and confidence.

India can therefore play a leading role in Gene hunting and drug hunting, which is going to be the most lucrative business in the world now. The untapped bio-wealth of India can be converted into economic wealth by S & T intervention.

### **Intellectual Property Rights (IPR)**

Intellectual Property (IP) means the creative products emanating from human mind/brain. IPR are the legal rights governing those rights granted to individual(s) or corporate bodies to have monopolistic ownership or control over such IP exercise of human brain such as thoughts, invention, processes, ideas having innovative and inventive steps capable of industrial applications. The holder of IPR gets an exclusive right over the use. It is intangible, Has the character of a property, Recognized by international and national laws, Can be transferred or sold or licensed like any other property, Protected against wrongful expropriation, Innocent use can be interpreted as an infringement.

### **Patent**

Patent is a set of exclusive rights granted by a government to an inventor or applicant for a period

time-normally 20 years from filing date. It is essentially a monopolistic rights i.e a negative right as it excludes others from making, using, selling, or importing patented invention.

### **Bioresource Based Rural Transformation**

Transformation of the subsistence economy of rural poor farmers to prosperous industrial farmers. The programme have the following components. Inventory, documentation and digitized database preparation of Plant Genetic Resources (PGR) of wild and non-traditional agricultural crops and the associated traditional knowledge system for conservation and sustainable utilization. Identification of local specific cultivation/collection and value added production technology based on local bioresources and human resources. Knowledge & skill empowerment and an enabling environment of rural farmers/people to convert the resources into wealth in an ecologically sound and sustainable manner.

Ms. Rachel Carson's "the silent spring"(1963) created ecological ripples around the world, and it is for the first time, that the world as a whole took note of the impending dangers that the deteriorating environment posed to humanity at large. This book has been regarded as a watershed in environmental history.

UN Millennium project 2005 reports, that at global level, 852 million persons are chronically hungry. This is slight reduction from the 1990 levels. Agriculture is the largest economic activity (75%) of the world's poor. Biological control forms part of the technical suite of solutions. Organic agriculture brings with it numerous challenges and biological control.

### **Impact of Climate Change in the Society**

Climate change is a manifestation and symptom of the lack of adequate consideration of environmental sustainability in development pathways. The climate change food production and economic crisis are wake up calls to the need for factoring in sustainability and development choices. In the last century due to human actions we have lost 35% mangroves, 40% of forests and 50% of wetlands. This is 100 times the natural rate of extinction. The IUCN red list (2009) reports that of the 44,837 species they have assessed, 38% are threatened and 804 are extinct. There is growing consensus that most of the vital signs of biodiversity are plummeting. 70% of the world poor live in rural areas and depend directly on biodiversity

for their survival and well being. The urban poor also rely heavily on biodiversity.

Percentage of people in Africa estimated by WHO to rely on traditional medicines (plants and animals) as the main source of their health care needs: 80 % . Number of people worldwide who depend on drugs derived from forest plants for their medicinal needs: 1 billion. About 8 % of the 52,000 medicinal plants used today are threatened with extinction. Number of times more likely a person living in a poor country is to be hit by a climate change-related disaster than someone from a rich country is 79 (UN-CBD, 2009).

Biological system is just not an assembly of tissues, cells, genes or proteins, but what is important is the traffic and cross talk between them – system biology. Understanding of the structural and functional dynamics of the cell system and its fine tune regulation. Systematic search of genes, natural compounds, designs and whole organisms with potential for value added product development by biological observations and biophysical, biochemical and genetic methods without disruption to nature.

There is significant concern about the impacts of climate change and its variability on agricultural production worldwide. First, issues of food security figure prominently in the list of human activities and ecosystem services under threat of dangerous anthropogenic interference on Earth's climate. Climate change may have particularly serious consequences in the developing world, where some 800 million people are undernourished. Many interactive processes determine the dynamics of world food demand and supply: agro-climatic conditions, land resources and their management are clearly a key component, but they are critically affected by distinct socio-economic pressures, including current and projected trends in population growth, availability and access to technology and development.



## Climate Change and Economic Analysis

Climate change could affect our society through impacts on a number of different social, cultural, and natural resources. For example, climate change could affect human health, infrastructure, and transportation systems, as well as energy, food, and water supplies. Over the past four decades, population has grown rapidly in coastal areas and in the southern and western regions of the United States. These areas are most sensitive to coastal storms, drought, air pollution, and heat waves. Young children are another sensitive age group, since their immune system and other bodily systems are still developing and they rely on others to care for them in disaster situations. Climate change can impact the health and well-being of indigenous tribes in many ways. Climate change will make it harder for tribes to access safe and nutritious food, including traditional foods important to many tribes' cultural practices. Climate change could threaten these resources, as well as the goods and services they produce and the jobs and livelihoods of those who depend upon them. Communities that developed around the production of different agricultural crops, such as corn, wheat, or cotton, depend on the climate to support their way of life. Climate change will likely cause the ideal climate for these crops to shift northward. Combined with decreasing rural populations, as in the Great Plains, a changing climate may fundamentally change many of these communities. Climate change is projected to increase the frequency and intensity of extreme weather events, such as heat waves, droughts, and floods. These changes are likely to increase losses to property and crops, and cause costly disruptions to society. Escalating losses have already affected the availability and affordability of insurance in vulnerable areas.

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## Environment Education and Awareness

Amrita Dass

*“Our goal is not just an environment of clean air, potable water and scenic beauty; the objective is an environment of wholesome quality of life, decency and mutual respect for all other human beings and all other living creatures.”*

Research has clearly established the fact that Individual human behaviours affect the global landscape. Small actions in the microcosm have major consequences on the macrocosm.

Climate Change represents a systemic disruption which has become the greatest threat on the human horizon. Tackling the numerous challenges posed by it demands basic changes in our thinking process and actions that link global change to individual and local behaviour. This requires one to have a GLOCAL attitude ie thinking globally (beyond the present time scale) and acting locally while also thinking locally and acting globally.

In this context, Environmental Education is not just the conveying of factual information regarding the composition of atmospheric pollution and the threats these present etc. It refers to organised efforts of teaching how natural environments function and, particularly, how human beings can manage ecosystems. Its goal is to inculcate sensitivity, mindfulness and responsibility along with the inclination and ability to live sustainably.

For adults, the focus of Environment Education is re learning while for school students it is building the foundations for future lifelong learning. Innovative teaching methodologies integrate different kinds of knowledge while connecting the dots, incorporating:

- Metaphors like the journey of a drop of water from the ocean, to the cloud and to the tap illustrating how every living cell has a share in the great cycles of the eco system
- Narratives and story telling
- Systems thinking to 'understand the web of interconnectedness, and how things unfold over time. Thus we need to go beyond linear narratives to multiple intertwined causes that are widely dispersed.

“If we want to understand Nature, we must also be conversant with the language in which it speaks to us.” (Richard Feynman). This requires us to connect with the Natural World and understand the joy or distress reflected in a bird call or the fury of a Tsunami or forest fire or the calm of an undisturbed habitat. We have to go beyond appreciation to understand the complexities and dynamics of our environment.

In this regard, Environment Education guides us to tap into our inherent environmental intelligence which Howard Gardner refers to as 'Naturalistic Intelligence' in his theory of Multiple Intelligences. This heightens intelligent environment action which is holistic. For instance, we tend to confuse global warming with ozone depletion rather than connecting the other dots such as energy usage, automobile emission, eco-diversity depletion and damage.

