



7th International Seminar 2016

Sustainable Resource Management Towards Food, Energy, Environment and Livelihood

November, 27 - 29, 2016

Mahatma Gandhi Haus
Göttingen, Germany



Programme & Abstract Book

Jointly Organized by:



Collaborative:

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<http://www.aasf.de/gruppierungen/ifsdAA/ifsdAA-seminar-2016/>

Editors: Dr. S. Khatodia, Dr. K. Wolde Giorgis & Prof. R.K. Behl



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Messages



7th International Seminar 2016

Sustainable Resource Management Towards
Food, Energy, Environment and Livelihood



Kuma Demeksa Tokon
Ethiopian Ambassador to Germany
Federal Democratic Republic of Ethiopia



Message

With pleasure, I learned that the International Foundation for Sustainable Development in Africa and Asia at the Afro-Asiatische Studienförderung (AASF) in collaboration with the International Council for Sustainable Agriculture (ICSA) Vöcklabruck, Austria and several other organizations are jointly organizing the 7th International Seminar on “Sustainable Resource Management Towards Food, Energy, Environment and Livelihood” from 27-29 November 2016.

Judicious resource management in agriculture and its sectors is key determinant of sustainability for food security, environment protection through the use of renewable energies and income generation for livelihood of the masses in rural and urban settlements.

I trust that aspects like agro-biodiversity, germ plasm conservation and their utilization through modern biotechnology, agro-production and agro-processing technologies and use of advanced technologies like information technology, bio-nano-technology, remote sensing will be discussed during this seminar.

I am happy that the organizers have also taken cognizance of socio-economic aspects related to sustainable development and livelihood. All such aspects are of immense value for sustainable development in Africa and Asia in particular, and all other countries in general.

I look forward to the recommendations emerging from this seminar and I wish successful deliberations.

I congratulate the organizers as well as participants of the 7th international seminar.

A handwritten signature in blue ink, which appears to read 'Kuma Demeksa Tokon', enclosed within a large, loopy blue oval.

Kuma Demeksa Tokon

प्रभु लाल सैनी
मंत्री



राजस्थान सरकार
कृषि, पशुपालन, मत्स्य, गोपालन
एवं कृषि विपणन विभाग
6322, मंत्रालय भवन, शासन सचिवालय
जयपुर-302005 (राजस्थान)

Message

It is a matter of delight and pleasure that the International Foundation for Sustainable Development in Africa and Asia (IFSDAA) at African Asian Studies Promotion Association (AASF), Gettlingen ,Germany in collaboration with International Council of Sustainable Agriculture (ICSA) at International Research Centre for Renewable Energy(IFEED),Vechelde, Germany , Nordic Folke Center, Thy, Denmark and SKM Agriculture College , Padampur,Rajasthan , India are organizing 7 th International Seminar on Sustainable Resource Management Towards Food, Energy , Environment and Livelihood from Nov 27 to 29, 2016 at Mahatma Gandhi House , Goettingen ,Germany.

I trust that Sustainable development is needed in each country for food and energy supply security, clean and green environment, health and hygiene and livelihood for all for coherent existence of mankind. Sustainable resource management is an integral component of sustainable development, particularly in the areas agriculture, renewable energy and environment. Environmental soundness as well as fragility is of utmost concern to all living beings especially under climate change.

I understand that at this interdisciplinary seminar, topics like Agro biodiversity, Crop and livestock production , resource management including land and water, food technology, environment pollution, renewable energy and use of advance technologies etc will be discussed.

All such topics are of cardinal importance for Rajasthan, India which offers vast ecological and soil type variations for validation of research conducted globally. We will welcome research and development collaboration with advance research institutes, researchers and development functionaries globally.

As it is world known fact that Indian Vedic Culture is the only base of Sustainable civilization and environment friendly. I wish through a call on this way. I believe that scientists, scholars and development functionaries from several countries converging at a common platform during this seminar will avail excellent opportunity to share experiences to harness gains of science and Technology for human welfare.

I congratulate the organizers and wish them grand success.


(Prabhu Lal Saini)

निवास : 47, सिविल लाईन्स, जयपुर-302006



Ag. Er. Esmail Eqbal

President of
African Asian Studies Promotion Association
Afrikanisch-Asiatische Studienförderung e. V.



Message

I am happy to learn that Mahatma Gandhi House in Göttingen is hosting the 7th international seminar organized by the “International Foundation for Sustainable Development in Africa and Asia” (IFSADAA) jointly with the “International Council for Sustainable Agriculture” (ICSA) in Viechelde, Germany and other organizations.

