National Seminar
On

"UNIVERSITY INDUSTRY PARTNERSHIP: A MARCH TOWARDS SUSTAINABLE GROWTH (AMTSG-2015)"

12th and 13th March, 2015

ABSTRACT BOOK



BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY
LUCKNOW
ESTABLISHED 1996

Organized by
Center for Industry Institute Partnership Program
Babasaheb Bhimrao Ambedkar (Central) University,
Lucknow – 226025

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Lucknow – 226025

बाबासाहेब भीमराव अम्बेडकर विश्वविद्यालय
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BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY
LUCKNOW
ESTABLISHED 1996

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Vidya Vihar, Raebareli Road
Lucknow-226 025 (U.P.) INDIA

Prof. Ranbir Chander Sobti
Vice Chancellor



No.: VCS/15
Date: 10.03.15

Message

It gives me immense pleasure to know that Centre for Industry Institute Partnership Programme (CIIPP) is organizing a two day national seminar on the theme "University-Industry Partnership: A March Towards Sustainable Growth" on 12th and 13th March, 2015.

In an interdependent world, communication is the strongest and most imperative gesture evolved by nature for development and evolution of the technology and mankind as whole. Human race could not have progressed in absence of interaction. Similarly for further exploration, investigation, research and development; interaction/communication between universities and academic institutions is the prime urge. Such type of interactions are lacking in India. Conference like this can go a long way in transfer of intellect from academia to industry.

I appreciate this noble gesture for organizing such an interactive endeavor wherein delegates from research institutes, academics and industry will come under one roof to discuss the future course of collaborative efforts for innovation science and technology. I hope that the participants are going to be immensely benefited from this academic endeavor.

Best wishes!

(R C Sobti)

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FNASc, FNA, FAMS
Chief Executive Officer
Biotech Park, Lucknow &
Former Director, IITR



MESSAGE

March 7, 2015

I am delighted to learn that the Center for Industry Institute Partnership Program, Babasaheb Bhimrao Ambedkar (Central) University, Lucknow is organizing a National Seminar on 'University Industry Partnership: A March Towards Sustainable Growth (AMTSG-2015) from March 12th to 13th, 2015.

When industry and universities work in tandem to push the frontiers of knowledge, they become a powerful engine for innovation and sustainable growth. I am sure that this seminar will provide an opportunity for industries as well as academia to interact on issues related to environmental, social and economic aspects and suggest a work plan for sustainable growth.

I wish all success to the event and congratulate the organizers for selecting such an important topic of current interest.

P.K. Seth

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AMTSG-2015

SKiES Life Technologies Pvt. Ltd.

Bringing nature to life



Dr Suman PS Khanuja
Mentor & Director
Date: 7 March 2015

Message

"*Think beyond*" is the *mantra* to innovate while science provides the runway for wings of the mind to take off to reach where it never did before! The need is of daring to ask "*Why not?*" That's the route to "innovation" which leads to the unreached horizons. Academia and Industry have always questioned each other and then partnered also whenever the question is answered.

Time has arrived when Institutions and Universities take proactive lead, break boundaries and make way for Joint Ventures with Industry rather than a formal PPP model. It is rightly in the direction that the Centre for Industry Institute Partnership Programme (CIIPP), BBA University is organizing a two day national seminar on 12th and 13th March, 2015. The theme **'University Industry Partnership: A March towards Sustainable Growth'** is an indicator of the vision of leadership and the team who are organising this event. I congratulate the organizers for the sincere effort that they have been sustainably making for the cause and wish a translational success to them in the mission!!

Suman Khanuja

Dr Suman PS Khanuja
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AMTSG-2015

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फेलो, ए0 ई0 वी0, फेलो, आई0 एस0 पी0 पी0
संकायाध्यक्ष, प्रबन्ध अध्ययन विद्यापीठ
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BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY

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Date 09/03/15



Message

This is time to extent the research and innovation from the university to the industries for which both the stakeholders are required to come on one forum. I believe that the second National Seminar of CIIPP, BBA University to be held on 12th – 13th March, 2015 will provide such forum.

I appreciate the efforts made by CIIPP for successful organization of this National Seminar and wish for its grand success.

RPSingh

(Rana Pratap Singh)
Coordinator, CIIPP

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AMTSG-2015

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Co-coordinator, CIIPP
Coordinator, Industrial Microbiology



Message

It gives me immense pleasure to welcome all the delegates to Babasaheb Bhimrao Ambedkar University, Lucknow for the two day national seminar on "University-Industry Partnership: A March Towards Sustainable Growth" on 12th and 13th March, 2015.

In India the research in university and other academic institutions is limited to the laboratories. Most of the research or outcome of the research never sees light of the day. Research particularly in the field of science has a little meaning if it cannot reach the end user directly or through industries. The universities act as a source of new ideas and industry offers a natural route to maximize the use of these ideas into economic value.

The workshop will encourage new multidisciplinary interaction that will promote stronger bridge between the two facilitates. Such interactions between industry and institute will lead to innovations at both university and industry level and subsequent transfer of specific technology to the industry as per need.

I firmly believe that the seminar will be fruitful and act as a bridge between the academia, researchers and the industries. Wish all the delegates wonderful two days of scientific interactions.

Naveen Arora

(Naveen Kumar Arora)
Organizing Secretary

AMTSG-2015

Patron : **Prof RC Sobti**
Vice Chancellor, BBA University
Convener : Prof Rana Pratap Singh, Coordinator, AMTSG-2015
Organizing Secretary : Dr. Naveen Kumar Arora
Co-coordinator, AMTSG-2015

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PROGRAMME OUTLINE

National Seminar

University – Industry Partnership: A March Towards Sustainable Growth

12th and 13th March, 2015

Venue: Seminar Hall, School of Environmental Sciences (SES)

March 12, 2015				
12 th March 2015, AMTSG-2015	**09:00-10:30 am**	Registration		
	10:30-11:50 am	Inauguration		
	11:50-12:00 am	High Tea		
	Session 12:00-01:30 pm	**First Technical Session Industry Academia Interface**		
		Chairperson: Dr S P S Khanuja , Director and Mentor Skies life technology Former Director, CIMAP, Lucknow Co-Chairperson: Dr R D Tripathi, Chief Scientist, Environmental and Ecotoxicology Lab, NBRI, Lucknow		
	Keynote Talk 1	Dr SPS Khanuja	Former Director CIMAP, Director and Mentor Skies life technology	Creating new horizon of industry from laboratory for translation route of research reaching the user
	Keynote Talk 2	Dr R D Tripathi	Chief Scientist, Environmental and Ecotoxicology Lab, NBRI, Lucknow	Role of thiol metabolism in arsenic detoxification and development of safer rice (Oryza sativa L.) for arsenic contaminated regions
	Plenary Lecture	Dr Usha Bajpai	Department of Physics, Lucknow University	Urgent need for interaction between industry and academia for popularizing the use of renewable energy
	Plenary Lecture	Dr Suresh C Bajpai	Chief Advisor, RISE, Lucknow	Role of industry oriented innovations for sustainable development
	Invited Speaker	Dr Poornima Vajpayee	IITR, Lucknow	
	01:30-2:00 pm	Lunch		

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	Session **02:00-04:00 pm**	**Second Technical Session** **Sustainable Agriculture and Industry: The Emerging Trends**		
		Chairperson : Dr. Alok Kalra, Crop Protection Division, CIMAP, Co-Chairperson : Dr. Rakesh Pandey, Department of Microbial Technology and Nematology, CIMAP, Lucknow		
	Keynote Talk 1	Dr Alok Kalra	Crop Protection Division, CIMAP, Lucknow	Novel strains of bioinoculants: Possible bioinputs of agri-products providing multiple benefits to the farmers
	Keynote Talk 2	Dr Rakesh Pandey	Department of Microbial Technology and Nematology, CIMAP, Lucknow	Microbes: strategic value added inputs in soil for better plant health and phytonematode management in medicinal and aromatic plants
	Plenary Lecture	Dr Sudheer Mehrotra	Dept. of Biochemistry, University of Lucknow, Lucknow	Intellectual property rights
	Plenary Lecture	Dr Dinesh Yadav	Department of Biotechnology, DDU Gorakhpur University, Gorakhpur	Intervention of transgenic technology for promoting sustainable agriculture
	Speaker	Sakshi Tewari	Department of Environmental Microbiology, BBA University	Bioformulations from fluorescent pseudomonads for enhancing growth of sunflower crop under saline conditions
	04:00-04:30 pm	High tea		
	04:30-6:30 pm	**Poster Session** **University Industry Partnership: A March Towards Sustainable Growth**		
	07:00-09:00 pm	Cultural Program and Dinner		
March 13th , 2015				

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	09:40-10:00 am	Breakfast		
	Session **10:00 -1:00 pm**	**Third Technical Session** **Industry Oriented Innovations for Sustainable Development**		
		Chairperson Dr K K Sinha Co-Chairperson Dr Anant Shukla		
	Keynote Talk 1	Dr K K Sinha	Coordinator SMS Envocare Ltd, Ghaziabad	Green Productivity Methodology: A case of edible oil industry
	Keynote Talk 2	Dr Anant Shukla	Coordinator, GIZ, New Delhi	Sustainable inclusive growth through university-industry partnership oriented towards economic and knowledge self-sufficiency
	Plenary Lecture	Dr S B Pal	Genesis Technology, Mumbai	Technical input required for climate change studies and investigation: A step forward for university industry partnership
	Invited Speaker	N K S More	DES, BBAU	Corporate environmental responsibility: For and against social good
	Speaker	Dr Suman Upadhyay	DEM, BBAU	Microorganisms as a source of quality protein and their mass production
	Speaker	Mr Vaibhav Srivastava	BBAU, Lucknow	Knowledge sharing: Collaboration between universities and industrial organizations
		Interaction and panel discussion		
	01:00-02:00 pm	Lunch		
	02:00-04:00 pm	**Fourth Technical Session** **From Biology to Industry – Avenues and Innovations**		
		Chairperson Dr MP Darokar		

		Co-Chairperson Dr Sanjay Kumar		
	Keynote Talk 1	Dr M P Darokar	Head, Molecular Bioprospection, CSIR-CIMAP	Plants as a sorce of novel antibacterial agents for commercial utilization
	Keynote Talk 2	Dr Sanjay Kumar	CIMAP-Lucknow	Medicinal and aromatic plants farming: A sustainable model for farm pharma partnership
	Invited Speaker	Dr Jay Shankar Singh	DEM, BBAU	CH_4 (Potent greenhouse gas): Problems & mitigation
	Speaker	Neha Malviya	DBT, DDU Gorakhpur	Plant specific transcription factors for developing stress tolerant transgenic crops: Relevance and its immense potential
	Speaker	Mr Rishish Mishra	BBAU, Lucknow	Industry –academia collaboration at higher education (creating win-win situation through CSR)
	Speaker	Neeraj Kumar Ojha	BBAU, Lucknow	University Industry Partnership: Working for mutual benefit and challenge of managing collaboration
	4:00-04:15 pm	High Tea		
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CREATING NEW HORIZON OF "INDUSTRY FROM LABORATORY" FOR TRANSLATIONAL ROUTE OF RESEARCH REACHING THE USERS

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Translational R&D leading to viable technologies is the soul of success for any techno-entrepreneurial venture. The most important success driver is the element of novelty and innovation. This feasibility can go very high in frontier fields of life sciences if we take the threats as the opportunities of strategic research to create new industrial avenues. The time is ripe to bring in the paradigm shift from conventional thinking of "From laboratory to Industry" to a new horizon of "Industry from Laboratory". "*Think beyond*" is the *mantra* to innovate while science provides the runway for wings of the mind to take off to reach where it never did before! The answer to the quest of mind for *what, how* and *why* is simple way to define science and hence any one can become a scientist in life by efforts to satisfy this quest. But there are a few rather very few examples among them who dare to ask "*Why not?*" That's the route to "innovation" which leads to the unreached horizons. Science and nature have always questioned each other and then merged also whenever the question is answered. Today the leads and discoveries arising from biological sciences research and biotechnology platform are able to open up many such opportunities for complete range of enterprises, whether small and medium or large. In recent past, two models of such plants, which have transformed lives of many in India with export potential and hence affecting rest of the world as well are mints (particularly menthol mint) and anti-malarial drug producing plant *Artemisia*. Today, these plants represent two big industrial sectors namely aroma industry and pharmaceutical industry. This multi-disciplinary research carried out at CIMAP, Lucknow resulted into superior varieties and technologies developed in these plants, which can produce more yield per unit area as well as better quality to fetch a higher price for the produce. The beneficiaries have been farmers, who have been turned into the real time Bio-entrepreneurs cultivating and marketing the aroma and drug molecules from their fields. An example of "industry from laboratory" as the venture by the researcher from scratch called "Skies" (www.skiesindia.com) which could germinate as a startup micro-industry representing bio-entrepreneurship in nutraceuticals sector. The origin of all these possibilities lies in the knowledge domain and where else one would find this wealth if not universities and institutions of education and research. Teachers will have to be learners too!

The only way is to let young generation think out-of-box and channelize the creative ideas is by mentoring through real time involvement of academia in shaping up industrial ventures!