The holistic Green School Concept developed by Prof Thakur S Powdyel, former Education Minister of Bhutan, is a path breaking one. He emphasises that a 'Green School is green in more than colour'. It is green “because it begins with a 'Love of Life' and encompasses social, cultural, intellectual, academic, aesthetic, moral and spiritual greenery. Its aim is to contribute to a Green Bhutan, 'the true home of Gross Natural Happiness.'

### **Key Benefits of Environment Education and Awareness:**

***Learning transcends the classroom:*** Students get an opportunity to step out into the real world for experiential learning. They participate in public campaigns, undertake research projects, make films and write blogs etc to invite positive action.

***Enhances holistic learning:*** Environment education helps students correlate various social, environmental, political and economic issues, encouraging them to get a well-rounded understanding.

***Boosts creative thinking:*** Spending time with nature, an essential part of environment education, develops a greater appreciation and respect for various animal and plant species while also boosting one's enthusiasm, imagination and creative thinking.

***Sensitizes students*** to ecological needs, makes them more considerate

***Greater sense of responsibility:*** Environment-conscious students will naturally feel a greater responsibility towards their personal spaces (like home and school) as well as their surroundings.

Environment Education and Awareness is then an individual and collective call to action to 'reach a balance where people, habitat and wild life can co-exist' (Steve Irwin), reverse the monumental damage and prevent the catastrophic consequences.

**Dr. Amrita Dass**

Educationist and Career Consultant

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# Spider Plant, *Chlorophytum comosum* L. as an Effective Phytoremediator for Indoor Pollution due to Cigarette Smoke

Seemaa Ghate

Indoor pollution refers to the physical, chemical, and biological characteristics of air in the indoor environment within a home, institute, building, office or any close room having inadequate ventilation. Indoor air pollution is more severe in the developed countries as houses are relatively airtight, reducing ventilation and raising pollutant levels due to energy efficiency facilities. Many medicos relate indoor pollution with many allergies. According to World Health Organization (WHO), indoor pollution is one of the top five threats to public health. Indoor air pollution is a very real and dangerous thing because indoor air is far more concentrated with pollutants than outdoor air. It is estimated that each year 2.2 million deaths are due to indoor air pollution as compared to 500,000 deaths from outdoor air pollution. Women and children are most vulnerable to health effects due to indoor pollution as they spend more time indoors and are exposed.

Inadequate ventilation can increase indoor pollutant levels as enough outdoor air does not enter indoors to dilute emissions from indoor sources and even indoor air pollutants do not go out of the home. The indoor air is not circulated properly. High temperature and humidity levels can also increase concentrations of some pollutants.

The main indoor sources for indoor pollution are phenyls, mosquito repellents, heavy smelling incense sticks, cigarette smoke, perfumes, hair sprays, furniture polish, glues, air fresheners, paper towels, plastic bags, cement dust and many other products used in the house. The health effects include irritation of eyes, nose and throat. Respiratory track problems are very common. In more severe cases there may be headaches, nausea and fatigue. In the long term, some of the pollutants are suspected to damage to the liver and lungs. In most severe cases it may lead to mental disorders and even cancer. Living things can also create indoor air pollution. Things like dust mites, pet dander, mold, mildew and airborne bacteria are all living creatures that cause human health problems by polluting indoor air. Their effects may be as several types of allergies or may be as dangerous as causing infectious diseases.

The most common source of indoor pollution in non-ventilated indoor spaces is cigarette smoke. Cigarette smoke contains around 7000 different chemicals including arsenic, formaldehyde, cyanide, lead, nicotine, carbon monoxide, Benzo [a]pyrene and other poisonous chemicals. These harmful

chemicals are carcinogenic. It is well known that smoking causes a wide range of problems to the person who smokes as well as to the passive smoker or the person who is in the same room with a smoker and is not himself/herself a smoker. The adverse problems range from burning eyes, nose, and throat irritation to cancer, bronchitis, severe asthma, and a decrease in lung function. It is estimated that even if inhaling is passive, you are inhaling 4,000 chemicals, a large number of which are carcinogens, or cancer-causing chemicals.

Phyto-remediation is a biological technique used to restore polluted environments to their natural state. It involves the use of living plants and their related microorganisms to remove contaminants from the environment or to degrade contaminants to a lesser toxic form. This technology is used widely because compared to other remedies; it is less destructive and generally affordable. Another advantage is that it adds aesthetic beauty.

Dr. Wolverton's study of the interaction between plants and air found that houseplants, when placed in sealed chambers in the presence of specific chemicals, removed those chemicals from the chambers. He concluded that plants can clean pollutants in homes, offices, factories and retail outlets. Wolverton expanded the study and assigned plants a rating from one to 10, based on a plant's ability to remove chemical vapors or indoor air toxins, ease of growth and maintenance, resistance to insect infestation, and the rate at which water evaporates from the leaves.

Volatile organic compounds (VOCs) removal by indoor plants, does not suffer from any of these drawbacks: start-up and maintenance costs are minimal, no specialized equipment, electricity, or other resources are necessary, and plants can continually remove VOCs, day and night. As part of the manned space program, NASA scientists in the 1980s found that certain indoor plant species and their associated microorganisms effectively removed VOCs in closed systems, purifying the air. Phyto-remediation or using green plants is one of most economical and environment-friendly techniques to address the organic and inorganic pollutants in the environment. Plants have always affected the concentration of pollutants in our environment due to their biomass and capacity to gaseous absorption. Plants require deep roots,



luxuriant leaves, pollutant absorbing properties and the associated bacteria in root zones, to absorb, take-up, accumulate, metabolize and degrade the pollutants from water, soil and air. The ideal way for plants is to use pollutants and their metabolites as nutritional elements during the growth and to completely remove the pollutants physically and chemically from the environment. However, to choose the best plant for pollution absorption it should survive and grow fast in heavy biomass, good leaf structure and elaborate root system and tolerate the high concentrations of pollutants. In the present research it was decided to test the phyto-remediating ability of a common low lighter survivor house plant, *Chlorophytum comosum*. Pollutants under consideration were benzo[a]pyrene and nicotine, poisonous chemicals released through the smoke of cigarette.

The monitor chosen was *Chlorophytum comosum*. It is the most commonly cultivated species, and commonly used as a houseplant as survives in a low light. The monitor was chosen due to its easy growth in all types of mediums tested in the laboratory. This plant requires less maintenance, is fast growing and its lamina is broad enough to show injury symptoms.

This research was sponsored by Department of Science and Technology (D.S.T.), New Delhi. Research work was done at Know How Foundation, Bavdhan, Pune, the host institute. Close chamber



Spider plant as a monitor

Cigarette smoke



Treatment chamber

study for exposure of experimental plant to the cigarette smoke was performed during this research project. Plants were exposed to smoke from cigarette, for specific duration. To enhance the activity of phyto-remediation, it was decided to add consortium of gram negative bacteria, Sphingomonas in the medium in which plants were growing. Activated charcoal was also added for better absorption and speeding the activity of phytoremediation. Analysis of treated leaves was done on a triple quadrupole GC/MS/MS (Agilent 7000C) with Electrospray Ionisation (ESI) for benzo[a]pyrene and Xevo TQD Waters triplequad LCMS for Nicotine. Range of benzo[a]pyrene absorbed by *Chlorophytum* is 8-10 ppb and that of nicotine is 65-183 ppm. This is average of five replicates of plants tested.