AASF being secular, Non-Profit, non-governmental organization has been actively engaged in organizing reintegration seminars for the last 3 decades, preparing academics from Africa and Asia who after years of study stay in Germany are preparing their return to their respective countries.

IFSADAA was established at AASF in 2007 and since then been promoting application of science and technology for the welfare of peasantry and civil society in the spirit of Mahatma Gandhi through a series of international seminars conducted at Mahatma Gandhi House, at the Institute of Plant Breeding and Acclimatization in Radzikow, Poland, at the Cereal Research non-profit in Szeged, Hungary, and at the Universal Institute of Technology in Hisar, India.

I understand that the themes of the seminar include topical issues of food security through the management of natural resources like agro-diversity, land, water, applied inputs like agrochemicals while sustaining the soundness of the environment and income generation for livelihood. All these issues are cardinal for each government and the global community.

I wish that the Local Organizing Committee (LOC) with the International Advisory Committee members will do their best to realize the goals of sustainable development for the welfare of mankind.

As president of AASF I assure you that we shall do our best for the success of this seminar as well as for your comfortable stay.

I congratulate all participants and wish the fruitful discussion.

Ag. Er. Esmail Eqbal

Programme



7th International Seminar 2016

Sustainable Resource Management Towards
Food, Energy, Environment and Livelihood



Sunday, November, 27, 2016

10:00-13:00	Registration	
11:30-12:00	Tea Break	
12:00-13:00	Registration	
13:00-14:30	Welcome Lunch	
Time	Speaker	Title

Theme: Resource Management / Co-chairs

14:30-15:00	Prof. Arthur Riedacker	Why Should Fertilizer for Cereal Production Be Subsidized in all Countries to Meet the Target of 2015 Paris Agreement on Climate Change?
15:00-15:30	Prof. Wolfgang Merbach	Effect of Mineral Fertilization on C and N Contents in Soil of Long-term Fertilization Trials in Halle/S
15:30-16:00	Prof. A. Bağcı	The Heavy Metal and Mineral Compositions of Grains of Dome Triticale Genotypes
16:00-16:30	Prof. Neeru Narula	Plant Growth Promoting Rhizobacteria for Bio Control of Plant Diseases: Mechanism of Action and Use for Crop Production

16:30-16:45 Coffee Break

Theme: Agro-Biodiversity / Co-chairs

16:45-17:15	Prof. K. D. Sharma	Photosynthetic Efficiency and Antioxidative Defense Mechanisms induced by AM Fungi in Wheat (<i>Triticum aestivum</i> L.) under Terminal High Temperature Stress
17:15-17:45	Dr. Arifur R. Siddiqui	Achieving Food Security in the Chittagong Hill Tracts: Denmark's support to Agriculture in the Region
17:45-18:05	Dr. Babita Khosla	Aluminum Tolerant Isolates of Ectomycorrhizal Fungi for Reclamation of Bauxite Mined Out Acidic Soils
18:05-18:25	Dr. Iqbal	The Threat to Food security from Climate Change in Sri Lanka
18:25-18:45	Dr. Kahsai Wolde-Giorgis	Sustainable Development Issues in the East-African Context regarding energy

19:00 Dinner

Monday, November, 28, 2016

Inaugural Session

09:00-10:10	Welcome & Greetings
10:10-10:25	Inaugural Address
10:25-10:30	Vote of thanks
10:30-11:00	Tea Break & Press Conference

Theme: Plant Breeding & Biotechnology / Co-chairs

11:00-11:30	Dr. Manfred Kern	Global Food Security / Nutrition Security 2025/2050: Impact of Pollinator Services in Agriculture
11:30-12:00	Dr. Andreas Börner	Plant Genetic Resources for Food and Agriculture (PGRFA) – Conservation and Utilization for Research and Plant Breeding
12:00-12:30	Prof.. Ravindra N. Chibbar	Food Diversity to Combat Global under- and over- Nutrition and Improve Human Health
12:30-13:00	Prof. Geert Haesaert	Water use Efficiency and Grain Yield and Impact on Photosynthetic and Fluorescence Parameters of Drought Stressed Triticale Genotypes

13:00-14:00 Lunch

Theme: Sustainability, Energy & Poverty / Co-chairs

14:00-14:30	Prof. N. El Bassam	Facing the Challenges of Poverty of Hunger and Migration
14:30-15:00	Prof. M. Osaki	Achievement of CDEFs securities in high carbon/water reservoirs ecosystem by tropical peatland restoration
15:00-15:30	Prof. Preben Maegaard	Wind Energy as a Lever for Community Development
15:30-15:45	Dr. Munish Nagpal	Perspectives and Challenges of Solar Energy Applications in Haryana
15:45-16:00	Dr. Sam Essiamah	Solar Lamps for Ghanaian School Children as Incentive for Sustainable Tree Planting in the context of North-South School Partnership