KEYWORDS- Development, Sustainability, Knowledge, Learning

REGULATORY ISSUES IN INDIAN BIOPESTICIDE INDUSTRIES: CURRENT SCENARIO AND FUTURE PROSPECTS

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Annual economic damages of pests on crops, pastures and forest areas accounted approximately US$ 250 billion all over the world. This was according to surveys conducted in the USA, UK, Australia, South Africa, India and Brazil, with data from the Ministry of Natural Environment. The management of which employs the use of hazardous pesticides. Ecofriendly alternatives include the use of biopesticides. According to the report "Global Biologicals Market Research Report", the global agricultural biologicals market is estimated to grow from $3,954.1 million in 2013 to $8,951.8 million by 2019, at a CAGR of 14.6% from 2013 to 2019.Currently, 34 agriculturally important microbes have been permitted for mass production and commercialization for use in agriculture of which *T. viride, T. harzaianum, Pseudomonas, Beauvaria bassiana, Metarrhizium anisopliae* and *Bacillus subtilis, Gliocladium* spp., *Verticillium lecanii,* Grannulosis viruses and nuclear polyhedral viruses (NPV) are most popular and have been included in a schedule vide an amendment in insecticides Act, 1968 for the commercial production of biopesticide and published in the Gazette of India dated 26th March 1999. *Trichoderma, Pseudomonas* and *Beauveria* have curved a niche for themselves in India as important biocontrol agents for the sustainable management of various pests and diseases. However, their reach is still limited to some selected states in the country. The major reason for this phenomenon is the mushrooming of some spurious products and poor quality storage facilities in the country. The research on biocontrol agents (BCAs) can be fruitful only when we commercialize and register the product based on superior strains. To achieve this, certain norms specified by Central Insecticides Board are to be followed. The mass production of microbes based formulation is also very important part in the development of technology. Although the biological control ability of *Trichoderma* has been shown for many years, the ability of these fungi to increase the rate of plant growth and development, especially to enhance the production of more robust roots is now being documented. While working on potential strains of *Trichoderma* collected from different habitats, we have documented the biocontrol ability of these organisms not only at

laboratory level but also at field level as well as up to the extent of commercialization. We also noticed that several strain increase the size and numbers of deep roots quite below the soil surface. Besides such potentialities, certain *Trichoderma* species are highly efficient producers of many extracellular enzymes and are used commercially for production of cellulases and other enzymes that degrade complex polysaccharides. Our recent interests warrant the use of secondary metabolites as potential biopesticidal as well as biofungicidal agents. From our local free-living *Trichoderma* isolates we are extracting and separating different chemical fractions in search of novel bioactive metabolites for their *in vitro* testing against phytopathogenic fungi and bacteria. In our recent observations, we have noticed the enhancement of antioxidant and free redical scavenging properties in the agricultural crops (vegetables, fruits etc.) treated with *Trichoderma*. These *Trichoderma*-treated crops are free from pesticidal contaminations, organic and safer for human consumption. Maximum colony forming units and shelf life of *Trichoderma* was observed in wheat bran and bajra grains. Our work on a novel *Trichoderma* strain with enhanced fungicidal, nematicidal and growth promotion property is an outstanding one among the fungal bioinoculants consisting of *T. harzianum* and novel strain of *B. bassiana* and NPV was transferred to Department of Agriculture, U.P., Government for its commercial production by U.P. Government's 9 biopesticide manufacturing units. The Directorate of Agriculture, Government of Uttar Pradesh got regular license from CIB under section 9(3) for commercial production of above 3 biopesticides. The *T. harzianum,* NBRI-1055 technology has also been transferred to Gujarat Green Revolution Company limited (GGRC), Vadodara, a joint venture of Gujarat State Fertilizer and Chemicals Limited (GSFC), Vadodara; Balaji Crop Care Pvt. Ltd., Hyderabad. The products have reached farmer's fields in several states of the country. The product "Sardar Ecogreen Biofungicide", "TRICHA" and "UPDERMA" are based on a potential strain of *T. harzianum* NBRI-1055, having the abilities to control phytopathogenic fungi, tolerate abiotic stress, stimulate plant growth, induce phenol contents in plants, induce systemic resistance in plants against several phytopathogenic organisms, as well as an efficient root colonizer with long shelf life. A talk-based formulation (2% WP) using *T. viride* strain 2953 and *B. bassiana* has also been transferred to Balajee Crop Care Pvt. Ltd., Hyderabad for commercial production. The present paper will discuss about these parameters setup by CIB and other aspects related to commercialization and registration of biopesticides in India.

KEYWORDS- Biopesticides, Phytopathogenic, Phenomenon, commercialization

EMERGING TRENDS IN FARM-FIRM LINKAGES IN INDIA

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Indian agriculture heading towards Grey Revolution after successful Green, Brown, Blue and White Revolutions. However, unlike developed nation, agriculture still remains the backbone of our country. The recent policy of liberalization and globalization has opened up new avenues for agriculture modernization and industrial partnership. This has not only stressed on improving agricultural inputs, infrastructural facilities in rural areas but liberalizing inputs reducing subsidies, loosening ceiling laws and generating agricultural surplus for home and international markets. In light of this scenario emerging trends in Farm-Firm linkages in India is discussed.

KEYWORDS- Agriculture, Globalization, Farm-Firm Linkages, Liberalization

MEDICINAL AND AROMATIC PLANTS FARMING: A SUSTAINABLE MODEL FOR FARM -PHARMA PARTNERSHIP

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The farming of medicinal and aromatic plants is gaining momentum in the country from last two decades. Due to availability of diverse climatic conditions and required resources, there are great opportunities for cultivation of medicinal and aromatic plants and development of business/ entrepreneurship based on these plants in the country. As per its mandate CSIR-CIMAP has been promoting cultivation of the medicinal and aromatic plants in different part of the country. Several medicinal and aromatic plants are being now cultivated in large areas in the country especially Menthol Mint, Vetiver, Tulsi, Lemongrass, Palmarosa, *Artemisia annua*, Sataver, Kalmegh, etc. Due to down fall in the supply of quality raw material required for aroma and pharma industry, some of the medicinal and aromatic plants are now being cultivated with industrial partnership. To ensure the sustainable supply of the quality raw material there in need to strengthen the bond between farmers and user industry. One sustainable model of farm – pharma partnership has been established by CSIR-CIMAP in the country for the anti-malarial drug plant - *Artemisia annua* through which contractual cultivation of *Artemisia annua* has been started by a Ratlam based Pharma Company by involving more than 2000 farmers of Uttar Pradesh, Uttarakhand, Bihar, M.P and Gujarat. Such efforts of CSIR-CIMAP has created new avenue for agri-entrepreneurship in rural areas. The scope and opportunity of Farm – Pharma partnership will be discussed during the presentation.

KEYWORDS- Pharma partnership, Ratlam, Palmarosa, Vetive

MICROBES: STRATEGIC VALUE ADDED INPUTS IN SOIL FOR BETTER PLANT HEALTH AND PHYTONEMATODE MANAGEMENT IN MEDICINAL AND AROMATIC PLANTS

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Enormous quantities of waste materials are produced all around the world, which create a number of environmental problems particularly in India. Among different forms of wastes, the biowaste can be managed through green technology with conformity of insurance for sound environment, human, animal and plant health. One can foresee the presence of inert power in the biowaste, particularly plant waste and their byproducts in the form of array of useful micro and macro nutrients, soil reclamation power, remediation of contaminated soil, food source to variety of microbes used in microbial management of plant diseases etc. The conversion of such biowaste into a qualitative, efficient and organically rich material for farmers in India is the most pressing need of the day. Nowadays, environmentally sustainable biowaste harvesting has become an integral part of our modern farming system. Being a rich source of nutrients, this value added biowaste not only enhances the plant health and yield but also restricts pest and pathogen population below the damaging level. Currently conversion of biowaste technology into an effective product opens a novel and economically viable perspective for its utilization in plant protection and production system. The hidden properties of value added biowaste products are: to prevent soil erosion, to improve and protect soil and water quality, beneficial effect on physical soil properties (porosity, saturated hydraulic conductivity, enhanced water holding capacity, decreased soil acidity, increased soil organic matter, balance calcium and nitrogen levels in soil, protection of plants from harmful effects of pests and pathogens, inducing resistance, increase in microbial activity and most importantly facilitating nutrients to various beneficial microorganisms. As a result of various industrial and agricultural processes, a variety of biowaste is produced and one of them is, distillation waste produced from medicinal and aromatic plant industries. Experimental results have demonstrated that these wastes possess enhanced and better capability for the multiplication and proliferation of useful fungal antagonists like *Trichoderma harzianum*, *Paecilomyces lilacinus* and *Fusarium oxysporum* in comparison to other agricultural and industrial waste products. In different experimentations the value added biowaste was found to be useful in reducing the root knot

nematode, *Meloidogyne incognita* population below the threshold level on variety of medicinal and aromatic plants and enhanced the growth and yield. Addition of value added biowaste products in soil enhances the soil suppressive power against several plant diseases especially nematode diseases of medicinal and aromatic plants. Further the value addition chain continues to transform different distillation wastes into vermicompost, which then becomes a carrier of useful bacterial and fungal antagonists for their future use. A significant enhancement in plant growth parameters and reduction in nematode pest population were achieved on various medicinal and aromatic plants when such value added vermicompost was incorporated into soil. Besides, aqueous extracts of such vermicompost prepared from distillation waste was found to possess nematode hatching inhibitory and nematostatic effect respectively.

KEYWORDS- Biowaste, Vermicompost, Nematostatic, *Paecilomyces lilacinus*

ROLE OF THIOL METABOLISM IN ARSENIC DETOXIFICATION AND DEVELOPMENT OF SAFER RICE (*ORYZA SATIVA* L.) FOR ARSENIC CONTAMINATED REGIONS

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Arsenic (As) contamination of rice raises concern over extensive evaluation of As accumulation and toxicity. Thiolic metabolism plays important role in As detoxification. During the present study, 303 rice genotypes were screened for As tolerance under hydroponic conditions. The selected tolerant and sensitive rice genotype accumulated significantly contrasting amounts of arsenic in roots (89 and 1181 μg g^{-1} dw respectively). These contrasting characters were maintained during field evaluation *vis-a-vis* grain arsenic accumulation in the selected genotypes. Biochemical and molecular studies showed involvement of thiolic metabolism in As accumulation and tolerance. It was noticed that total phytochelatin: arsenite molar ratio (PC-SH: As^{III}) was 3.430 in low arsenic accumulation rice genotypes (LAARG) while, it was only 0.685 in the case of high arsenic accumulation rice genotypes (HAARG). Various PC species (PC_2, PC_3 and PC_4) were detected in both the germplasms, the PC concentrations were more in HAARG with dominance of PC_3. Expression analysis of several metal(loid) stress related genes revealed significant upregulation of glutaredoxin and sulphate transporter in HAARG along with that of γ-glutamyl cysteine synthetase, phytochelatin synthase and ascorbate peroxidase. Further, activity of phytochelatin synthase and cysteine synthase was higher upon arsenic accumulation in HAARG. In order to restrict As in the rice roots as a detoxification mechanism, a transgenic approach has been followed through expression of phytochelatin synthase from *Ceratophyllum demersum (CdPCS1*), an aquatic plant. *CdPCS1* over expressing rice transgenic lines showed marked increase in PCS activity and enhanced synthesis of PCs in comparison to wild type. Transgenic lines showed enhanced accumulation of As in root and shoot. This enhanced metal accumulation potential of transgenic lines was positively correlated to the content of PCs, which also increased several-fold higher in transgenic lines. However, the transgenic lines accumulated significantly lower As in grain and husk in comparison to wild type. The accumulation of As in grain was up to 59 % lower in most efficient transgenic in wild type, in which most of arsenic (327%) was sequestered in root when grown on arsenic laden soils (12 mg/kg)

KEYWORDS- Arsenic, Contamination, Phytochelatin, Biochemical, Wild Type

ROLE OF INDUSTRY ORIENTED INNOVATIONS FOR SUSTAINABLE DEVELOPMENT

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Innovation is the process and outcome of creating something new, which is also of value. Innovation involves the whole process from opportunity identification, ideation or invention to development, prototyping, production marketing and sales, while entrepreneurship only needs to involve commercialization. Today, it is said to involve the capacity to quickly adapt by adopting new innovations (products, processes, strategies, organization, etc). Traditionally the focus has been on new products or processes, but recently new business models have come into focus, i.e. the way a firm delivers value and secures profits. The innovation comes about through new combinations made by an entrepreneur, resulting in a new product, a new process, opening of new market, new way of organizing the business and new sources of supply. There are several types of innovation process, product/service, strategy, which can vary in degree of newness - incremental to radical and impact - continuous to discontinuous. With the Indian economy growing rapidly in global contexts, the need of industry oriented innovations has come to play significant roles in the near future. This paper highlights the roles that industry oriented innovations can play for sustainable development of the country.

KEYWORDS- Commercialization, Prototyping, Sustainability, Innovation

URGENT NEED FOR INTERACTION BETWEEN INDUSTRY AND ACADEMIA FOR POPULARIZING THE USE OF RENEWABLE ENERGY

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The use of renewable energy technologies in India is growing exponentially. The demand and supply and rising concern about greenhouse emissions is one of the factors of the popularization of renewable energy systems. However, the academia, institutions and local industries have not shown enough interest in this sector. The Ministry of New and Renewable Energy, Government of India and State Nodal Agencies have been involved in planning and funding of renewable energy courses at various levels of education. However, with the launch of the Jawaharlal Nehru Solar Mission and with the zeal of the present Government, the much higher targets have been set resulting into foreign companies entering into Indian market with local collaborations. This calls for urgent need for interaction between industry and academia for popularizing the use of renewable energy, particularly solar energy. The paper highlights the skill developments in various renewable energy technologies and the role that the academia, institutions and industries should play for proper and effective skill development of renewable energy technologies in India.