Extensive root system of *Chlorophytum* has created beneficial environment for microbial propagation and activity. The rapid uptake of Sphingomonas from rhizosphere enables plant to expedite the activity of phyto-remediation. The plants showed absorption of Benzo[a]pyrene and Nicotene, a poisonous pesticide from smoke of cigarette. It may be said that due to addition of activated charcoal the pollutant absorption is rapid and due to activity of Sphingomonas, *Chlorophytum* could take up pollutants from indoor atmosphere and phyto-remediation was effective. *Chlorophytum comosum* can be a potential phyto-remediator for indoor pollutants released from cigarette smoke. It can be effectively used in smoking zones.

Growing one or two house plants on the desk at the office may not completely protect a person from indoor pollution but plants have the power to lift people's spirits. Phyto-remediation may work effectively on indoor pollution when implemented on a large scale. Phyto-remediation is a promising technique to remove pollutants, but studies of plant's species, habitat and transformation rates of various pollutants still needs much research. It is clear that phyto-remediation already plays an important role in removing pollutants from the environment we just need to find the right plant for the right pollutant.

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# Rice (*Oryza sativa* L.) Landrace Kalanamak of Uttar Pradesh Improved to Protect Health, Wealth and Environment

R.C. Chaudhary, Sunil Kumar, S.B. Mishra, R. Kumar and Anjali Sahani

## Introduction

Kalanamak rice variety is heritage rice and an epitome of best aromatic rice cultivated and consumed in Uttar Pradesh. To the local palate, this heritage rice Kalanamak is even classed superior to Indian mystery rice Basmati. However, over 3000 years of cultivation and farmers' way of handling seed, neglect by research institutions and double onslaught on economic front by High Yielding Varieties (HYV), its area went down from 50,000 ha to less than 2,000 ha. Deterioration in grain "quality" and loss of aroma happened due to a gamut of reasons starting from spontaneous mutation and out-crossing that resulted into mixtures of aromatic and non-aromatic types, non-scientific seed production and altered cultivation, environment change and processing practices. However, by continued researches done at Participatory Rural Development Foundation (PRDF) during 1998 to 2019, varieties and technologies were developed to save Kalanamak and bring its old glory back.

## Efforts & Findings

This heritage rice of eastern Uttar Pradesh (U.P.) as Lord Buddha's blessings (*Prasad*), some 3,000 years ago, has received research and development inputs from PRDF. Kalanamak rice is highly aromatic and short-grained rice variety, which can be, milled any mill contrary to special rubber roll mills needed for Basmati. Out of a collection of 250 accessions of Kalanamak landraces, KN 3 (2010) was developed and after hybridization, three more were notified namely Bauna Kalanamak 101 (2016), Bauna Kalanamak 102 (2017) and Kalanamak Kiran (2019). Kalanamak Kiran was notified by Central Sub-Committee on Crop Standards Notification and Release of Varieties for Agricultural Crops" in August 2019. Legal protection under Protection of Plant Varieties and Farmers Right Act (PPV & FRA), and Geographical Indication (GI) tag for growing in 11 districts of Basti, Devipatan and Gorakhpur divisions provided firm footing for its exploitation commercially. The varieties, technologies and legal protection, put Kalanamak from extinction to distinction and area jumped in 40,000 ha in 2019.

## Grain Quality & Human Health

Kalanamak Kiran has highest Zinc + Iron content among all north Indian rice varieties. Iron is needed for blood formation and Zinc for brain function (protects against Alzheimer and Parkinson's diseases). Kalanamak Kiran has high (10.4 %) protein contrary to about 6% of common rice varieties. The unique quality of Kalanamak Kiran is its low Glycemic Index (53.1 %) compared to 89 % of common white rice. The recently notified variety Kalanamak Kiran has lower amylose (20%) than 24% of Basmati, thus remains soft even after long time after cooking. Soft on the palate even after it has cooled down.

## Farmers' Income

Kalanamak Kiran yields double (50 quintals / ha) compared to 25 of its parental variety. Being speciality rice, selling price of its paddy is around Rs.4000/- quintal compared to Rs. 1,800/- of common rice. Summarily compared to Rs. 17,500 / ha net profit from common HYV rice, Kalanamak KN 3 will give Rs. 44,375, Bauna Kalanamak Rs. 71,500 and Organic Kalanamak Rs. 92,500 per hectare net profit. With the PRDF arranged contract growing, by involving farmers and marketing companies from Kharif 2018, tripling the net profit of the farmers is assured sustainably. Under Paramparagat Krishi Vikas Yojna (PKVY) of the government of India, more than 2,500 farmers are growing it in Gorakhpur district alone. Kalanamak area increased from 2,000 ha to 40,000 ha during 2019. Market linkage has been developed with local chains and export market to Singapore. Thus, the proverb "Paddy and Poverty go together" is a myth now. Kalanamak Kiran rice variety was notified by Government of India's Central Sub-Committee on Crop Standards Notification and Release of Varieties for Agricultural Crops" in August 2019.



## Clean & Green Environment

Under Paramparagat Krishi Vikas Yojna (PKVY) of Government of India, organic farming is being protected, which PRDF is implementing in several districts including Gorakhpur where 2,500 farmers are practicing it. Just in one year, in our estimate, they saved 530.725 tons of synthetic agrochemicals (fertilizers, pesticides, herbicide etc) valued at Rs. 1,98,40,000. This is net saving protection of environments even on this small scale. Therefore,

producing Kalanamak rice organically has immense saving of the environment.

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## Infollution and Mental Health of Adolescents

**Rashmi Soni**

*Infollution* is a new word that combines "information" and "pollution" to connote the negative, polluting side effects of the IT revolution. Like pollution in our physical world, *infollution* in our digital world is an unintentional by-product of the excessive and uncontrolled use of resources. There is a new world offering new opportunity and new potential, particularly for the new generation who are accessing it. This world of new technology known as Information and Communication Technology (ICT) exists within the real world but has rules and behaviours exclusive to it. Cyber world offers knowledge, personal growth, extended relationships and fun. There are also new exclusive dangers and challenges, particularly for children and young people. The internet, mobile phones, and other technology devices have created a 24/7 digital world that influences the lives of millions of people. Children should be safeguarded wherever they are, including in Cyber world.

Children use the Internet like the telephone of yesteryear. They use it for entertainment, education and communication and not necessarily in that order. In some ways chat rooms are like milk bars and coffee houses of the past where young people could spend time without adult interference. The Net itself is not to be feared but it can become a distorted reality if the adolescent spends all their waking hours online. The adolescents of today are the first generation to be raised in a world where computers are a common entity in classrooms and homes. This is a big change to prior generations where technology did not overlap into all areas of our lives. In addition to the tremendous benefits that technology offers, including access to information and educational resources, the increased immersion of students into a digital age has also contributed to the evolution of new participants in and witnesses to the emergence of social problems

in the cyber world (Berson, & Ferron, 2002).

There are following three forms of Infollution:

### Cyber Violence

The National Crime Prevention Council's definition of cyber-bullying is "when the Internet, cell phones or other devices are used to send or post text or images intended to hurt or embarrass another person". As a new medium of instant human communication, the internet permits anonymity and multiple identities.

### Violent or Obscene Content

The openness of the web has led to easy access for children to violent or obscene materials such as pornography, violent texts, and images, videos including online games and gambling. But at the same time it has allowed sexual predators to have easy and anonymous access to our children.

### Information Overload

"Information overload" is a term that refers to the difficulty a person can have understanding an issue and making decisions that can be caused by the presence of too much information.