16:00-16:15 Coffee Break

Theme: Plant Breeding & Biotechnology / Co-chairs

16:15-16:45	Prof. E. Arseniuk	Resistance Breeding of Crop Varieties for Integrated Pest Management(IPM) Implemented into Various Agricultural Production systems.
16:45-17:15	Prof. Dieter Trautz	Sustainable Intensification - the Future of Agriculture?
17:15-17:35	Dr. Afifuddin Latif Adiredjo	QTL for Leaf Morphological Traits Associated with QTL for Leaf Carbon Isotope Discrimination and Water Use Efficiency in Sunflower
17:35-17:55	Dr. Latifa Zhouri	Genotype x Environment Interaction in Morocco: Growth and Behavior
17:55-18:15	Dr. Jyoti Rana	Root Lesion Nematodes: 'Hidden Enemies' of Crop Plants
18:15-18:35	Dr. S. Khatodia	Development of Virus Resistant Transgene-free Mung Bean Plants using CRISPR/Cas9 System
18:35-18:50	Nishat Passricha	Lectin receptor like Kinase: a boon for salt stress tolerance in rice

19:00 Dinner

Tuesday, November, 29, 2016

Theme: Plant Breeding & Biotechnology / Co-chairs

09:00-9:30	Prof. R.K. Behl	Mitigating Climate Change Effects on Yield in Cereal Crops Through Plant Breeding and Biotechnology
9:30-10:00	Prof. Csaba Lantos	Wheat Phenotyping for Abiotic Stresses via Complex Stress Diagnostic System
1:00-10:30	Prof. S. K. Pahuja	Combining Ability and Heterosis Studies in Forage Sorghum Hybrids for Yield, Quality and their Related Traits

10:30-11:00 Coffee Break

11:00-11:20	Dr. Damanhuri	Is the Different Time of Emasculation Affect the Black X White Rice (<i>Oryza sativa</i> L.) Hybridization?
11:20-11:35	Éva Nagy	Wheat Phenotyping for Abiotic Stresses via Complex Stress Diagnostic System
11:35-11:50	M. Kapás	Characterization of Genetic Resistance to Rust Diseases in Triticale Cultivars

Theme: Technology / Co-chairs

11:50-12:20	Prof. P.B.S. Bhadoria	Technology Intervention for Sustainable Developments
12:20-12:50	Prof. Neeraj Dilbaghi	Nanomaterials Based Sensors for Environmental Applications
12:50-13:10	Dr. Insa Kühling	On-Farm Research in Western Siberia: Potential of Adapted Management Practices for Sustainable Intensification of Crop Production Systems
13:10-13:25	Dr. Alka Vasan	Value Addition and Processing: A Study of Barley Based Cookies
13:25-13:50	Manisha Mani	Agri-preneurship: Sustainability in Food and Environment
13:50-14:00	Dr. Palvinder Singh	Imperatives of Teaching Elements of Sustainability at Undergraduate Level for sensitizing youth
14:00-14:10	Rahul Pannu	Role of farm machinery in sustainable rice production in India

14:10-15:00 Lunch

Closing Ceremony

15:00-15:10	Summary
15:10-15:20	Closing Remarks and signing of MoU
15:20-15:30	Vote of thanks

15:30-16:00 Coffee Break

Wednesday, November, 30, 2016 & Thursday, December, 1, 2016

08:00-17:00	Scientific Excursion to IFEED
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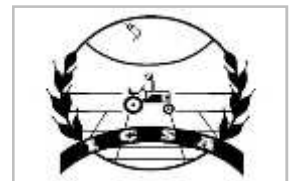


Abstracts



7th International Seminar 2016

Sustainable Resource Management Towards
Food, Energy, Environment
and Livelihood



Karl Fritz Heise Lecture

Dr. Karl Fritz Heise (1925 - 2004)

Mitbegründer der AASF e.V.
Geschäftsführer der AASF e.V.: 1959 - 2004
Verleihung des Bundesverdienstkreuzes: 1996



Dr. Manfred J. Kern

Managing Director
agriExcellence GmbH
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Global Food Security / Nutrition Security 2025/2050: Impact of Pollinator Services in Agriculture