KEYWORDS- Renewable Energy, Jawaharlal Nehru Solar Mission, Academia, Skill Development

PHARMACEUTICAL FORMULATIONS OF TITANIUM (IV) COMPLEXES AGAINST CANCER

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Despite the innumerable efforts towards cancer treatment, it still pretenses threat toward society. Our group is basically working on Ti(IV) based compounds as they are excellent anticancer drug candidates with a broad spectrum of effect. Compared to normal cells, cancers cells possess high concentration of iron as it is required for their growth. Transferrin (Tf) is a well-known blood protein, which binds to iron and transport it in body. Normally, Tf is 30% iron saturated so it can easily transport some other di, tri, and tetra positive metal ions. We are utilizing the combination of Ti (IV), Tf and the blends of several ligands for development of anticancer drugs. We selected Ti (IV), protein, and ligands by considering important structural components for their targeted deliver into cancer cells. The metal binding moieties will biomimics the transferrin binding site. Obviously, the metal moiety will have a high affinity for Ti (IV) but an even higher affinity for Fe(III), therefore, we will have metal displacement by Fe(III) which will facilitate Ti (IV) release within cells. The idea is to release Ti(IV) from such ligands in cancer cells as it has anticancer properties, and in returns binds with Fe so as to deficit it from cancer cells. Some water soluble stable complexes Ti(IV)-citrate and Ti (IV)-NTA have been synthesized and found well suitable for the reaction with apoTf at physiological pH 7.4.

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KEYWORDS- Ti (IV) Based Compounds, Transferrin, Biomimics, Anticancer

AGRICULTURAL INOCULANTS: GLOBAL TREND AND FUTURE IN SUSTAINABLE AGRICULTURE

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Agricultural inoculants can be described as the formulation product containing one or more beneficial microorganism that helps in plant growth and development. It has been noticed that in recent time bio-inoculant has emerged as an alternative to harsh chemical used in agriculture but studies also conclude that the beneficial attributes of commercial bio-inoculants for sustainable agriculture systems are not clearly defined and to support their effectiveness in field condition is still perplexed by inadequate quality standards and insufficient knowledge of their use. However, use of specific inoculant for nutrient and disease management in different crop system had provided good outcomes and future research is this field will definitely strengthen its wider use in agroindustry. Currently bio-inoculants consumption and developments is region and crop based. Mostly its use for soybean cultivation is reported in the U.S., Brazil where as in Argentina, pea and lentil crops are treated in Canada. India, china, Thailand, Philippines and Vietnam are using in rice cultivation. Market trend of agricultural inoculants shows that it has grown exponentially in the last few years and this trend is projected to continue. The market was valued at $232.22 million in 2013; and projected to grow at a Compound Annual Growth Rate (CAGR) of 9.5% from 2014 to 2019, the market is projected to reach $398.56 million by 2019. North America accounted for the largest share of the agricultural inoculants market in 2013 but Latin America is projected to emerge as the fastest growing region and grow at a CAGR of ~10% from 2014 to 2019. Novozymes A/S (Denmark), BASF SE (Germany), DuPont (U.S.), and Advanced Biological Marketing, Inc. (U.S.) are the largest players in the global agricultural inoculants market.

KEYWORDS- Agricultural, Inoculants, Disease Management, Chemical

SECTORAL ENGAGEMENT, INCLUSION AND SUSTAINABLE GROWTH: A NEW WAY OF FRAMING PUBLIC DISCOURSE

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A uni-lienar theory of development was the European model, replicated round the globe during 1960. But in the mid-1980 and 1990s the idea of sustainable growth and development cut the imagination of thinker and scholar across the discipline and the nation state. Sustainability is the motto of this very agenda of development process. The development theory stressed earlier to more industrial development and more exploitation of man and material resources. But sustainability, has given backseat to this aforesaid idea by conceiving preservation, conservation and meticulous use of recourses as the objective of growth process. For this reason green auditing, social auditing played a major role in determining the fate of public policy. The higher institution of learning and industry need to be cooperative by creating conducive atmosphere, intelligently as a producer of idea to became a productive force to determine its social outcome. So to give more practical shape to this aspect the public discourse need to be mobilized by linking sectoral level to enrich the knowledge of sustainable growth. How to make a public discourse on the above issue is an attempt made in this paper, so that it will make a substantial contribution to this extensive domain of knowledge a more goal oriented one.

KEYWORDS- Development, Sustainability, Knowledge, Learning

GLOBALIZATION AND ITS IMPACT ON INDIAN AGRICULTURE FOR SUSTAINABLE DEVELOMENT IN INDIA

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This paper is deals with a basically a globalization and its impact on the Indian agriculture for the sustainable development in India, the globalization is the process began in1991 as a result of new economic policies. The main feature of this economy is that it work at central level and the states have the right to make changes in the central policy depending on their requirements, and they are responsible for making it work. Thus the new system has changed from command economy to federal economy. Globalization alludes to builds the development of money, inputs, yields, data and science crosswise over inconceivable geographic ranges.

KEYWORDS- Economic, Globalization, Development, Policy

CORPORATE ENVIRONMENTAL RESPONSIBILITY: FOR AND AGAINST SOCIAL GOOD

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To underline the classical model of social responsibility denies that business has any direct environmental responsibility provides an ample scope for deliberations is not a gross understatement. This model sees business as cooperating with society in attaining the environmental goals freely selected by consumers in the marketplace. If business serves some or more environmental goals not by taking any special environmental responsibility but by fulfilling its function within free market economy. There are number of challenges to such models many are well known the most prominent one being market failure that market offer no guarantees of successfully meeting society's need. Environmental factors such as pollution and resource depletion and gods for which there is no mechanism such as loss of biodiversity or survival of endangered species provided examples where market failures can be linked to environmental destruction. Another challenging issue is business interests at micro level and at macro level are not necessarily the same. Because they are guided by many factors like policy, governance etc. In general the entire range of issues in which economic growth competes with environmental ends the consumers satisfaction is the prime concern than anything else. The issues ranging from wildlife protection to conserving biodiversity to energy conservation would remain important goals along with satisfying the consumers. The neoclassical model of "profits through growth" holds well on practical ground. It underlines incorporation of environmental concerns into the moral minimum and thus it is thesis and antithesis of for and against the society.

KEYWORDS- Environmental factors, economy, society, antithesis

EFFECT OF GANGA WATER POLLUTION ON THE GROUND WATER QUALITY OF THE ADJOINING REGIONS

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River Ganga is the most sacred river to Hindus and is also regarded as a lifeline to millions of Indians who live along its course and depend on it for their daily needs. Now a days the river is adversely affected by the pollutants from industries and wastes poured into the river without any treatment. Pollution of river water is likely to pollute ground water resources along its path of flow. In the present investigation impact of sewage pollution of river Ganga on the ground water in and around Kanpur was checked. Seventeen different sites were selected for the study taking river and ground water samples for the analysis. Physico-chemical and microbiological analysis of the samples revealed that river water is highly polluted. The dumping of untreated sewage exceedingly increases BOD and COD in the downstream sites suggesting that untreated dumping, heavily pollutes the river to such an extent that river has lost its natural self-cleaning or self-purification capacity to a large extent. As regards the ground water was concerned BOD was above from the minimum standard quality in the downstream sites. Therefore, effective measures should be taken to prevent the contamination in ground water. Out of seventeen selected sites, the result of PCR analysis showed that all the downstream sites (seven) were heavily contaminated with *E. coli,* whereas by the conventional plating method *E. coli* was found only in five sites. In fact water from wells (used for drinking and household purposes) around the river were found to be contaminated also showed disturbed physico-chemical characters.

KEYWORDS- Contamination, Pollution, BOD, DO, Coliforms

FRICTION STIR WELDING (FSW)-AN ENVIRONMENT FRIENDLY JOINING PROCESS

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Welding process is basically a backbone for all construction and fabrication activities going round the world. The skilled person who performs the welding process is termed as welder. It is observed that many full time welders suffer from several respiratory effects such as bronchitis, airway irritation, lung function changes, lung fibrosis, and increase in chances of lung cancer. It is a challenge for the workshop management to control the fumes and gases that are caused during welding process. General precautions such as local exhaust ventilation and respiratory protective equipment can be used. The dangerous effects of the fumes and radiations generated from conventional welding such as MIG, TIG, etc. are reported by several authors. In order to avoid health hazard effects of welding process, an environmental friendly process has been invented at The Welding Institute (TWI), United Kingdom, which is popularly known as Friction Stir Welding (FSW). This comparatively recent innovation has permitted friction technology to be used to produce plate fabrication. FSW is an emerging solid state joining process in which the material is joined without melting. FSW is an environmental friendly process which has no fumes and radiations. FSW process produces no smoke, fumes, arc glare and it is an eco-friendly welding process. Through this poster an attempt is made to review an environment friendly welding i.e. Friction Stir welding. Some light is put on process parameters like tool geometry, joint design and process speed. FSW is also compared with other welding processes from environmental safety point of view.

KEYWORDS- Welding, Environmental Safety, Radiations, friction Technology

LIQUID BIOFERTILIZERS, THEIR USE AND POTENTIAL IN SUSTAINABLE AGRICULTURE

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The major hurdle in developing an efficient bioinoculum products is to maintain shelf-life of formulated product as the most of the times plant-growth promoting activity of product diminishes perhaps because of inappropriate formulation. Liquid formulations contains microorganisms in dormant stage and nutrients that encourage formation of resting spores or cysts that aids in maintaining longer shelf life. Although liquid biofertilizers are much beneficial over carrier based biofertilizers due to its longer shelf life (12-24 months) but at same time cells may survive at higher temperature (up to 45°C) with lessor degree of contamination, greater protection against environmental stress and increased field efficacy. Studies indicates that high populations of cells can be maintained in liquid carrier material which is easy to use by farmers and can be easily exports to desired place. Various workers suggested that liquid carriers such as glycerol, coconut milk, Poly Ethylene Glycol (PEG), sodium alginate beads are best carrier for formulation of liquid biofertilizers due to its high water holding capacity, desiccation resistance and increased shelf life. All over world agro-industries are focusing to adopt liquid carriers as the best carrier and more research has been carried out to extend the availability of other liquid based carriers. In India use of liquid bioformulations in sustainable agriculture is strengthen but very few companies has started to manufacture it some of them are "Anubhav liquid biofertilizers" (Anand agricultural university, Anand) contain *Azotobacter chroococcum, Azospirillum lipoferum*, and *Bacillus coagulans* and a liquid biofertilizers of phosphate solubilizing bacteria is marketed by brand name PRABHARHIZO (Prabhat Fertilizer & Chemical Works) but the current need is to extended the research activity on liquid based formulation so as to more industry come forward to adopt the same.

KEYWORD- Liquid Formulations, *Azospirillum*, Shelf-Life, PEG

BIOFORMULATIONS: A NEW PARADIGM FOR ENVIRONMENTAL SUSTAINABILITY

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Agriculture is one of the most important sectors of the developing countries; especially Indian economy is highly dependent on agriculture. Loss in the production and yields of crops are mainly due to certain flawed agricultural practices, that has depleted nutritive value of soil. The future is only for the eco-friendly measures which not only lead to sustainable and pollution free environment but also development of a market sound product which instills confidence amongst the end users. A new paradigm for agriculture is based on agro-ecological concept and the bioformulations are one of the very important and feasible ways that can fulfill all the agricultural and ecological requirements simultaneously. Bioformulations are best defined as biologically active products containing one or more beneficial microbial strains in easy to use and economical carrier materials. Bioformulation refers to preparations of microorganism(s) that may be a partial or complete substitute for chemical fertilizers/pesticides. Designing and developing multifaceted bioformulation technology congaing combination of Plant growth promotion (PGP) and biocontrol traits functional under unpredictable field conditions is the prime urge of today's world. If this technology get transferred from laboratory to industries it will serve as a boon for maintaining environmental sustainability.

KEYWORDS- Bioformulation, Fluorescent Pseudomonads, Biocontrol

INTELLECTUAL PROPERTY RIGHTS (IPR)

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Intellectual property refers to creations of the mind: inventions; literary and artistic works; and symbols, names and images used in commerce. They allow creators, or owners, of patents, trademarks or copyrighted works to benefit from their own work or investment in a creation. Intellectual property rights reward creativity and human endeavor, which fuel the progress of humankind. Example: The multibillion dollar film, recording, publishing and software industries – which bring pleasure to millions of people worldwide – would not exist without copyright protection.

Patent

A patent is an exclusive right granted for an invention – a product or process that provides a new way of doing something, or that offers a new technical solution to a problem. A patent provides patent owners with protection for their inventions. Protection is granted for a limited period, generally 20 years. Patent protection means an invention cannot be commercially made, used, distributed or sold without the patent owner's consent.

Trademark

A trademark is a distinctive sign that identifies certain goods or services produced or provided by an individual or a company. The system helps consumers to identify and purchase a product or service based on whether its specific characteristics and quality – as indicated by its unique trademark – meet their needs. They may consist of drawings, symbols or three dimensional signs, such as the shape and packaging of goods. It must neither mislead nor deceive customers nor violate public order or morality.