### Statistics of Internet Use in India

Indians often turn to mobile internet, as the large majority of the digital population in India was mobile internet users in 2016. About 323 million people in India accessed the internet through their mobile phones in 2016, which corresponds to about 24.3 percent of the country's population. With over 460 million internet users, India is the second largest online market, ranked only behind China. By 2021, there will be about 635.8 million internet users in India. Despite the large base of internet users in India, only 26 percent of the Indian population accessed the internet in 2015. This is a significant increase in

comparison to the previous years, considering the internet penetration rate in India stood at about 10 percent in 2011. Furthermore, men dominated internet usage in India with 71 percent to women's 29 percent. The current generation of young people is living in two worlds at the same time-the real world and the cyber world-through new electronic technologies. The experience can be exhilarating as well as time-consuming, is informative and fun but less educational than recreational, and can create long lasting meaningful relationships with real people as well as open up new and dangerous risks of child abuse, bullying and intimidation. There are over 5 Lakh easily accessible websites containing obscene material and more than 60% of children admit seeing adult pictures on the Internet (*Source: indiachild.com*).

### **Role of Education in Safeguarding Children in Digital Era**

Considering that the cyberspace is a new reality connecting the globe, it is important for to develop a net ethics and digital literacy education programme in a joint effort to actively protect children from infollution. We need to develop programmes to help children understand the potential harmful effects of digital media, and to teach them practical safety guidelines and cyber ethics with interactive digital educational tools that maximize learning effectiveness and motivational appeal for children. It will ultimately aim to foster green digital environmental awareness not only among families with young children but also among the general public. If we want our children and adolescents to be smart and safe in the digital world – whether that is in school or out of school – having them understand how the technology works, how copyright works, how identity works, is way more important than whether they have access to information or not. Kids live in a digital world, so if we can teach them about what's going on and how to protect themselves and think critically, then we will be in a much better situation. Training teachers in the concepts of digital literacy is one of the biggest challenges ahead. There are many teachers who want to incorporate digital technology in lessons but who need to upgrade their skills to do so. However, on the other side of the coin, there are skilled teachers who are looking for an opportunity to use digital technology creatively.

### **Safeguarding Children On-line: Role of Parenting**

Family is a source of positive relationship and unique bonds among members and also it is the first school of

life. It plays a central role in the emotional and cognitive development of human beings. To understand Cyber world and social networking sites in particular, we have to challenge the myths by looking through the eyes of young people to draw honest comparators between cyber and real life relations and communications. Young people say they use Internet for communication, information, entertainment, gaming, escapism and attention seeking. Parents need to inform and empower children and young people to use a set of self-regulated social rules and protocols that will safeguard them and prevent abuse. We must work towards enhancing children's resilience, not only through an understanding of how the technology works and what it can do, but by enhancing social skills. To become active participants in this information society, children now have to have far greater skills of information retrieval in order to access and interpret data and further greater depths of critical thinking and analysis to be able to discriminate against information that may be biased and untrue.

### **Efforts by the Government**

The government needs to take a stand on the cyber violence and it can help eliminate the child predators. They take a strong viewpoint but there is plenty they could do with the laws to help protect children using the Internet. The government really needs to sit down and discuss these issues before it becomes a major problem in the future. A good start would be to crack down on the people who monitor Internet activity and make sure that they have plenty of information about how to spot a child predator.

Knowledge, supervision and guidance are the best protection as well as having agreements about use, both at home and away from home. It also becomes important to set a good example. However, passing of policies will not simply solve this problem. Parents need to play a bigger role in the over site of their children. After all, technology is moving faster than any government agency would ever hope to and there are no signs of this changing. If parents monitor their children while using the Internet, it can help to prevent a child from wondering too far from the good resources on the Internet.

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# Applications of Plastics Components in Medical Devices, Personal Protective Equipments: Preparedness for Pandemics to Disasters and other Allied Emergencies

V.P. Sharma, Y.K. Sharma and S.C. Sharma

## Introduction

The correct selection of raw material to shape, design, and colour of personal protective equipment depends on assessment of potential risk. The counter benefits may be in terms of protection from microorganisms, contamination of the healthcare workers through clothing, blood, body fluids, secretions, and excretions. We need to holistically evaluate the extent of risks and identifying measures needed to safeguard. The polymeric products may be used to create several items from aprons, masks, shield, lenses, and pacemakers to joint replacement devices in a number of shapes and sizes due to being pliable enough to fit into even the most intricate of moulds.

The plastic packaging, with its extraordinary barrier properties, light weight, low cost, durability, and transparency serves as material of choice for biomedical, therapeutic and pharmacy applications. Nowadays innovative medical procedures including sutures are dependent on plastics. These help us to develop medical tools, devices from syringes, insulin pens, intravenous tubes, catheters, inflatable splits to implants. These few items are for one-time use and help in prevention of the spread of dangerous diseases and have high strength-to-weight ratio, stiffness and toughness, ductility, corrosion resistance, bio-inertness, insulation, non-toxicity and outstanding durability. It may be at a relatively low cost compared with comparable other materials and thus plastics are resource efficient.

It is expected that the plastic medical device market in the U.S. may reach more than 5.8 billion pounds by the end of the current year. The variation may be due to COVID-19 pandemic and variety of trade-offs based on property requirements, pricing, environmental and regulatory issues.

The waste management needs to follow the cradle to grave approach and includes characterization, quantification, segregation, storage, transport, and treatment. Plastic has revolutionized the medical industry over the past century and it is being scrutinized for what happens after its desired performance is completed. Plastic may easily end up in marine environments, where it breaks down into tiny particles called microplastics affecting the ecosystem.

## Contribution in Improving Quality of Life with Potential Threats for Environment

Improving quality of life is one of the main benefits of integrating new innovations into medicine. Medical technologies like minimally-invasive surgeries, better monitoring systems, and more comfortable scanning equipment are allowing patients to spend less time in recovery and more time enjoying a healthy life. The demands on health care units or accessories e.g. diapers from children categories to adults, sanitary pads, infusion sets, syringes etc have increased as the human population finds them easy to use and dispose. They are thus now commonly used consumer items and marketed from different departmental stores to medical shops.

## Distribution, Disposal and Risk to Environment

During emergencies and pandemics they are more frequently used and indiscriminately disposed to the environment. Ultimately they become causative agents for several adverse health complexities. They may be traced from drains to water bodies and dumpsites. Some of them reach to agricultural field and in vicinity to food storage sites being easily blown by winds or through stray animals. They cannot be controlled without creating awareness at all levels from village to International platforms where the SDG goals are being discussed.

When patients' health, mobility and comfort are involved, reliability and durability are crucial. In the health care sector, wearable medical devices increasingly are called upon to perform a variety of important tasks, such as monitoring vital signs or delivering drugs. The tasks they perform are highly diverse, as are the demands imposed on the materials used to make them. Their popularity continues to grow as does the need for materials that satisfy the unique requirements of these devices.

## Packaging to Drug Delivery and Guidelines Compliances?

Generally, demand for medical plastics will outpace packaging applications especially in the area of prosthetic devices and minimally invasive surgical instruments. On the other hand, plastics in the packaging sector are largely driven by cost. Most consider that the use of engineering resins will increase faster than commodity resins because of increased physical demands being placed on resins used for medical devices.

Some hospitals are experimenting with replacing the blue wrap gowns or aprons with reusable sterilization items. The Centers for Disease Control, FDA, several pharmacopoeias, and regulatory organizations have set strict standards for medical instruments, devices and the pouches. Plastic has proven itself a life-saving material as far as the healthcare industry is concerned. A component in everything from IV bags, incubators, dialysis machines, stents and implants, artificial joints etc. Plastics have improved the overall quality of health care items and reduced medical costs, reduced the spread of infectious diseases and served to reduce pain levels in patients. Sterile plastic packaging and disposable plastic medical devices such as syringes, surgical gloves, IV tubes, catheters and insulin pens control the spread of infection and dangerous diseases. They need to be discarded after single use with systemic medical procedures recommended by CPCB and recommended international norms of biomedical waste disposal.