Industrial Design

An industrial design refers to the ornamental or aesthetic aspects of an article. A design may consist of three -dimensional features, such as the shape or surface of an article, or two-dimensional features, such as patterns, lines or color. To be protected under most national laws, an industrial design must be new or original and nonfunctional. Protecting industrial designs helps to

promote economic development by encouraging creativity in the industrial and manufacturing sectors, as well as in traditional arts and crafts.

Geographical Indication

A geographical indication is a sign used on goods that have a specific geographical origin and possess qualities or a reputation due to that place of origin. Most commonly, a geographical indication consists of the name of the place of origin of the goods. A geographical indication guarantees to consumers that a product was produced in a certain place and has certain characteristics that are due to that place of production. It may be used by all producers who make products that share certain qualities in the place designated by a geographical indication.

Copyright

Copyright laws grant authors, artists and other creators protection for their literary and artistic creations, generally referred to as "works". Works covered by copyright include, but are not limited to: novels, poems, plays, reference works, newspapers, advertisements, computer programs, databases, films, musical compositions, choreography, paintings, drawings, photographs, sculpture, architecture, maps and technical drawings. The creators of works protected by copyright, and their heirs and successors (generally referred to as "right holders"), have certain basic rights under copyright law. They hold the exclusive right to use or authorize others to use the work on agreed terms. Copyright give authors, artists and creators incentives in the form of recognition and fair economic reward increases their activity and output and can also enhance the results.

Trade secret or undisclosed information

A trade secret could be a formula, practice, process, design, instrument, pattern or information used by a business to obtain and advantage over competitors or customer. Trade secret business information is a valuable commodity, with companies failing to protect it and the intellectual capital that it represent, quickly losing ground to the competition. All Trade secret are confidential in nature but all confidential information may not be called trade secret.

Traditional knowledge

Traditional knowledge refers to the matured long standing traditions and practices of certain regional, indigenous, or local communities. Traditional knowledge also encompass the wisdom, knowledge, and teachings of these

communities. Some form of Traditional knowledge are expressed through stories, legends, folklore, rituals, songs and even laws.

World Intellectual Property Organization

Established in 1970, the World Intellectual Property Organization (WIPO) is an international organization dedicated to helping ensure that the rights of creators and owners of intellectual property are protected worldwide, and that inventors and authors are therefore recognized and rewarded for their ingenuity. This international protection acts as a spur to human creativity, pushing back the limits of science and technology and enriching the world of literature and the arts. By providing a stable environment for marketing products protected by intellectual property, it also oils the wheels of international trade. WIPO is a largely self-financed organization, generating more than 90 percent of its annual budget through its widely used international registration and filing systems, as well as through its publications and arbitration and mediation services. WIPO also services global registration systems for trademarks, industrial designs and appellations of origin, and a global filing system for patents.

The IPR has relevance to each and every field of development, such as health, agriculture, education, trade, biodiversity management, biotechnology, information technology, the entertainment and media industries, and so on. Further, with the advent of the IPR, the gap between developed, developing, and least-developed countries is widening and there is a need for its stringent regulation worldwide. There has been substantial advancement in scientific research owing to collaborations but the issue of IPR needs to be addressed.

KEYWORDS- IPR, Infra-structure, Faculty, R&D, Academia

INDUSTRIAL USE OF BIOPOLYMERS PRODUCED FROM RHIZOBIA: AN APPROACH TOWARDS SUSTAINABILITY

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There is an excessive use of plastic materials due to their low cost, good mechanical and thermal properties, however; it causes a worldwide problem due to their non-degradable property. These are now accumulating in environment at rates of millions of tons per year and causes harmful effects and biodegradable plastics are best alternative of non-degradable plastics and there is an urgent need of suitable techniques for the development of biodegradable plastics. polyhydroxyalkanoates (PHAs) are important biodegradable polymers and the main member of the PHA family is Polyhydroxybutyrate (PHB). PHAs are formed as naturally occurring storage polyesters (as reserve food materials) by a variety of microorganisms such as *Azatobacter, Alcaligenes, Methylobacterium, Rhizobium, Pseudomonas* etc. These microbial polyesters are used as eco-friendly polymers and can be used in various sectors such as agricultural, industrial and medical applications. Different types of PHA producing bacteria have some limitations and hence the potential of other microorganism needs to be explored. Synthesis and consumption of PHB is closely related with the biological nitrogen fixation due to this reason rhizobia can synthesize PHB in considerable amount. Several species of rhizobia synthesize PHAs as degradable polymers with potential industrial applications on large scale and these can be explored in future, so as to get rid of a chronic menace.

KEYWORDS- *Rhizobium*, Biopolymers, Bioplastics, PHAs, PHB

MICROBIAL TOXIN

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A toxin is a poisonous substance produced within living cells or organisms. Toxins can be small molecules, peptides or proteins that are capable of causing disease on contact with or absorption by body tissues interacting with or absorption by body tissues interacting with biological macromolecules such as enzymes or cellular receptors. Microbial toxins include toxins include toxin produced by micro-organisms, including bacteria and fungi. Microbial toxins promote infection and disease by directly damaging host tissues and by disabling the immune system .Bacterial protein toxins are involved in a number of infectious and food borne diseases and are considered as potential biological warfare agents as well. Their sensitive multiplex detection in complex environmental, food and biological samples are an important although challenging task. Solid-phase immunoaffinity capture provide an efficient way to enrich and purify a wide range of protein from complex mixtures. We have shown that Staphylococcal enterotoxin, for example, can be efficiently enriched by mean of magnetic immunocapture using antibody functionalized paramagnetic beads. The method was successfully interfaced by the on-beads and off-beads detection using matrix –assisted laser desorption / ionization time-of-flight mass spectrometry at the protein level and by off-beads nano-electrospray ionization –MS/MS detection at the enzyme digests level.

KEYWORDS- Bacterial Proteins Toxins, *Staphylococcus* Enterotoxin, Mass MALDI-ESI

TECHNICAL INPUT REQUIRED FOR CLIMATE CHANGE STUDIES AND INVESTIGATION: A STEP FORWARD FOR UNIVERSITY INDUSTRY PARTNERSHIP

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Science and technology are the main drivers of industrial, economic and social development, and university-industry linkages are vital to this process. The increasing CO2 concentration of atmosphere and associated predictions of global warming have stimulated research programs to determine the likely effects of future elevated CO2 levels on agricultural productivity and on the functioning of natural ecosystems. Researcher reported the results on plant responses on elevated level of CO2 by conducting experiments with different types of structure and simulation modelling which include growth chamber, controlled environmental chambers, open top chamber and free air CO2 enrichment facilities etc. The effects of atmospheric CO2 enrichment have been studied for many years in green house, controlled environmental chambers, OTCs and other elevated structures to confine the CO2 gas around the experimental plants. The accuracy on maintenance of CO2 inside chamber installed around the crops did not succeed in many other studies because of technical constrains. In the enclosed structure, the experiment will not be the same as that in the open top chamber and FACE facilities. Genesis Technologies is one of the leading organizations in India working on different models of climate change studies like Temp. Gradient Tunnel (TGT), Open Top Chamber (OTC), Free Air CO2 Enrichment System (FACE), Free Air Temp. Enrichment System (FATE), Free Air O**3** Enrichment System (FAOE) and Elongated Tunnel (ET) with instrumentation, control and automation system. We have successfully established systems for IIT, Kharagpur, ICRISAT, Hyderabad OUAT, Bhubaneswar, ICAR-Patna, ICRISAT-Hyderabad, JNU-New Delhi, IHBT-Palampur, IARI (CSIR) -New Delhi, National Bureau Agriculturally Important Insects (NBAII), Bangalore,, Assam Agricultural University (AAU), Jorhat, and Central Rice Research Institute, Cuttack, NBRI (CSIR), Lucknow and IIVR (ICAR), Varanasi , Indian Forest Research Institute (FRI), Central Potato Research Institute (CPRI), Jalandhar, Bharatidasan University , Trichy on various projects like OTC, TGT, FACE, FATE , CO2 Gradient Tunnel and elongated tunnel and CO2 elevated/controlled bioreactor for Azolla Cultivation. Various research work and experiments are being conducted on different crops and tree species on

effect of elevated CO2, temp, and ozone The present article highlights different executed projects in India in-house developed technologies by genesis technologies on different model and simulation with respective crops for last seven years.

KEYWORDS- FACE, FATE, TGT, OTC

MICROBIAL AMYLASES: PRODUCTION, APPLICATIONS AND FUTURE PROSPECTS

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Amylases are one of the most important families of enzymes in biotechnology. Amylases based pretreatment of starch into fermentable sugars represents an important area of industrial enzyme research with great potential for sustainable growth. These enzymes have almost completely replaced the chemical hydrolysis in the starch processing industry. The enzymatic hydrolysis of starch involves the synergistic action of endo-amylases (α-amylases), exo-amylases (b-amylase and glucoamylase), debranching enzymes (pullulanase), and other enzymes. The most important amylases for industrial and biotechnological applications are glucoamylases and α -amylases. α -Amylase (endo (1-4)- α -D-glucan glucohydrolase: EC 3.2.1.1) randomly cleaves the internal α -(1-4)-glycosidic linkages, resulting in oligosaccharides of varying chain length with an a-configuration and α-limited dextrins as products, which are further hydrolyzed to glucose by exo-acting amylases and other amylolytic enzymes. The amylases have the widest range of industrial applications, including brewing, baking, textile, and detergent. Very recently amylases have been reported for biosynthesis of metal nanoparticles which is also the current area of research in the field of bio-nanotechnology. Amylases are of ubiquitous occurrence, produced by plants, animals and microorganisms. However, microbial sources are the most preferred one for large scale production. Today a large number of microbial α -amylases are marketed with applications in different industrial sectors. In present review, we have summarized production, mode of action and physicochemical properties of amylases. In addition, applications and future prospects of industrially important enzyme having potential for diverse biotechnological applications are discussed in detail.

KEYWORDS- Amylases, Starch, Brewing, Detergent, Nanoparticles

CELLULASE-PRODUCING FUNGAL ENDOPHYTES: PROMISING BIOLOGICAL TOOLS WITH HUGE INDUSTRIAL APPLICATIONS

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Microbial cellulases are important biocatalysts with huge industrial applications including biofuel production, textile, laundry, paper and pulp industries, food and feed, brewing, agriculture, pharmaceuticals and in the production of various value-added chemicals. Since cellulase production at large scale is a costly process therefore research should be oriented in the direction of improving the process economics. The process cost can also be reduced by using microorganisms producing high titre cellulases. One group of such microorganisms are endophyteic fungi which are the colonizers of internal tissues of plants. Endophytic fungi are mutualistic partners of plants which are relatively unexplored organisms with significant cellulolytic activities. In addition to high titre cellulase production, endophytes are also effective to further reduce the production cost by using wide variety of easily available, inexpensive and waste material as a substrate. Thus considering their immense industrial potential, entophytic fungi can be a promising candidate for cellulase production however their use at industrial level still demanding more focused research by both academia as well as industries.

KEYWORD- Microbial Cellulases, Endophytic Fungi, Unexplored Organisms

UNIVERSITY INDUSTRY PARTNERSHIP: WORKING FOR MUTUAL BENEFITS AND CHALLENGES OF MANAGING COLLABORATION

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The numbers of research, we're performing earlier on partnerships between Industries and Universities, and were increased spectacularly over the past 20 years**.** As we know very well that Industry gets needed research, universities get funding, and society gets new products and technology. It's a balancing act for both to work for mutual benefits. This article examines the emerging Technology Transfer, Knowledge Transfer, Product-Process-Service Innovation, Publication Etc. are expected to play in economic development, as well as University Industry (U-I) mutual benefits by mutual understating and mutual collaboration. In this paper the interface between universities and industry is studied as a way of responding to the economic needs of society in the 21st century through academic entrepreneurship i.e. the variety of ways in which universities take direct part in the commercialization of knowledge through the supply of ingenious research and inventions. This university-industry interaction will help the industry pact with financial pressure to reduce costs, increase efficiency, increased competition and rising customer expectations. Collaboration with firms increases the quantity and quality of the research output only when the firm's characteristics craft them precious partners. Secondly, by this paper I have discussed about major challenges in which I have find some of challenges as eminence of information generates, lack of information about issue, time perspective, prospect of both the parties, technical issues etc. The purpose of this paper is to find out the Mutual Benefits and highlight various challenges which create difficulties to University-Industry Partnership (U-I).

KEYWORDS- University Industry Partnership, Mutual Benefits, Collaboration, Innovation

COAT PROTEIN-MEDIATED RESISTANCE AGAINST AN INDIAN ISOLATE OF THE COWPEA APHID-BORNE MOSAIC VIRUS RR3 IN *NICOTIANA BENTHAMIANA*

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Cowpea is major crop of Rajasthan, India and has high carbohydrates and proteins content of dry grain. Cowpea aphid-borne mosaic virus (CABMV) is a potyvirus that infects cowpea causing significant yield reduction. The Full genome of Indian CABMV RR3 isolate consists of a positive sense RNA molecule of 9894 nucleotides encoding a single polyprotein of 3174 amino acids was amplified and submitted in NCBI GenBank (KM597165). Coat protein-mediated resistance to CABMV was evaluated in *Nicotiana benthamiana*, a model host for the virus. The CABMV coat protein gene from a RR3 isolate of the virus was optimized for expression in plants under a CaMV 35S promoter and cloned into the Hind III site of the binary vector plasmid pBI121 to result in the plasmid pBI121-CPRR3. The plasmid pBI121-CPRR3 was used in *Agrobacterium*-mediated transformation of *N. benthamiana* leaf sections following the co-cultivation method. Regenerated plants were analyzed by PCR as well aphid transmission assay. R1 seedlings were assayed for kanamycin resistance and for presence of the coat protein and challenged with CAMBV-infected sap. Lines showing delayed symptom development were identified but no line showing immunity was identified. Delayed symptom development is significant resistance since it affords protection to the plants during the crucial early stages of development and exerts little evolutionary pressure on the virus to evolve new strategies.

KEYWORDS- Potyviridae, Cowpea Aphid-Borne, Mosaic Virus, Coat Protein

UNIVERSITY INDUSTRY COOPERATION TO BOOST "MAKE IN INDIA" INITIATIVE AND TO ACHIEVE SUSTAINABILITY

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Universities in developing countries have crucial roles to play in developing differentiated and effective academic order, and play an important role in the process of economic growth, making it possible for these countries to join the global knowledge society and give boost to the industrial research programs. This paper provides a review of studies that examine the extent to which university research promote industrial development. And how recent announcement of new government initiative as "Make in India" is going to impact sustainability of employment. The primary focus of the paper is on academic impacts that derive from the innovative outputs of faculty and students initiative. These impacts include the attraction of industrial laboratories to link with university. The student who graduate with advanced degrees may remain in the area to work in industrial labs or they start new science based businesses with sustainable environmental concerns. In this way problem of unemployment can be cater with sustainability in mind and better university-industry cooperation can yield in the actual field of competitive environment. Evidence of university-industry cooperation impacts development of skills among students and sharpen the same and help to update the faculties. Many graduates will end up leaving their own country and can be absorb to serve the local economies, if they are trained to serve local market. It is seen that university initiated fundamental research program have enormous socio-economic benefits among the masses. Government has come forward to take the help of both university and industry to make the society more sustainable, whether it is an environmental issue or the vicious cycle of unemployment.

KEYWORDS- University-Industry Cooperation, Sustainable, Environmental Issue, Employment

CYANOBACTERIA: A GREEN CAPSULE FOR BIOFERTILIZER PURPOSES

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The increasing demand of the biofertilizers and awareness among scientist and farmers for biofertilizers has open a way for the fertilizer manufactures and new entrepreneurs to get into bio-fertilizer production. Escalating global hunger as a consequence of ongoing increase in population will be serious concerns for food security in near future as well as earlier problem knocking the door. Entire dependence on chemical fertilizers for crop production have also threatens for disproportionate supplement of nutrients for crops and deterioration of soil health. Application of agrochemicals for intensive crop production have undeniably posed negative and sometimes irreparable threats to the environment. Therefore, there has been recent resurgence of interest in environmental friendly microbial biofertilizers technology. Farming on agriculturally important microbial bio-formulation technology for replenishing agrochemicals will be an emerging and eco-safe technology for agriculture. The Cyanobacteria also called as blue green algae (BGA) are proved to be a potential bio-agent by various researchers for the growing necessity of sustainable agriculture with a holistic vision of environmental protection. Cyanobacteria are equipped to use the sunlight to manufacture their own food through photosynthesis. BGA, prominent inhabitants of various agricultural fields, potentially fix atmospheric nitrogen, solubilize phosphate, produce phytohormone, exopolysaccharide and enhance crop productivity and improved soil structure and fertility. Cyanomat of cyanobacteria could stabilize the soil structure and enhance water holding capacity of stresses agricultural soils. The potentiality of cyanobacteria in crop production have offers these microbes as possible bio-agent for bio-fertilizer technology. Thus, cyanobacteria are an emerging ecologically feasible green capsule for bio-fertilizer purposes.

KEYWORDS- Biofertilizers, Global Hunger, Environment, BGA, Cyanobacteria

ENHANCE THE QUALITY OF MILK TO PREVENT MICROBIAL CONTAMINATION IN PERSPECTIVE OF PUBLIC HEALTH CONCERN BY USING MODERN DAIRY TECHNIQUES

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Being a nutritious commodity, milk serves as an ideal medium for the growth of various microorganisms. Poor handling of this can cause both economic loss and public health problems. Although freshly drawn milk from cattle may possess temporary 'germicidal' or 'bacteriostatic' properties, and further microbial contamination is prevented by freezing, heat treatment or irradiation. Incidence of microbial contamination in raw milk can originate from different sources such as air, milking equipment, feed, soil, faeces and grass. There are maximum chances of contamination found in milk during or shortly after milking. These are influenced by several things such as animal and equipment cleanness, season, ambient temperature, storage, personnel health, cleanness and animal health. Modern dairy techniques like proper udder sanitization, vacuum milking, ultra-heat treatment (UHT), inert type of milk processing equipment, modified atmosphere packaging (MAP), storage at specified temperature could be benefits for milkers, vendors and dairy farms though good quality milk production, processing and delivery to consumer. There are several other control measures also like good manufacturing practices (GMPs),hazard analysis critical control point (HACCP) provided by the various regulating authorities for contamination free milk production and its delivery to the market for consumer. It can be concluded that there is a need to implement such good hygiene practices and effective monitoring from production through the delivery chain to the consumer.

KEYWORDS- Germicidal, Quality of Milk, Dairy Techniques, Hygienic

BIOSURFACTANTS: INDUSTRIAL APPLICATIONS

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Biosurfactants have drawn significant attention of the researchers as potential alternatives to chemical surfactants available commercially. The use of biosurfactants is also being promoted due to adverse environmental impacts exerted by chemical surfactants due to their toxicity and recalcitrance. Biosurfactants are derived from bacteria, fungi and yeasts and have diverse industrial applications. They can be utilised as biopesticides as an alternatives to chemical pesticides. In addition, biosurfactants offer eco-friendly and cost incentive alternatives to synthetic/conventional surfactants. Consortia of biosurfactants obtained from different microbes can be utilized to enhance their synergistic effect, improved bioremediative applicability, reduced toxicity and greater utility as compared to conventional surfactants and pesticides. Although biosufactants have prolific applications in bioremediation and agriculture, their large scale production is difficult at present due to high raw material cost, high processing cost and low manufacturing output. As a result, the present research challenges are oriented towards their hyper production and to cut down the cost of raw materials. In addition, it is exigent to enhance their performance and development of their industrial applications.

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KEYWORDS- Biosufactants, production, Bioremediative, industrial applications

INTERVENTION OF TRANSGENIC TECHNOLOGY FOR PROMOTING SUSTAINABLE AGRICULTURE

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The unraveling of genome sequences of several crops have given new avenues for crop improvement in the years to come. No doubt conventional plant breeding has immensely contributed to food security in the past leading to the first 'Green revolution' in mankind history. The shrinkage of arable land in recent years owing to urbanization and industrialization along with drastic climatic disturbances, severity of both abiotic and biotic stresses demands development of potential technology for crop improvement and transgenic technology is one such technology with potential for promoting sustainable agriculture. The transgenic technology has immense potential to deliver if used judiciously as revealed by substantial increase of the commercialization of transgenic crops from 1.7 million hectares in 1996 to 181 million hectares in 2014. The transgenic technologies are assumed to be a land saving technology with potential for enhanced productivity in limited land area and curtailing deforestation. The transgenic crops popularly known as 'biotech crops' have the potential for sustainable agriculture by contributing to reduction of CO_2 emission indirectly by reducing the amount of pesticides applications in field. The herbicide tolerant crop further reduces the tilling practices and prevents loss of soil carbon and CO_2 emission. The possibility of food, feed and fiber security with enhanced productivity in limited arable lands, mitigating the influence of climate change in the form of abiotic stress tolerant crops, reducing insecticide and herbicide spray by the advent of herbicide and insect resistant crops, transgenic crops are immensely contributing to the sustainability in agriculture.

KEYWORDS- Green Revolution, Sustainable Agriculture, Biotech Crops, Herbicide

EXPLORING STREPTOMYCES AS SOURCE OF ANTIBIOTICS

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The discovery of first antibiotic penicillin stimulated the search for other antibiotics. S. Waksman**,** while at Rutgers University, announced in 1944 that he and his associates had found a new antibiotic, streptomycin, produced by the actinomycete *Streptomyces griseus.* This discovery arose from the careful screening of about 10,000 strains of soil bacteria and fungi. The importance of streptomycin cannot be understated, as it was the first drug that could successfully treat tuberculosis. Waksman received the Nobel Prize in 1952, and his success led to a worldwide search for other antibiotic-producing soil microorganisms. Waksman also gave the ways for exploration of Microorganisms producing chloramphenicol, neomycin, terramycin, and tetracycline. The discovery and the development of newer, more powerful antibiotics have transformed modern medicine. Soil has always been the promising source of antibiotics. Soil microbes mainly Streptomyces are the source many groups of antibiotic. Our initial studies revealed that 5000 Streptomyces species were isolated from environment among them only 200 were reported to produce antibiotics and in the current scenario only 25 antibiotics are clinically used for the treatment of human and animal diseases. An investigation was carried out to determine the presence of antibiotics producing Streptomyces from the soil. Soil samples were collected from different places and isolation of Streptomyces was done by pour plate methods. Further study is also planned to standardize and develop the different protocols to isolate the antibiotics producing streptomyces. This study will also be helpful to explore the unexplored antibiotics from streptomyces.

KEYWORDS- Penicillin, Antibiotics, Streptomyces, Protocols, Unexplored antibiotics

PLANT SPECIFIC TRANSCRIPTION FACTORS FOR DEVELOPING STRESS TOLERANT TRANSGENIC CROPS: RELEVANCE AND ITS IMMENSE POTENTIAL"

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The economy of a country is substantially influenced by its overall agricultural production and hence efforts are always made to increase the crop production by utilizing appropriate technologies. The approach of conventional plant breeding has resulted in development of superior varieties of several staple crops which might be helpful for attaining global food security. The drastic increase in human population over the years requires more production and conventional plant breeding has limitation to some extent for further enhancement of crop production. So, there is a need for new innovations in agricultural techniques. Instead of increasing the overall yield there should be more emphasis to minimize the loss incurred by several biotic and abiotic stresses globally. To improve crop productivity, it is necessary to understand the mechanism of plant responses to stress. The transcription factors known to be a major player in gene expression is now being targeted for transgenic based on the fact that a single TF regulates multiple genes by associating with the Cis-regulatory elements of respective promoters. The use of TF for developing stress resistance has been validated in few crops and needs to be further studied for making it relevant for commercialization. There are a number of biological process that are unique to plants, e.g. photosynthesis, nitrogen fixation, the reproductive processes, development and response to environmental signals. Therefore, numerous DNA sequence-specific transcription factors associated with gene expression in plants exclusively have been identified. On the basis of their binding domain transcription factors are classified into several families including zinc fingers, basic-region leucine-zipper (bZIP), basic-region helix-loop-helix (bHLH), homeodomain, MYB, MADS box, HMG-box, AP2/ EREBP transcription factor families which have been implicated in regulation of stress responses. The Dof (DNA-binding with one finger) transcription factor of the family zinc finger is one of the important plant specific transcription factor involved with diverse functions including biotic and abiotic stress. Presently in our lab PCR amplification, cloning, sequencing and functional validation through real time PCR at tissue level and abiotic stresses of 28 *Dof* genes in sorghum have been done. Study of *Dof* genes in pigeon pea and chickpea are in progress.

KEYWORDS- Substantially, Transcription Factor, Pigeon Pea, Homeodomain

FLAVORED ALCOHOLIC BEVERAGES: FRIENDS OR FOES FOOD PRESERVATION AND STERILIZATION TECHNIQUES FOR BABY FOOD

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For baby food the microbiological safety is a very important factor. Young children are sensitive towards micro- organisms. Even the exception of the parents is to by "absolutely" safe food. Theoretically this strong approach for baby food used after the 4th or 5th month can be questioned. Practical it is not possible because of the legal requirements and the consumer perception. No company producing baby food can survive if they do not fulfil the very highest hygienic standards. If products are produced in heat preserved way the "heat load" is the limiting quality factor. If the product must to be sterilized the influence of "heat load" to the product quality is tremendous. Theoretical even other preservation techniques are possible: For example products can be presented as dehydrated product to the consumers. If this can be produced with the help of frees dehydrating techniques the product quality will be relatively good protected. The problems here are the energy costs for doing so. Further on it is not sure that consumers will accept such products. A more realistic concept would be to present the baby food products as deep frozen products. The technique is available the costs are realistic and the consumers learned in the last years that the quality of deep frozen products are better than can food. From the quality perspective deep frozen products are in terms of vitamins and so on better than canned food .Explicitly if the product will not be stored to long. There are different possibilities beside or combined with autoclaves to available to sterilize or pasteurize canned food. A number of those techniques as ionizing irradiation or the use of preservatives is not acceptable for organic baby food. In terms of working with autoclaves one method seems practical available. To work with shaka methods means to bring the canned food inside the can to move in order to improve the heat transport inside the product. By doing so the sterilization time will be shortened and the heat load reduced. Theoretically a total new concept could be established. To change from a discontinuous process with autoclaves to a continuous concept with aseptic packaging opens a lot of new technological opportunities which seems to be positive for the quality.