As plastics are economical and more pliable than metal, it offers an alternative to the metal components traditionally used in these parts that wear out more quickly, causing a patient pain and discomfort. We must appreciate durability; plastic components offer longer life for products viz. implants and artificial joints because these components are durable and capable of withstanding tough stresses. Plastic parts are cheaper to create and thus to replace. With a longer shelf life than metals that wear and corrode over time, plastic parts are apt to last longer than other material parts and without the time and effort spent on the upkeep often required for components made of other materials. Sometimes metal prosthetics may pose discomfort due to corrosion, non-alignment or few allergic reactions due to other factors or poor compatibility, making movement difficult and painful. Sterile plastics can replace metals, offering patients comfort and strong structural integrity without fear of the wearer developing an allergic reaction.

Plastic containers of good quality may be with tamper proof caps and coding to secure potentially dangerous pills. With advancement in packaging solutions we may have uniquely designed containers, pouches, sachets. This may keep the stored in material safe from the leaking of and exposure. The proper labelling and transportation must be ensured. Drug and biomedical packaging are changing fast with new and active packaging shifts to meet challenging demands.

### **Usage in Intelligent Analytical Systems and Diagnostic Solutions**

The advanced equipments use the robotic plastic bodies, sensors, artificial intelligences for the safe

operation of scanners such as MRI. In these cases machine acts like an oversized magnet, without being safely housed in a plastic encasement, objects in the room made from iron and steel would become dangerous projectiles once the machine activates. Thus medical, diagnostic and analytical industry has benefitted from the incorporation of plastics. We may not undermine the implications of plasticizers, stabilizers, monomers, other additives associated with plastics but attempt to have balanced risk management and usages for the society. We cannot underestimate the toxicological implications of monomers and plastic additives. The voluminous literatures are readily available through data bases, toxicological profiles, webinars and reference books.

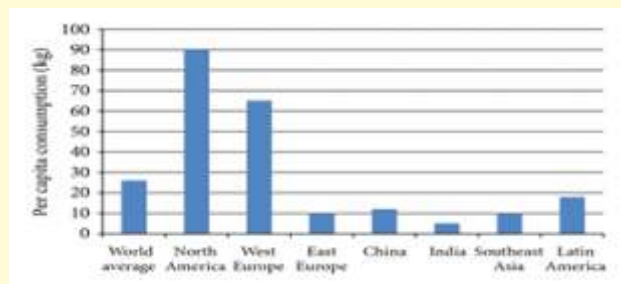
### **New R & D in Plastics**

R & D experts have developed Bio-plastics that degrade in seawater amid a growing plastic waste crisis impacting the world's oceans. These are environmentally sustainable and efforts are in progress for compatible materials with value added features and to be techno feasible at affordable prices. To create the material, the research team combined starch, the primary component of carbohydrates, and cellulose, which is derived from plants. Through a technique devised by the researchers, the starch was transformed into a high-strength, extremely water-resistant sheet material that, combined with the cellulose, biodegrades in seawater. Although biodegradable alternatives to plastic have already been achieved in other parts of the world, these materials are reportedly of lesser quality than their standard consumer plastic counterparts. Researchers have developed a biodegradable food wrap plastic alternative derived from soybeans or lobster shells into a plastic alternative.

We may use alcoholic, hydrogen peroxide, sodium dichloroisocyanurate based disinfectant of reputable and tested formulations; Bronocide SP (AIP) alcohol-phenol-iodine disinfectant and polyvinyl pyrrolidone iodine (PVPI) to disinfect radiographic films and gloves. The guidelines also stipulate the selection and use of PPE with high performance in terms of protection from sprayed liquids, such as contaminated body fluids.

Internationally scientists have discovered a new use case for canola by product by strengthening a plant-based, biodegradable, in-development cling wrap. During the development of a cassava starch-based cling wrap, food and bioengineering processing the expert and her team applied the cellulose nanofibers from canola straw to improve the tensile strength of the clear, plastic-like cling film. The leftover straw is typically used for little else beyond bedding for soil nutrients, yet contains valuable ingredients such as

lignin and cellulose, which support the canola plant. Sometimes, plastics of specialized specifications serve as the transparent plastic for medical applications. This is preferably due to impact and heat resistance, strength, exceptional purity and biocompatibility. Innovative smart biodegradable polymers used as implantable medical devices have the unique role of controlling function and they do not break down even in the human body.



Country-wise Per Capita Consumption of Plastic (2018)

### Inference

We must understand that preventive and mitigation measures are important in both healthcare and community settings. We need to prevent panic buying and waste the PPEs as these are needed by different sectors and foremost by healthcare staff. The misinformation about these items and stockpiling may contribute in creating unnecessary demands and inappropriate distribution amidst masses. We need to

support in strengthening the support chain established by Government and voluntary groups during extreme situations of National/International demands.

The unregulated biomedical waste management including PPEs is a public health problem and pose serious threat to human health and safety as well as to the environment for the present and forthcoming generations. Thus we need to adopt safe and reliable methods for handling of waste. Health Care Workers [HCW] must select and wear appropriate PPEs as counter measures against exposure to infectious body fluids and blood splash for occupational safety, prevention from accidental infection. It is important for healthcare workers to ensure the protective performance of each PPE against penetration of pathogens and recommended to use sanitizers with desired efficacy. The International Standards Organization ISO 22609, 10993 tests must be adhered to ensure suitability of biomedical devices.

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## Role of Plant Micronutrients in Cellular Metabolism

**S.N. Pandey**

Essential nutrients are available at all the functional sites in the cell compartments in concentrations commensurate with their functional requirement (Marschner, 1995). Mineral nutrients have been divided into two categories on the basis of quantitative requirements in plant functions as macronutrient elements and the micronutrient elements (Loomis and Shull, 1937). The micronutrient required more than 1mg/l in solution culture (viz. N, P, K, S and Mg etc.) and those required in minor quantity such as Zn, Cu, Mn, B, Mo, Cl (<1mg/l) are classified as micronutrients. The properties of the soil and other environmental stresses affect availability of essential micronutrient elements to the plants. The micronutrient disorders (deficiency and toxicity) cause adverse effects on structural and bimolecular functions of plants. The micronutrients play their roles in structure and functions, defense system against abiotic stresses and in reproductive biology of plants. Micronutrients play their role as activator of enzymes, form complex with organic ligands, work as carriers of electron,

regulate reproductive development, and help in homeostasis of plants. The essential micronutrients are constituents of a large number of organic structures. Zinc and boron both maintain the structural integrity of plasma membrane, whereas Zn detoxifies the reactive oxygen species under abiotic stresses. The enzymes are involved in mineral metabolism, photosynthesis, ion uptake, respiration, biosynthetic pathways, nitrogen-fixation and stress-defense mechanism, where they work as activators. Zinc is a significant constituent of several proteins which interact with DNA and influence gene expression. Copper is a terminal component of electron transport system (ETS) in inner membrane of mitochondria. It is the constituent of cytochrome oxidase. It also has affinity with organic ligands. Copper is also involved in photosynthetic ETS as it is main constituent of plastocyanin. Manganese form bond with oxygen containing molecules, ligands with amino acids of D1 protein present in photosystem II reaction center. Iron containing proteins play important role in biological system as it is constituent

or activator of several enzymes such as SOD (superoxide dismutase), lipoxygenase, and nitrite reductase, and forms Fe-S clusters. Thus, several micronutrients are constituents in cellular organic structures and bimolecular functions in the cell.