KEYWORDS- Microbiological Safety, Highest Hygienic Standards, Heat Load, Frees Dehydrating

BACTERIAL EXOPOLYSACHHARIDES: INDUSTRIAL AND AGRICULTURAL APPLICATIONS

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Increasing use of chemicals deteriorate environment and cause harmful impact on living being. Many species of bacteria possess the ability to synthesize and excrete extracellular polysaccharides [EPS] during their life cycle which can be use in the place of chemical products in various types of industries e.g. food industries, drug industries, cosmetics industries etc.There are many types of microorganism that secretes EPS in large amount such as *Pseudomonas, Actinomycetes, Rhizobium* etc. Among these EPS producing microorganism *Rhizobium* is one such bacterium that secretes EPS at suitable condition possessing remarkably high moisture holding capacity and serve to maintain minimum moisture in their immediate environment. It has been seen that bacterial EPS provide protection from various environmental stresses, such as desiccation, predation and the effects of antibiotics. However, in recent years the interest in EPS has increased considerably in various industries because these compounds are candidates for many commercial applications in the health, bio nanotechnology, food, cosmetics, and environmental sectors. EPS can have industrial applicability in production of gums, food products, pharmaceuticals, bio-emulsifiers, bio-flocculants, chemical products etc. In agriculture sector, the fluidity of fungicides, herbicides, and insecticide can be improved by the addition of exopolysaccharide. Thus in the future EPS may be a very good alternative of chemicals in industries on large scale production.

KEYWORD- Extracellular Polysaccharides, *Rhizobium*, Environmental Stresses, Bio-Emulsifiers

ADVANTAGES OF GAMMA IRRADIATION IN SCIENCE AND INDUSTRY

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Irradiation is process in which food is exposed to high doses of radiation in the form of gamma rays, X-rays or electron beams. Irradiation can kill bacteria in food, Irradiation creates a complex series of reactions that alter the molecular structure of food and create known carcinogens and other toxic chemicals, including toluene. In addition, byproducts of irradiation. Animals fed irradiated foods have died prematurely and suffered stillbirths, organ damage and nutritional deficiencies. Irradiation can also change the flavor, odor, texture, color and nutritional content of food. The radiation level approved by the FDA. Irradiation is used to create a false sense of security about food safety. It is promoted as a solution to the overcrowded and unsanitary conditions on factory farms that make animals susceptible to disease. However, since irradiation may not eliminate all bacteria from foods, and since foods can be contaminated or re-contaminated after having been irradiated, the process does not totally eliminate the possibility of foodborne illness. That is why the USDA recommends the same food-handling practices for irradiated foods as for non-irradiated foods. Food is irradiated to extend its shelf life and kill pests like fruit flies. Currently, the US Food and Drug Administration has approved irradiation of foods including meat and poultry, fruits and vegetables, herbs, spices and flour. However, only a few of these approved foods are actually produced commercially; currently, irradiated foods are limited to small amounts of ground beef, spices, and some imported fruit. Irradiated foods sold in grocery stores are required to be labeled.

KEYWORDS-Gamma Ray, Medical Science, Food Science, Agricultural

WATER POLLUTION STUDY OF YAMUNA RIVER AT TAJ CITY, AGRA

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Agra is known as Taj City, an important historical and industrial city is situated on the bank of river Yamuna. The underground water in this zone is hard and saline, so the entire city depends upon the Yamuna river water supply for its domestic and industrial purposes. Yamuna River carries a minimum load of population up to Delhi and Agra, due to the disposal of untreated sewage and industrial waste situated along its bank. In the present study the quantitative assessment of different physico-chemical and biological pollutant in the raw water of Yamuna River from Nov. 2013 to Oct. 2014. Sample drawn from the intake of Waterworks at 30 days intervals were subjected for physico-chemical and biological analysis in laboratory of different parameters. The average value of different parameters was calculated on the basis of three replicated of sample. The results has been shown in three seasons as winter (Nov.-Feb.), summer (March-June) and Rains (July-Oct.). The standard deviation and coefficient is worked out to know the extent of variation in minimum and maximum and maximum values of each parameters. Turbidity showed remarkable variation during the study. It was showed minimum (28 mg/l) in summer while maximum (3800 mg/l) in rains which due to maximum water whereas the reduced flow and gradual sedimentation was responsible for low turbidity in summer season.

KEYWORDS- Physico-Chemical, Biological Pollutants, Yamuna, Agra

ENVIRONMENT AS SOURCE OF MDR BACTERIA

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The emergence of multidrug resistance (MDR) in bacteria and lack of novel classes of antibacterial agents have raised an immediate need to identify such agents, which can reverse the phenomenon of MDR. Drug resistance bacteria are bacteria that become resistance against one or more antibiotics / drugs. In the current scenario, these bacteria increase severity of infection and burden on the latest generation of antibiotics. These bacteria are found in environment, hospital and in normal community also. In the present study, different bacteria were isolated from different places representing different environments. Initially antibiotic resistance profiling was done. On the basis of Disc diffusion assay and Minimum Inhibitory Concentration (MIC), the two bacteria were behaving like multi drug resistance. This study will be helpful to know the correlation between the environment and clinical isolate as well as to know the exact mechanism of resistance. This study will also impact on the flow of drug resistance and easy to tackle the MDR on industrial level

KEYWORDS- MDR, Drug Resistance, Environment, MIC

MICROORGANISMS AS A SOURCE OF QUALITY PROTEIN AND THEIR MASS PRODUCTION

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The dried cells of microorganisms (algae, bacteria, actinomycetes and fungi) used as food and feed are collectively known as 'Microbial protein'. Since ancient times a number of microorganisms have been used as a part of diet. The term 'microbial protein' was replaced by a new term "single cell protein" (SCP) in 1967. In India, little attention has been paid on the mass production of SCP, though mushroom cultivation started in the early 1950's. There may not be enough animal proteins to feed the growing human population in the future, especially in many developing countries. Therefore, in the light of protein shortage, microorganisms offer viable alternative of protein supplements. They can be used to replace totally or partially the valuable amount of conventional vegetable and animal protein feed. For this development of technologies utilizing agriculture and food waste products would play a major role for the production and supply of SCP and are possible solutions to meet a shortage of protein if and when the amount of protein produced by agriculture and fishing becomes insufficient. This will help alleviate waste disposal problems and also reduce the cost of production. The use of microbial protein as food has several advantages over animal proteins. Microbial proteins can be a good source of B-vitamins, carotene and carbohydrates. Additionally microbial proteins can be produced under laboratory settings and thus land shortage and environmental calamities (such as drought or flood) will not be a bottleneck in SCP production compared to other common mushrooms in market.

KEYWORDS- Mushroom, Fungi, Pharma-industry, ITS

ADVANCE TOOLS AND TECHNIQUES USED IN CEREAL AND CEREAL PRODUCTS PROCESSING/PRESERVATION

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Cereal grains and meals and flours made from them should not be subject to microbial spoilage if they are prepared and stored properly because their moisture content is too low to support even the growth of molds. A little moistening will permit only growth of molds, but more moisture will allow the growth of yeasts and bacteria. Although the microbial load of cereal grains, meals and flours may not constitute a spoilage problem by itself, the number and types of microorganisms in such products are of concern since these products are used in the formulation of many other foods. The microbial contribution of cereal grains and flours to convenience foods is an important consideration from a public health aspect and as a source of possible spoilage. The exteriors of harvested grains retain some of the microorganism they had while growing plus contamination from soil insects and other sources. Now a days-Advance tools and techniques for cereal preservation can be applied such as Asepsis: - As in food industries, the adequate cleaning and sanitization of equipment is essential for reasons of both sanitation and preservation. Use of Heat:-. The complete baking process ordinarily destroys all bacterial cells, yeast, and mold spores, but not spores of the rope-forming or other bacteria. Use of Chemical preservatives:-A larger number of preservatives may be employed, particularly as mold inhibitors. Use of Irradiation:-In bakeries, ultraviolet ray have been used to destroy or reduce numbers of mold spores in dough and proof rooms, on the knives of slicing machines. Grains spoiled by molds represent a potential animal or human health hazard as well as a great economic loss.

KEYWORDS- Chemical Preservatives, Formulation, Microbial Spoilage

BIOFERTILIZERS: AN ALTERNATIVE SOURCES OF CHEMICAL FERTILIZER FOR SUSTAINABLE AGRICULTURE IN 21th CENTURY

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Chemical fertilizers are use in agriculture crop production is increases but it adverse effects to rise the environmental pollution and causes harmful impact on living beings. For example: The chemical fertilizers used on the crop land, when doing rain then reaches in water bodies due to causes eutrophication in water bodies and effects flora and fauna. By this way as an emerging alternative comes in agriculture crops for sustainable development known as biofertilizer Biofertilizers are carrier based substance which contains live bacterial or fungal formulations when applied to seeds, plants surface and soil help in mobilization of various nutrients by their biological activity. Biofertilizers are added nutrients through natural process by Nitrogen fixation, solubilizing and stimulating phosphorus. Since they play several roles a prepared scientific term for such beneficial bacteria is Plant Growth Promoting Rhizobacteria (PGPR). Biofertilizers like *Rhizobium, Azotobacter, Azospirillum* and Blue Green Algae are in use since long time. Biofertilizers are cost effective ecofriendly and when they are required in bulk can be generated at the form itself.

KEYWORDS- Biofertilizers, Formulations, Nutrients, Ecofriendly

ORGANIC FARMING AS SUSTAINABLE FORM OF AGRICULTURE

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Organic farms produce foods without excessive use of pesticides, hormones, antibiotics or petroleum-based fertilizers. It has health benefits and lessens the likelihood of certain diseases. Industrial agriculture maximizes production and profits by using excessive amounts of chemical pesticides, herbicides and hormones that endangers our health. Organic farms do not raise more animals than the land is capable of supporting. Farmers use composted manure as food for their crops. Factory farms concentrate enormous numbers of animals in small areas, storing their waste in huge lagoons. It is then sprayed on surrounding fields, contaminating soil and water with pathogens, heavy metals, and excess nutrients, creating an overwhelming stench, and releasing hazardous gases that often sicken neighboring residents. Organic farms conserve scarce water resources through practices such as drip irrigation and planting regionally-appropriate crops and protect local aquifers from contamination. Industrial agriculture contaminates ground and surface water with toxic pesticide and fertilizer runoff, hormone and antibiotics residue, heavy metals and harmful pathogens contained in manure that seep into our water supply. Organic farming promotes soil fertility and land conservation through methods including crop rotation, planting of cover crops, and continual addition of organic matter. Efforts are currently in progress to perfect no-tillage techniques. Industrial farming causes chronic erosion and depletion of nutrients due to extensive plowing, constant planting and reliance on toxic chemical pesticides and fertilizers. The central theme is Agricultural production will need to increase substantially with limited natural resources.

KEYWORDS- Industrial agriculture, Organic farming, hormone, Industrial farming

DEVELOPMENT OF DRY FORMULATION OF *PSEUDOMONAS FLUORESCENS* AS BIOCONTROL AGENT AGAINST FUNGAL DISEASE IN PLANTS

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Organic farms produce foods without excessive use of pesticides, hormones, antibiotics or petroleum-based fertilizers. It has health benefits and lessens the likelihood of certain diseases. Industrial agriculture maximizes production and profits by using excessive amounts of chemical pesticides, herbicides and hormones that endangers our health. Organic farms do not raise more animals than the land is capable of supporting. Farmers use composted manure as food for their crops. Factory farms concentrate enormous numbers of animals in small areas, storing their waste in huge lagoons. It is then sprayed on surrounding fields, contaminating soil and water with pathogens, heavy metals, and excess nutrients, creating an overwhelming stench, and releasing hazardous gases that often sicken neighboring residents. Organic farms conserve scarce water resources through practices such as drip irrigation and planting regionally-appropriate crops and protect local aquifers from contamination. Industrial agriculture contaminates ground and surface water with toxic pesticide and fertilizer runoff, hormone and antibiotics residue, heavy metals and harmful pathogens contained in manure that seep into our water supply. Organic farming promotes soil fertility and land conservation through methods including crop rotation, planting of cover crops, and continual addition of organic matter. Efforts are currently in progress to perfect no-tillage techniques. Industrial farming causes chronic erosion and depletion of nutrients due to extensive plowing, constant planting and reliance on toxic chemical pesticides and fertilizers. The central theme is Agricultural production will need to increase substantially with limited natural resources.