### Some Regulatory Functions

Most of the essential micronutrients such as Zn, Cu, Fe, Mo, Mn are cofactors in enzyme-catalyzed reactions. Although, they catalyze various class of enzymes but specifically oxidoreductases are most significant (Sharma, 2006). The micronutrients have variable oxidation states in constituent of oxidoreductase mediated flow of electron from one molecule to the other. Many iron-containing enzymes play their role in fatty acid metabolism, biosynthesis of growth hormones and terpenoids, and they also work as signalling molecules. Iron provides tolerance to the plants against abiotic stress through antioxidant enzyme defense system. Some non-haem iron enzymes containing Fe-S cluster cofactor are nitrite reductase (4Fe-4S) which catalyze electron reduction of nitrite ( $\text{NO}_2^-$ ) to ammonium ( $\text{NH}_4^+$ ). Aconitase contains four iron atoms localized in cytosol. On the inner mitochondrial membrane, electron transport proteins contain cofactor as iron or copper. In the matrix of mitochondria,  $\text{NAD}^+$ -isocitric dehydrogenase is activated by manganese. In oxygen evolving system of light reaction (pigment system II) Mn is involved in oxidation of water. The flow of electron from PS II to PS I is coordinated by the involvement of copper and iron. The enzyme  $\text{NADP}^+$ -malate dehydrogenase activated by the functions of Mn in photosynthesis of  $\text{C}_4$  plants, this enzyme is also involved in biosynthesis of fatty acids in lipid storing seeds. The role of zinc in regulatory functions is by its involvement mostly in enzymatic systems. So far more than three hundred enzymes are known to contain zinc as a cofactor. Zinc provides stability to proteins (zinc fingers, zinc clusters, and RING finger domains) and involved in transcriptional regulation. Zinc is an activator of carbonic anhydrase activity in reversible conversion of  $\text{CO}_2$  to bicarbonate in  $\text{C}_4$  plants during photosynthesis. Some important other enzymes containing Zn as a cofactor are carboxypeptidase, superoxide dismutase and alcohol dehydrogenase. Molybdenum works as a cofactor in more than 30 enzymes, involved in redox reactions of regulatory metabolism, in biosynthetic pathway of auxins and abscisic acid. Nitrate reductase and xanthin oxidase contain molybdenum which catalyze the reactions in which nitrogen and nitrogenous compounds are involved. Another Mo-containing enzyme aldehyde oxidase catalyzes the terminal reaction in the biosynthetic pathway of abscisic acid and auxins.

Boric acid (boron) plays metabolic role in vascular plants forming complexes with hydroxyl radicals of compounds such as *o*-diphenols and sugars having two adjacent hydroxyl groups in *cis*-configuration (complex between boric acid and *cis*-diol furanoid groups of sugars like fucose and apiose). Its role in cell wall structure is the cross-linking of polysaccharides. Essential micronutrient chlorine is constituent of about 130 organic compounds. It is essential part of the manganese-cluster (in oxygen evolution complex of pigment system II in light reaction of photosynthesis) which catalyzes the oxidation of water. Chlorine also plays the role in turgor and osmo-regulatory maintenance of the cell. Nickel and cobalt the part of several enzymes catalyze biosynthesis of organic compounds. Cobalt is cofactor of vitamin  $\text{B}_{12}$  (cobalamin) which is a coenzyme in nitrogen fixation. Nickel is a cofactor of jack bean urease, required in plants in which urea is the source of their nitrogen.

### Secondary Metabolism, Hormones and Signalling Molecules

During the biosynthesis of secondary metabolites a large number of enzymes catalyze the reactions; most of them contain micronutrients as an activator or cofactor of the enzyme. Some examples are: (i)- Precursor of lignin is *p*-coumaric acid, which is produced from trans-cinnamic acid which is catalyzed by cinnamate-4-hydroxylase (that is NADPH-cytochrome P450 dependent haem enzyme). (ii)- Cinnamyl dehydrogenase is activated by zinc; this enzyme catalyzes the conversion of *p*-coumaraldehyde to cinnamic alcohol (monolignols), thereafter subsequently polymerized to lignin. (iii)- Precursors of aromatic amino acids are synthesized through shikimate pathway. In the first order of reaction, condensation of phosphoenolpyruvate and erythrose-4-phosphate to produce DAHP synthase enzyme, is activated by manganese. Gibberellins are a major signalling molecule in plants which synthesized by the involvement of the several enzymes containing micronutrients as activator. The catalytic activity of kaurene synthase contains activators  $\text{Co}^{2+}$  and  $\text{Mn}^{2+}$  to synthesize precursor of gibberellin *ent*-kaurene. In the next step of reactions *ent*-kaurene oxidase (a P450 haem monooxygenase) is involved in the conversion of *ent*-kaurene to *ent*-kaurenoic acid). Various other enzymes are also involved further to catalyze the conversion of  $\text{GA}_{12}$  aldehyde to gibberellins. For the biosynthesis of jasmonic acid three different enzymes are required which contain Fe as a cofactor for their activation. In the biosynthesis of abscisic acid and ethylene, several enzymes with cofactor of Fe and Mo are involved in catalytic activity.



## Protective Role of Plant Micronutrients

Various types of abiotic stresses produce highly reactive oxygen species (ROS) such as  $O_2^-$ ,  $OH^\cdot$  radicals in the plant cells. Stress of essential micronutrients induces the activity of membrane bound NADH-oxidase leading to enhanced production of superoxide ions ( $O_2^-$ ) during electron transport in chloroplasts and mitochondria. The superoxide radicals lead to the lipid peroxidation particularly of membrane lipids. Micronutrients Zn, Cu, Mn, Fe, are known to be an important constituent of the several groups of enzymes. An enzyme superoxide dismutase (SOD) plays role in the first line of the defense in detoxifying ROS in the plant cells. Some micronutrients are cofactors of SOD

(Mn-SOD, Cu-Zn SOD and Fe-SOD). These micronutrients containing enzymes (superoxide dismutases) convert superoxide ions ( $O_2^-$ ) to hydrogen peroxide ( $H_2O_2$ ). Hydrogen peroxide is also toxic to membrane lipids. The high concentration of  $H_2O_2$  is converted by the activity of catalase (CAT) and ascorbate peroxidase (APX) to the water ( $H_2O$ ), a harmless condition. Thus, micronutrients regulate bimolecular functions in plants along with their functional and structural roles

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## Vertical Farming: A Step to Combat Environmental Pollution

**Prerna Mitra**

### Introduction

A silent but new revolution is taking place in the agricultural sector. In prehistoric days, especially in the Neolithic age, human beings started farming. In the late 18th and early 19th centuries, they started the multi crop farming and farm breeding, producing sustainable urban food requires considering all factors of sustainability collectively including, environmental, social and economic advancement. A new method that has been proposed to address the issue of sustainability and to meet the growing food demand is, designing and implementing Vertical Farms Vertical farming is a concept that involves cultivating plants with livestock on vertically inclined surfaces such as in skyscrapers in urban areas, where there is a lack of available land and space.

### Vertical Farming (VF)

Vertical farming is a method to produce leafy veggies (spinach, amaranthus, mint, lettuce, kale, basil) and some non-tree fruits (tomatoes, brinjal, strawberries) where there is nearly no available arable land; these are grown in vertically stacked layers made of PVC pipes resembling a multi-storied building of plants. The plants are grown in a controlled environment under artificial lighting using LED bulbs, either in a building and polyhouse on rooftops or open land. V-farming can be either aeroponics (growing plants in air or mist without the use of soil or any other medium) or hydroponics (growing plants using mineral nutrient solutions in water solvent without soil). Though there is no exact data on how many V-farms are there in India or in the world, what farmers know is that it is a very high productive farming, with nearly 70-80 per cent more harvest per unit of area. If

one has a 1000 sq ft plot of land, vertical farming on it yields a harvest which is equivalent to 3,000-4,000 sq ft of plot. Moreover, with a crop cycle of 3-4 times a year, the profits are substantial as compared to traditional farming.

### Objective of Study

This study is an attempt to review the major opportunities and challenges of Vertical Farming and its role to combat or mitigate environmental pollution.

### Environmental Pollution

Water pollution happens when chemicals or dangerous foreign substances are introduced to water, including chemicals, sewage, pesticides and fertilizers from agricultural runoff, or metals like lead or mercury. According to the Environmental Protection Agency (EPA), 44% of assessed stream miles, 64% of lakes and 30% of bay and estuarine areas are not clean enough for fishing and swimming. The EPA also states that the United States most common contaminants are bacteria, mercury, phosphorus and nitrogen. These come from the most common sources of contaminates, that include agricultural runoff, air deposition, water diversions and channelization of streams.

Common types of air pollution are dangerous gases, such as sulphur dioxide, carbon monoxide, oxides of nitrogen and chemical vapors. These can take part in further chemical reactions once they are in the atmosphere, creating acid rain and smog. Other sources of air pollution can come from within buildings, such as secondhand smoke. Soil contamination or Soil pollution can occur either because of human activities or because of natural

processes. However, mostly it is due to human activities. The soil contamination can occur due to the presence of chemicals such as pesticides, herbicides, ammonia, petroleum hydrocarbons, lead, nitrate, mercury, naphthalene, etc in an excess amount

### Methodology

In the current study, a systematic review was performed on previous literature on the primary research question: what are the opportunities and challenges of VF mentioned in these academic and scientific papers. The articles published in newspapers/magazines were reviewed.

Vertical farming in mitigating/combating environmental pollution. Vertical Farming provides ways and solutions to combat environmental pollution through following three systems:

(a) **Hydroponics:** It involves growing of food in water using mineral nutrient solutions without soil. It reduces soil-related cultivation problems like soil borne insects, pest and diseases.

(b) **Aeroponics :** In aeroponics, there is no growing medium and hence, no containers for growing crops. In aeroponics, mist or nutrient solutions are used instead of water. As the plants are tied to a support and roots are sprayed with nutrient solution, it requires very less space, very less water and no soil. Thus the chances of soil pollutants are reduced.

(c) **Aquaponics :** It is a bio-system that integrates recirculated aquaculture (fish farming) with hydroponic vegetable, flower, and herb production to create symbiotic relationships between the plants and the fish. It achieves this symbiosis through using the nutrient

Vertical Gardens help the environment exactly in the same way a normal horizontally placed garden does. Plants play a vital role in cleaning the air, they help to reduce noise pollution as they possess noise reduction capabilities. Another important function of the plants is to reduce the amount of carbon monoxide in the air and filter out the pollutants by breathing them in and then exchanging them for clean, fresh, clear oxygen. Coming to the noise reduction, for long plants have been used to reduce noise levels on raucous roads and highways across the globe. Vertical gardens expand on this idea, as vegetation naturally helps in blocking high-frequency sounds. The use of vertical gardens could significantly change the urban environments by eradicating the noise of the hustle and bustle we have actually adapted to.

An article appeared in Times of India dated 23 Feb 2020 revealed that we could save the planet by turning the renewable energy and air directly into

food. The article highlighted the production of food from air by the Finnish company – Solar Foods and it produces Natural kind of protein called Solein. I would suggest that it can adopt the method of vertical farming too, to save the environment and farm lands from depletion by producing food from air.

### Challenges

It is not cost effective as for establishing the vertical farming system high cost is involved in erecting the structures along with its automation like computerized and monitoring systems, climate control system, etc. The excess nutrients used in vertical farming may interfere and contaminate the main urban water system if not taken care of. Lot of garbage, plant residues, etc. will be generated around the buildings with vertical farming which needs to be disposed of properly.

### Benefits of Vertical Farming

Vertical Farming can be fitted to both refurbishments and new builds, from small independent houses to huge commercial developments. These are totally versatile and can be installed both inside and outside the building structures. They can create a breath-taking statement by producing an alluring and inviting environment. The inhabitants are always greeted by a lush green environment; it also creates a soothing effect of being around plenty of foliage. Also, these walls work as a natural air-filtration system, which means more fresh air to breathe, basically these walls are purveyors of good health and healthy minds. The installation of vertical gardens can earn buildings credits from recognized Green building certifiers like LEED (Leadership in Energy and Environmental Design), and IGBC (Indian Green Building Council). More points mean improved carbon footprint and increased property values. A vertical green wall is a natural air-filter, it helps in the creation of a cleaner and invigorating environment which helps to enhance the occupant's health and productivity. Considering a typical office environment, where the workers are exposed to harmful air toxins like carbon monoxide, formaldehyde, Benzene and VOCS, a vertical garden in such an environment can break down harmful toxins while releasing fresh oxygen into the workplace air. Both the interior and exterior vertical green walls by a process called “evapotranspiration” cool the air in the hotter summer months. During the winter months, it adds to the building insulation consequently reducing energy costs required for the heating of the building. Exterior vertical garden can reduce the wall surface temperatures by nearly 50 degrees °F, this can help in significant energy savings. One lesser known benefit of a vertical garden, these structures can reduce noise levels in

buildings. Across the world, plants are being used to reduce the noise levels along roads and highways. Vertical gardens can expand on this idea as vegetation 'naturally' blocks high-frequency sounds. These walls act as an extra insulation with a layer of air between the plants and the wall. Additionally, they can reduce noise levels by refracting, reflecting, and also by absorbing acoustic energy. Just as the name suggests, in VF everything grows upwards rather than getting spanned horizontally. Vertical gardens rely on racks and can be effectively built as a tower which means no need to invest in elusive land areas. In terms of water usage, a vertical farm consumes 90% less water than the traditional gardens, this is because water is constantly harvested and reused. But, bigger savings come in the form of labor. Huge lavish garden settings demand a lot of manpower to maintain it, but with vertical gardens, only one skilled professional can do the job of monitoring the plants and ensuring that all the parameters are correct. Buildings get adversely affected by fluctuating temperatures which causes materials to contract and expand, which over time results in deterioration, fissures, and cracks. Having exterior vertical gardens

protect buildings not just from temperature fluctuations but also diverts water away from walls when it's raining heavily and also provides protection from harmful UV radiation. So when multi-story buildings were invented during Greek and Roman cities to provide cheap residences, they may not have realised that they were laying the foundation for future techniques for vertical farms. But looking at the fast burgeoning populations, vertical farms may just become the norm for a majority of vegetable production by 2050.

### Conclusion

Vertical farming can be potentially beneficial in increasing food production, maintaining high quality and safety and contributing to sustainable urban farming. Well-known advantages of growing food within the urban territory can be beneficial environmentally, socially and economically. Vertical farms can also provide solutions for increasing food security worldwide.

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## CGES Activities

### National Conference on the Effect of Climate Change on Agriculture, Biodiversity and Human Health (CABH-2020)

A National Conference on the effect of climate change on agriculture, biodiversity and human health organised jointly by Clean and Green Environmental Society (CGES) and CSIR-National Botanical Research Institute (CSIR-NBRI) at NBRI was inaugurated on 22<sup>nd</sup> February, 2020 by the renowned environmentalist Padma Bhushan Dr. Anil P. Joshi. In his presidential remarks Dr. Joshi stressed the need for saving of air, water and forests for sustainable development and livelihood in the society..