KEYWORDS- Formulation, *Pseudomonas fluorescens,* Talc

EXPLORING SOIL FUNGI AS SOURCE OF ANTIMICROBIALS

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The discovery of chemotherapeutic agents and the development of newer, more powerful antibiotics have transformed modern medicine. Furthermore, antibiotics have proven exceptionally useful in microbiological research. Penicillin, the first antibiotic, was initially discovered in 1896 by a twenty-one-year-old French medical student named Ernest Duchesne. His work was forgotten until Alexander Fleming accidentally rediscovered penicillin in September 1928. Soil has always been the promising source of antibiotics. Soil microbes mainly soil fungi are the source of first antibiotic and many more. An investigation was carried out to determine the presence of antibiotics producing fungi from the soil. Soil samples were collected from 4 different places and isolation of fungi was done by pour plate methods. Further study is also planned to standardize and develop the different protocols to isolate the antibiotics producing fungi. This study will also be helpful to explore the novel unexplored antibiotics from soil fungi up to industrial level

KEYWORDS- Chemotherapeutic Agents, Penicillin, Antibiotics, Soil Fungi

MICROBIAL BIOSYNTHESIS OF ZNO NANOPARTICLES: AN ECO-FRIENDLY APPROACH

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Nanotechnology is emerging as a rapidly expanding field with its applications in science and technology for the purpose of manufacturing new materials at the nanoscale level. Nanotechnology has enabled researchers to fabricate nanoparticles of desired size and shape suitable for use in a variety of industrial products. Among all other metal oxide nanoparticles, zinc oxide nanoparticles (ZnO NPs) have gained profound attention due to their low band gap and high surface to volume ratio (surface area), for wide range of applications in the fields of electronics, light (UV) emission, chemical sensor and personal care products. Endowed with high catalytic efficiency and strong adsorption ability they are also employed as key ingredient in sunscreens, rubber processing, wastewater treatment, and as a fungicide. At present, conventional synthesis of ZnO NPs include sol–gel, wet chemical route, microwave method, gas-phase synthesis, micro-emulsion, dry-casting and micellar templating *etc*. The chemical roots for fabrication of ZnO NPs use expensive chemicals and toxic solvents as reducing and capping agents and also results in production of large amount of hazardous by-products. To avoid the use of toxic organic solvents and severe reaction conditions (temperature, pressure, and long refluxing time) for the synthesis of nanomaterials, Biological methods involving bacteria, fungi, yeasts and their enzyme systems have drawn the attention of researchers as possible and eco-friendly alternatives to chemical and physical methods for the synthesis of zinc oxide nanoparticles. However, for large scale commercial applications there is a need to explore novel microbes and optimum conditions favoring rapid biosynthesis of ZnO nanoparticles.

KEYWORDS- Biosynthesis, Zinc Oxide, Nanomaterials, Micro-Emulsion

UNIVERSITY- INDUSTRY INTERACTION- A TOOL OF LEARNING FOR SUSTAINABLE FUTURE

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New university-industry partnerships are now emerging to promote sustainable development throughout the world. This emerging university-community partnership is being designed to benefit the surrounding area by: (1) creating green jobs, (2) increasing energy efficiency and reducing greenhouse gases, (3) supporting research in the science of sustainability and sustainable technologies. Strategies to accomplish these objectives include workforce development, training, and integrated support for research at the universities. Future potential activities include a green science park, a community resource center and business incubation support. Against a background of increasing international competition and rapid technological change, governments are actively encouraging collaboration as a means of improving innovation efficiency and thereby enhancing wealth creation. Collaboration provides companies with the means by which to advance technologically, at lower cost and with less inherent risk. Collaboration also provides access to a greater breadth and depth of knowledge and technologies than would normally be possible through internal development. For universities the benefits include additional public and private funding, and increasingly, licensing and patenting income, as a result of technology transfer activities. However, these considerable potential benefits are often not realized in practice. The major reason is that collaborations between, often diverse, organizations, need considerable management effort in order to be successful. Given the substantial investment (both public and private) currently being made in collaborative research activities, it is clearly important to ensure that collaborations are managed effectively, and the benefit achieved maximized. This paper is going to discuss the university industry interaction as a tool of learning for future sustainable development.

KEYWORDS- University-Industry Partnerships, Collaboration, Substantial Investment

LACCASES: THE GREEN ENZYMES FOR SYNTHETIC DYES DECOLOURIZATION

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Synthetic dyes are among the major chemical pollutants that originate mainly from textile and paper recycling industries. Synthetic dyes are poorly biodegradable pollutants with toxicity, mutagenicity and carcinogenicity, and cause serious environmental problems because of these characteristics. These dyes are unusually resistant to degradation and decolorization by physical or chemical methods including adsorption, precipitation, chemical degradation or photodegradation. Physico-chemical remediation techniques also have financial and methodological disadvantages. Therefore, the development of eco-friendly biological treatment techniques for removal of synthetic dyes from waste water is required. Recently, as an eco-friendly alternative strategy to conventional treatments, the enzymatic approach represented by laccase has gained much momentum in the decolourization/degradation of textile and other industrially important dyes from wastewater. Laccases, multicopper oxidoreductases considered as the ultimate "green catalysts" in biotechnology and offer an attractive solution because of its potential to degrade wide spectrum dyes having diverse chemical structure. Their broad substrate range and relative autonomy (they use molecular oxygen from air as an electron acceptor and they only produce water as by-product), makes them suitable for the decolourization of synthetic dyes. By exploring hyper secretary strains, enhancing laccase production by media optimization, better understanding of the mechanism for the reactions of interest, and optimizing the catalytic activity of laccases, they can be utilized in a better way in diverse fields of biotechnology.

KEYWORDS- Laccases, Synthetic Dyes, Decolourization, Oxidoreductases

MOLECULAR TECHNOLOGIES FOR DETECTION OF PATHOGENS IN WATER ENVIRONMENT: A NEW MOVE TOWARD WATER TREATMENT INDUSTRY

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Water is elixir for life, but many people do not have access to clean and safe drinking water and die because of waterborne diseases. The analysis of drinking water for the presence of indicator microorganisms is a key to determine the microbiological quality and assess the pathogen removal efficiency of water treatment plants. Moreover, different indicator microorganisms are being used in different countries for the microbiological examination of drinking water. But, there are several limitations in the general use of indicator bacteria as water quality indicator such as sensitivity to inactivation during treatment and also by sunlight exposure, short survival as compared to pathogens, non-exclusive fecal source, ability to multiply in some natural environments, and inability to identify the fecal pollution source (point or non-point). As a result, there are no ideal bacterial indicators currently used to fulfill all the established criteria for drinking water quality. Thus, the direct detection of pathogens in water environment using molecular techniques is considered to be a more suitable alternative. Molecular techniques provide sensitive, rapid and quantitative means for detecting the pathogens including newly emerging pathogens. The molecular techniques today being continuously improved in order to make them standardized and applicable to a wide variety of matrices, to increase their sensitivity, rapidity and to reduce the time, costs and steps used for the detection of pathogens and indicators. However, there are some drawbacks, which are the remaining challenge for theses molecular techniques include: concentration, viability or infectivity, quantification, skill or infrastructure and cost.

KEYWORDS- Waterborne Diseases, Drinking Water Quality, Pathogens, Infrastructure

COMMERCIALIZATION OF BIOPLASTICS- RESEARCH AND DEVELOPMENT

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Plastic is the most dominant materials used in agriculture, electronics, medical devices and packaging. Starting from a mere 1.65 million tons in 1950 they reached 280 million tons in 2011 and continue to show explosive growth as populous countries like India and China become more industrialized and consume more plastic materials. Plastic is a non-biodegradable product, with the potential to affect the human health as well as cause great harm to the environment. Instead of these synthetic plastics, Bioplastics are natural products synthesized and catabolized by different organisms and have broad biotechnological applications. They can be assimilated by many microbial species. Bacteria accumulate these polymers as an intracellular carbon storage material generally in response to essential nutrient limitation in the presence of excess carbon. More than 20 bacterial genera including *Bacillus, Azotobacter, Alcaligenes, Pseudomonas, Rhizobium* and *Rhodospirillum* were identified as potential Bioplastic producers and do therefore possess biocompatibility with the host. Bioplastics receive an increasing amount of attention by both industry and consumers as one of the main drivers toward a bio-economy. The term Bioplastic, however, encompasses a range of polymers that can either be bio-based, biodegradable or both. These materials account for approximately 1.5% of global plastics demand, but it is estimated that they could substitute up to 85% of conventional polymers. Biodegradable plastics such as starch blends or polylactic acid (PLA) have dominated early bioplastic market development with applications in food packaging, catering products, shopping bags, medicine, tissue engineering and agriculture. More recently the concept of replacing conventional oil-based plastics such as PE, PP or PET with their bio-based counterparts has gained commercial importance. Most important factor in commercialization of this degradable bio-based material is the cost feasibility, apart from this, there is a concern about genetically modified organisms, sustainably grown biomass, It is essential to analyze feedstock availability, industry infrastructure, customer, industries and government policies for sustainable and ecofriendly development of this recent technology

KEYWORDS- Bioplastic, Sustainable Development, Biodegradation, Bioplastic Market.

KNOWLEDGE SHARING: COLLABORATION BETWEEN UNIVERSITIES AND INDUSTRIAL ORGANISATIONS

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The role of universities as a source of knowledge is very vital for the growth of R & D in industrial perspective in the country. However, the lack of adequate liasioning between the two industries does not facilitate the knowledge transfer as per the requirement of the industry. Industry has its own perspective, which cannot be curiosity oriented, it has to be achieve the objective of the industry in terms of need based output to the society. Industry cannot sustain the knowledge generation at their end alone as it is cost intensive and requires infrastructure facilitating the generation of knowledge. It also does not come under the overall objectives of the Industry. Therefore, industry has to come closure to the knowledge centers/universities/academic/institutions and organize their own need base research and development. Academic institutions may also in this process be aware of the requirements of the industry in particular and society in general. The proper bridge between the two facilitates the exchange of requirements verses knowledge thus the need of the time. Such interactions are expected to lead to innovations at the universities level and subsequent transfer of specific technology to the industry as per need.

KEYWORDS- Academia, University, Industry, Liaison

GENETIC DIVERSITY OF BRINJAL (*SOLANUM MELONGENA* L.) AS REVEALED BY RAPD MARKERS

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Eggplant (*Solanum melongena* L.) is an important crop and has a growing reputation and is now cultivated globally. The Solanaceae family to which *S. melongena* belongs is an important family, too. Tomato, potato, tobacco and petunia are some example species of the Solanaceae family. This important family with 3000-4000 species shows a high level of morphological diversity which results in confusion about its systematic and this diversity is at the level of genera, species and cultivars. The aims of the studies reported in this thesis were to analyze genetic diversity of eggplants as revealed by RAPD and SSR markers. Randomly amplified polymorphic DNA (RAPD) markers, resulting from the polymerase chain reaction (PCR) amplification of genomic DNA fragments using short oligonucleotides (usually 10-mers) of arbitrary sequence as primers, provide a fast and easy approach for many purposes in plant genetic analysis. For these reasons many fruit species have been successfully fingerprinted using RAPD markers. Study of phenotypic and genetic diversity in landrace collections is important for germ plasm conservation. In addition, the characterization of much diversified materials with molecular markers offers a unique opportunity to define significant marker-trait associations of biological and agronomic interest. Ninety-six genotypes of brinjal were collected from the research farm of IIVR, Varanasi and were screened with eighteen RAPD (Random amplified polymorphic DNA) and fifty SSR (Simple sequence repeat) primers in order to determine genetic identities, genetic diversity and genetic relationships among these cultivars. Unweighted Pair Group Method with Arithmetic Mean (UPGMA) clustering grouped the cultivars into five groups. The genetic distance information obtained in this study might be useful to breeder for planning crosses among these cultivars. The results of RAPD studies showed that although a high similarity value was observed, diversity was detectable among the accessions. The results of SSR studies were also meaningful with their concordance with previous studies and observed diversity with a good fit to statistical results.

KEYWORDS- Eggplant, Genetic Diversity, RAPD, SSR, PCR

CH_4 (POTENT GREENHOUSE GAS): PROBLEMS & MITIGATION

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Methane (CH_4), one of the most important greenhouse gases (GHGs), traps heat by absorbing infrared radiation contributing up to 20% of global warming, being 30 times more radiative than CO_2 on a molar basis. Therefore, being as a most potent global warming gas its continuous increasing concentration in the atmosphere is great cause for concern. Its atmospheric concentration is rising due to natural and anthropogenic disturbances. Emission of CH_4 from different sources like wetlands, paddy fields, coalmines, etc. not only leads to the environmental disturbances but also severely affect the agriculture production as well as human health. The largest biological sink for atmospheric CH_4 is aerated soils, where CH_4 is being consumed by methanotrophs, which use CH_4 as sole carbon and energy source. Methanotrophic population and diversity is an important factor that may govern the CH_4 sink potential of terrestrial soil. Human activities such as forest clearing, land-use changes and farming practices result into significant alteration in the organic carbon content, soil moisture and N-nutrient status, which adversely affect the methanotrophs community structure and disparity in net biological CH_4 oxidation activity. In spite of the above, the use of synthetic fertilizers in agriculture significantly reduces the soil CH_4 sink activity of methanotrophs. Therefore, there is need to develop an innovative tool which can improve the sustainable agriculture without affecting the soil CH_4 uptake process. Bio-fertilizers (Cyanobacteria, *Azolla*) could be an emerging green-clean and innovative tool to enhance agriculture production without affecting the soil CH_4 sink activity of methanotrophs. In addition to the use of biofertilizer in agriculture, the constructive land management practices such as afforestation or reforestation, re-vegetation of coal mine spoiled area, reclamation of waste lands, etc. can contribute significantly in enhancing the global soil CH_4 sink activity.

KEYWORDS- GHG, Methanotroph, Cyanobacteria, *Azolla*, Bio-fertilizers

GREEN ICT FOR HEALTHY INDUSTRIALIZATION

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Information and Communication Technology changed the life of this generation. Its contribution is not confined to social affairs only but it also effected economically. It is a boom for economic growth; it can be more effective for the economic growth if the power consumption can be reduced by few percentiles. Many of the components used in ICT consumes lots of energy and has other indirect causes like NIC which is a vital component of ICT, it consumes 50% of the total power consumed for the sending and retrieving of the information. In future, this percentage will hike as use of ICT is growing rapidly. The motive of this paper is to encourage for making ICT eco-friendly that can help the industries in its sustainable growth and healthy Industrialization.

KEYWORDS- ICT, Eco-Friendly, Power, Industries

PLANTS AS A SOURCE OF NOVEL ANTIBACTERIAL AGENTS FOR COMMERCIAL UTILIZATION

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Plants are known to be the sources of structurally diverse phytomolecules that play significant role in drug discovery with novel mechanism of action. These phytomolecules may directly inhibit or exterminate pathogenic bacterial strains. Some phytomolecules may enhance the antimicrobial activity of antibiotics or alter the virulence and/or the adaptation of the pathogen towards the host. Plants and their products, throughout the world have long held a leading place in their medicinal and antibiotic usage for the treatment of infectious diseases. The plant secondary metabolites viz. terpenoids, alkaloids, glycosteroids, flavonoids, polyphenols etc. have become alternate source of antimicrobial agents because of structural diversity. Bioprospecting this nature's gift provides the means to fight the mighty killers, the diseases like TB, Malaria, Cancer, HIV etc. as well as facilitating general health care. Therefore, business opportunities are visibly expanding due to diversified usages of herbals in pharma, cosmetic and nutraceutical industries. India with its natural wealth of medicinal and aromatic plants on one hand and increasing demand of herbal and traditional plant-based extracts, formulations and pure biologically active molecules in an opened global market, needs to be explored for commercial utilization. Some of the plant based leads that have become available at CSIR-CIMAP especially for combating infections caused by multidrug resistant strains will be discussed during the presentation.

KEYWORDS- phytomolecules, nutraceutical, Bioprospecting, Secondary Metabolites

ROLE OF *RHIZOBIUM* AS A BIOFERTILIZER: A WAY TOWARDS SUSTAINABLE AGRICULTURE

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Agriculture is the very important and basic sector all over the world including our country. Nitrogen is an essential macro nutrient for plant growth and development, but it is not available to the plants due to its unavailability in the form of atmospheric nitrogen and it is a key issue for agriculture. The ability to reduce atmospheric N is done by microorganism and *Rhizobium* is most important nitrogen fixing bacteria. *Rhizobium* is able to form nodules on roots of leguminous plants and plays an important role in agriculture by fixing N symbiotically with legumes and this process is called as biological nitrogen fixation (BNF). BNF is an important component of sustainable agricultural systems. Approximately 88% species of legumes have ability to form nodules with rhizobia for example soybean fixes approximately 16.4 Tg N annually and this represents that 77% of the N is fixed by crop legumes that involves legume-rhizobia symbiosis. *Rhizobium* inoculants are well known agronomic practices to obtain adequate amount of N. Bioformulations of Rhizobia have been in use from long time, because of economic and ecological significance of leguminous plants, and are expected to reduce use of chemicals in future, and improving ecology of soil through BNF. Thus use of rhizobia as biofertilizer to enhance crop productivity on large scale will be a very useful technique in the sustainable agriculture.

KEYWORDS- *Rhizobium,* BNF, Leguminous Plants, Biofertilizer

AFLATOXINS AND ITS SIGNIFICANCE IN FOODS

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Aflatoxins are produced by certain strains of *Aspergillus flavus* and *A. parasiticus* and other species. The number and types of aflatoxin produced vary with the strain. For example, *A. flavus* link strains produce B1 and its related metabolites, while *A. parasiticus* produce both B1 and G1 and the related metabolites. Both species will grow on wide variety of substrate over a mesophilic range of temperatures. Optimal conditions for the production of aflatoxin are a_w of 0.85 and a temperature of 25 to 40C. *A. flavus* was isolated from the meal as part of the animal feed, and subsequently a toxic metabolites or toxins was isolated and identified. The resulting A. flavus toxin was called aflatoxin. Aflatoxin B1, the most toxic of the aflatoxins, is toxic to various animals. Many of the other aflatoxins have been shown to be toxic or carcinogenic to different species of fish, mammals and poultry .Since the discovery of aflatoxin in the early 1960s numerous surveys have been conducted on the detection of the aflatoxins in foods. Many commodities will support the growth of toxigenic strains if inoculated including various dairy product, bakery products, fruit juices, cereals and forage crops. In most cases, the growth of toxigenic strains and the elaboration of aflatoxin occurs following harvesting or formulation of the product. Peanuts, cottonseeds and corn are susceptible to aflatoxins due to attack of fungus. However, considering all available data on aflatoxin, it is now suggested peanut flour not be depended on as a protein source for feeding malnourished infants. Prevention and detoxification of mycotoxins is one of the most challenging toxicology issues of present time.

KEYWORDS- Aflatoxins, *Aspergillus Flavus*, Carcinogenic, Toxic

INDUSTRY-ACADEMIA COLLABOTION AT HIGHER EDUCATION (CREATING WIN-WIN SITUATION THROUGH CSR)

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India has the second largest education system in the world (after China) but still we are fighting with many social problems such as employability, students drop-out, learning disabilities, language barriers and cultural difference. According to Confederation of Indian Industries (CII), in the country the Government is doing most of the funding for research and development at present time but Industries should also engage themselves in terms of not only funding but also in skill development, innovation and entrepreneurship. This paper is an attempt to study the correlation of academia and industry collaboration and to invite greater private sector to participate and bridge the gap between the two to enhance employability of people of the society. Also to contribute in finding the problems and challenges emerging at higher education and provide alternatives and opportunities which can create new paths for industries to get the needed qualitative research results and qualified human resource, for universities to get funding sources and technology transfer for better development, for society to get new products, services and employability. It's a balancing act to create a win-win strategy for both the university and industry.

KEYWORDS- Collaboration, Funding, Employability, Learning Disabilities

ENDOPHYTES AS ALTERNATIVES TO HARMFUL AGROCHEMICALS FOR SUSTAINABLE AGRICULTURE

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Endophytes are beneficial microbes that reside intercellularly inside the plants. Interaction of endophytes with the host plants and their function within their host are important to address ecological relevance of endophyte. Endophytic microbes possess a wide range of metabolic properties that may modulate plant growth. Numerous studies have suggested the beneficial effects of endophytes on plants which may include enhanced insect and nematode resistance, fungal disease resistance, enhanced vegetative growth due to phytohormone production, nitrogen fixation and increased nutrient uptake. Endophytes also play an important role in increased abiotic tolerance and improved phytoremediation. These advantages envisage the use of endophytic bacteria for more successful biological control of plant diseases and improved crop production. Since many synthetic agricultural agents have been and currently are being targeted for removal from the market, because of profound harmful effects on human health and environment, perhaps endophytic fungi could serve as a reservoir of untapped biologically based compounds that may present alternative ways to harmful agrochemicals with huge agricultural potential.

KEYWORDS- Phytohormone, Vegetative Growth, Phytoremediation

BIOFORMULATIONS FROM FLUORESCENT PSEUDOMONADS FOR ENHANCING GROWTH OF SUNFLOWER CROP UNDER SALINE CONDITIONS

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Stress tolerating strains of *Pseudomonas aeruginosa* possessing plant growth promoting and biocontrol activity was screened for the production of exopolysaccharides (EPS). EPS production was monitored in the cell free culture supernatant (CFCS) and extracted EPS was further purified by thin layer chromatography. Purified EPS was taken to design talc based formulation and its efficacy was checked on oilseeds crops including sunflower (*Hellianthus annuus*), under in vivo saline conditions (soil irrigated with 125 mM of saline water). Application of metabolite based bioformulation significantly enhanced the yield and growth attributes of the plant in comparison to control (untreated seeds) under stress and non-stress conditions. Germination rate, vigour index, plant length, dry weight, seed weight increased remarkably. The above findings suggests the application and benefits of utilizing metabolite based EPS formulation in boosting early seedling emergence, enhancing plant growth parameter, increasing seed weight and mitigating stress in saline affected regions. Such bioformulation may enhance RAS/RT (Root Adhering Soil to Root Tissue ratio), texture of the soil, increase porosity, improve uptake of nutrients, and hence may be considered as commercially important formulation for renovation of stress sites and enhancing plant growth.

KEYWORDS- Bioformulations, Exopolysaccharides, *Pseudomonas aeruginosa,* Stress

SUSTAINALE AGRICULTURE AND INDUSTRY

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This review paper is based on the basis of previous time agriculture method and in present time use of manure and DDT, urea as well as chemical fertilisers are used in agricultural land.as the increasing the rate of population food resources are required in very high rate. So we approach for use of bio fertilizers to enhance the productivity as well as to improve fertility of soil. Use of chemical pesticides are not eco-friendly they continuously decrease the fertility and land become to unfertile but bio fertilizers are safe, cheaper, harmless as well as very effective for sustainable development.

KEYWORDS- Transgenic Crop, Bio compost, Animal Dunk, Productivity

BIOFERTILIZERS FOR SUSTAINABLE AGRICULTURE

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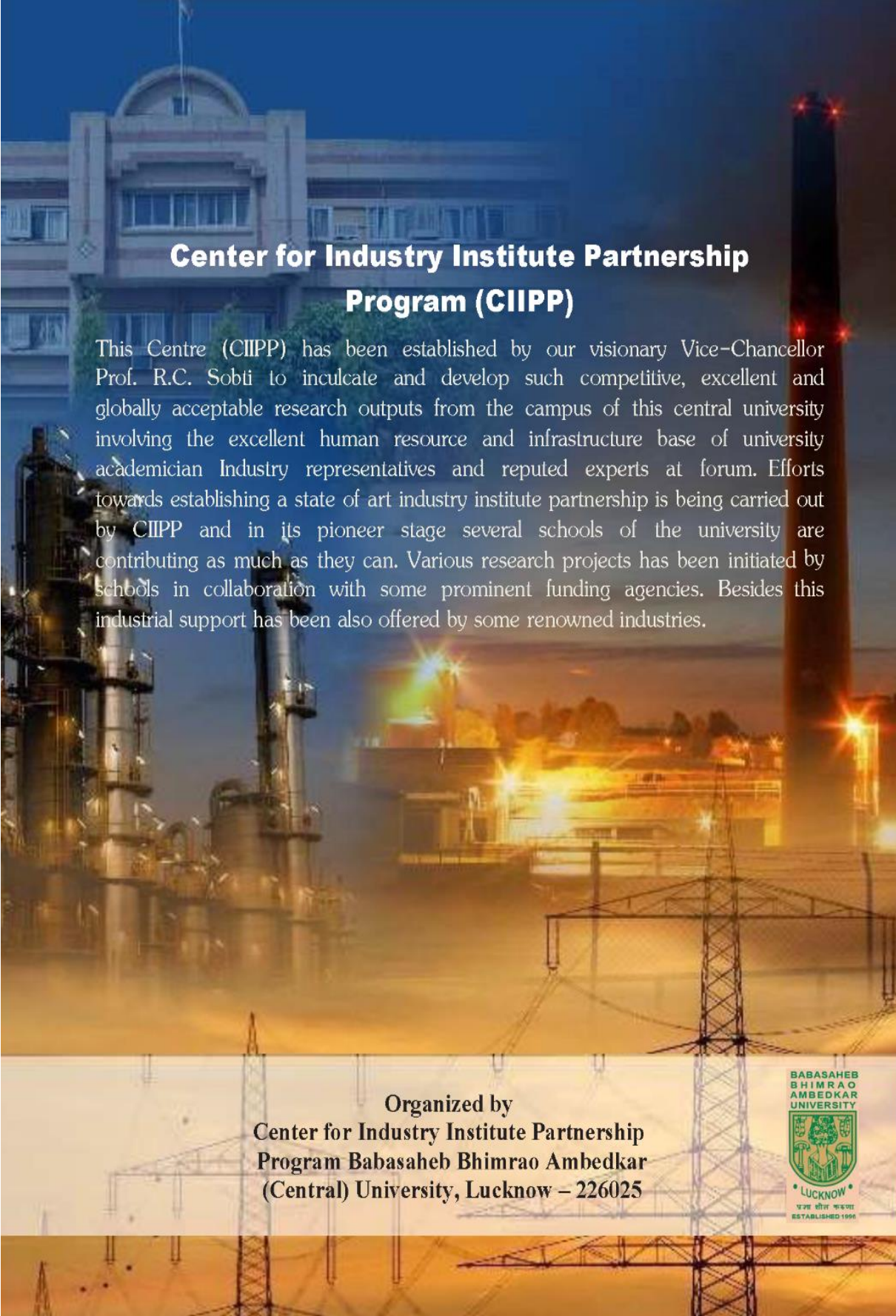
Biofertilizers are well recognized as an important component of integrated plant nutrient management for sustainable agriculture and hold a great promise to improve crop yield. The present study aims to isolate and identify nitrogen fixing bacteria *Azotobacter* and *Azospirillum* and its application on chili plant (*Capsicum annum*) to see its effect on the growth and yield of plant. .A pot experiment was conducted to study the effect of two bacterial inoculation *Azotobacter* and *Azospirillum* and their combination on growth and yield of *Capsicum annum*. The result showed that application of mixed bacterial inoculants (*Azotobacter + Azospirillum)* on *Capsicum annum* produced significant yield with respect to plant height number of leaves, number of branches per plant, high chlorophyll and protein content when compared with single inoculation and control. This study will be helpful for the development of biofertilizer from these mixed culture on industrial level as well as it will also help us to maintain the sustainability of the environment.

KEYWORDS- Biofertilizers, *Azotobacter*, *Azospirillum,* Industrial



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