Felicitation of Prof. R. K. Kohli and Dr. Anil Joshi



A view of audience

Lamenting on the poor conditions of the villages, he said that if conditions are not improved, there may be increased migration towards urban areas posing grave problems to the environment in future.

Prof. R.K. Kohli, Vice Chancellor, Central University of Punjab, Bhatinda delivered a keynote address on the topic of agriculture, biodiversity and health. Dr Kohli said that earth with limited dimensions and resources can meet the needs of every lifeforms, provided we are in a position to main the life-support system..In the event of disturb basic ecological processes, the health of any ecosystem is bound to get affected adversely, he added. Dr. Kohli further

pointed out that every ecosystem directly depends on the level of richness of its biodiversity.

Director CSIR-NBRI, Dr. S.K. Barik in his welcome address expressed hope that major recommendations arising out of this very important national conferences will be implemented by all the concerned institutions in a time bound manner.

President CGES, Er. Sumer Agarwal in his remarks said that Clean and Green Environmental Society is committed to make people aware about the importance of cleanliness and saving of biodiversity for overall health and prosperity of the society. Dr. SC Sharma, General Secretary, CGES presented a brief report on the activities and achievements of CGES during the past about five years.

A souvenir published on this occasion and CGES Newsletter were released. Dr. Priyanka Agnihotri, scientist NBRI proposed the vote of thanks and Ms. Shailja Tripathi conducted the proceedings.



Release of CGES Newsletter



Prof. P.K. Seth and Prof. Y.K. Sharma in a session

The aim of the conference was to bring the eminent scientists, academicians, environmentalists, policy makers, non-government organisations, etc. from all over the country on a common platform to discuss critical issues arising out of the climate change, and its effects on agriculture, biodiversity and human health and to formulate the strategies for taking up the corrective measures. The conference had also

provided a unique forum to the young researchers and the students to present their innovative ideas and sharing their research experiences in the conference. About 200 participants including young researchers from different universities and research organizations participated in two day conference.



Guests and participants of CABH-2020

There were 37 presentations, one Keynote talk, four invited lectures, five lead lectures and 26 oral presentations during first and second day of the conference. The major recommendations arising out of presentations made by the eminent scientists and researchers made in different technical sessions of two-day national conference and worthy of implementation by the concerned government departments, agencies and societies are enumerated below:

#### **Recommendations of the CGES–NBRI National conference February 22-23, 2020**

1. Environment must be saved from plastics and other pollutants without further loosing time.
2. Our goal is not only clean air, potable water, healthy soil and scenic beauty but also a wholesome environment for a green earth where life sustains.
3. Vertical farming and gardening should be promoted to decorate houses, produce family food and help in conserving land and environment.
4. Ecotourism should be developed and promoted for health, wealth and sustainable use of natural resources.
5. Examples set for developing and conserving landraces in crops to double the framers income are available in Kalanamak rice. Such Nutrifarm approaches must be followed elsewhere to save environment while sustaining income and improving human health.
6. Reduction of plant, animal and beneficial microbial diversity must be halted to protect the environment for future generations.



## Video Meeting

A cloud HD video meeting was organized on 20<sup>th</sup> May, 2020 to discuss the problem of Vilayati Babool (*Prosopis juliflora*) and its effect on biodiversity in Agra. Shri K. C. Jain Advocate from Agra and Prof. Y.K. Sharma, Dr. S. N. Pandey, Dr. S.C. Sharma, Col. Ajay Gupta and Dr. A. K. Singh, all from Lucknow participated in the meeting.

## International Webinar on House Plants

An international webinar on the Theme “Houseplants for Mitigating Indoor Pollution” was organized by the prestigious Department of Botany, Isabella Thoburn College, Lucknow on the World Environment Day, 5<sup>th</sup> June 2020 from 5PM to 7PM. Dr. Panzy Singh, Head, Department of Botany, IT College and a CGES member coordinated the webinar. There were more than 200 participants from all over the world.



The inaugural talk was given by Guest Speaker, Former Emeritus Scientist, CSIR-NBRI, Lucknow, Dr. S.C. Sharma, CGES Secretary General on House Plants. He gave an exhilarating presentation punctuated with live demonstration of Pollution reducing (Phyto-remediating) Indoor Plants reared by him in his own Green Villa. He explained various types of Pollution and the role of CGES and certain Indoor plants mitigating Pollution. A special mention was made of Spider Plant, Snake Plant, Money Plant, Peace Plant, Bamboo Palm, Areca Palm, Aloe Vera, Dracaena, Italian Basil and Ferns. Dr Sharma also explained how these indoor plants could be propagated. He also delved into Terrace gardening, Vertical garden, Balcony gardening and Window gardening.

Principal, Chandra Bhanu Gupta PG College of Agriculture, Lucknow, Prof. Yogesh Kumar Sharma FISEB, Joint Secretary, CGES and former Head Botany Dept, University of Lucknow was introduced by Dr. Panzy Singh and spoke about gardening in the present scenario.

Dr. A.K. Singh, an executive councillor of CGES and former Chief Scientist, CSIR-CIMAP spoke on medicinal plants that are suitable for a home garden.

The enlightening talk encompassed plants like Giloe, Ashwagandha, Kalmegh, Turmeric, Ginger, Tulsi, Lemongrass etc.

Col. Ajay Gupta, CGES IT Advisor and former SSA, SGPGIMS gave a talk on role of information technology in environment. After briefly covering about technology advancement affecting environment adversely, he enumerated the major role of Information Technology in restoring the purity and originality of the environment. A number of systems – GIS, NMIS & ENVIS were introduced to the audience. The initiatives of centrally controlled solar and wind energy, use of Info-Tech for creating Websites, Webinars & E-learning, reduction of paper use and reduction of transport and power in office were brought out in detail.

Dr. Divya Thomas, Clinical Pharmacist (U.S.A) expressed her thoughts on the role of plants in pharmaceutical industry. She also described the ongoing research over various benefits of plants.

Dr. Panzy Singh also presented her concluding presentation on some beautiful house plants and thanked all the speakers and participants of the international webinar.

## Felicitation

CGES congratulates Dr. Prabodh K. Trivedi and Prof. Yogesh Kumar Sharma for their appointment and wishes them all the best for their future endeavours.



Dr. Prabodh Kumar Trivedi, FNA, Principal Chief Scientist, CSIR-NBRI and CGES member took over the charge of Director, CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow on February 14, 2020.

Dr. Prabodh K. Trivedi



Prof. Yogesh Kumar Sharma, FISEB, Former Head, Botany Department, University of Lucknow and Joint Secretary, CGES has been appointed Principal, Chandra Bhanu Gupta PG College of Agriculture, Lucknow. Prof. Sharma has taken over the charge of the Agriculture College on April 10, 2020.

Prof. Yogesh K. Sharma

## New Publication

- Lotus (*Nelumbo nucifera* Gaertn.): National Flower of India  
Authors: S. C. Sharma, A. K. Goel and Y. K. Sharma  
Publisher: Bishen Singh, Mahendra Pal Singh, Dehradun (India)

## Forthcoming Events

- Fifth Foundation Day of CGES (July, 2020)
- CGES Webinar on Environment and Health (August, 2020)
- Plantation Drive by CGES in Schools, Colleges and Parks (July-September, 2020)

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