ABSTRACT

Improvements in future agriculture are key requisites to safeguard food and nutrition security in 2025 and 2050. Global crop production has to be doubled between 1995 and 2025 triggered by population increase, modified eating habits, increased calorie and meat as well as vegetable consumption. Between 2015 and 2050 more than a doubling of food/crop/fruits/vegetable/stimulants/nuts production is necessary in order to feed 9.3 billion people living on earth. Key factors, which have to be considered are: loss of arable land caused by urbanization, industrialization, desertification; water shortages; shrinking resources; climate change; species extinction; economic disparities; political instabilities; migration; global trade; new cutting edge technologies in agriculture; digital information systems. Besides that, pollination is a key process providing food/nutrition security and wider ecosystem stability. Agricultural crop production is mainly based on self-pollination (e.g. wheat, corn, rice,) and 35 percent of pollination by insects, birds and bats (e.g. fruits, vegetables, nuts, beans, stimulants). Methods: Calculations and forecasts based on around 600 actual lead papers and books from different fields were made in order to assess the demand and value of pollination services in global agriculture by 2050. The value of pollination done by insects such as bees, bumblebees, hover-flies, butterflies, beetles is calculated to \$US 150 – 250 billion per year by several authors. This is close to 10 percent of global value of agricultural production. The necessity to intensify agricultural production implicates an intensification of pollination (commercial pollination/wild pollinators) by factor 3 until 2050. A “Pollinator Vision 2025/2050” reflecting the increased demand of crops being pollinated will be given in order to demonstrate, what is needed to feed global population. Essential management tools will be shown to safeguard pollination in agriculture, to protect ecosystem services, threatened species, biodiversity as well as the environment.



Theme: Plant Breeding & Biotechnology



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Plant Genetic Resources for Food and Agriculture (PGRFA) – Conservation and Utilization for Research and Plant Breeding

A. Börner^{*1}, M. Agacka-Moldoch^{2,1}, M. Allam^{3,1}, M.A. Rehman Arif^{4,1}, M. Börner^{5,1}, R. Tarawneh¹, U. Lohwasser¹, M. Nagel¹

¹ Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben, Germany

² Institute of Soil Science and Plant Cultivation, State Research Institute, Puławy, Poland

³ National Research Center, Cairo, Egypt

⁴ Nuclear Institute of Agriculture and Biology (NIAB), Faisalabad, Pakistan

⁵ Enza Zaden Research & Development B.V. Enkhuizen, The Netherlands

ABSTRACT

Plant genetic resources play a major role for global food security. The most significant and widespread mean of preserving plant genetic resources is ex situ conservation. World-wide 7.4 million accessions are stored in about 1,750 ex situ gene banks. One of the ten largest ex situ collections of our globe is located at the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) in Gatersleben, Germany, conserving 150,000 accessions from 3,200 plant species and 780 genera. Since the majority of genebank holdings globally are stored as seed, seed storability is of exceptional importance for germplasm conservation. At IPK research on seed longevity was initiated for a range of crops and wild relatives stored over decades. Historical germination data accumulated during 35 years of seed monitoring were analysed to predict species specific seed longevity at IPK storage conditions. The study considered 75 species. In total 157,402 observations comprising 79,075 accessions were analysed. Beside interspecific differences variation was also detected within species and genetic analyses were initiated using long term stored and experimental aged materials. The complex trait seed longevity was studied exploiting classical quantitative trait locus (QTL) analysis and association genetics. Association-based trait mapping, largely and effectively used in human genetics, is an innovative methodology in detecting genes. Results obtained for wheat, barley, oilseed rape and tobacco are presented.



Food Diversity to Combat Global under- and over- Nutrition and Improve Human Health

ABSTRACT

Global agricultural production has generally kept pace to meet the demands of a growing world population in terms of dietary energy requirements (9.2 MJ/day) needed for daily normal functioning of human body. In developing countries significant progress is being made to meet the requirements of macronutrients such as carbohydrates and proteins, but there is still the widespread deficiencies of micronutrients such as of minerals and vitamins. Even in the developed countries diet rich in macronutrients is deficient vital micronutrients, which also results in malnutrition. In developed countries, the food habits lead to overconsumption of macronutrients (>11.3 MJ/day) which combined with lifestyle changes has resulted in an overweight and obese population. The obesity has resulted in an increased incidence of non-communicable chronic diseases, such as diabetes, coronary heart disease, colorectal cancer which are major challenges to human health and wellbeing. Agriculture production systems have focused to ensure increased production of staple foods to meet the dietary energy requirements of human beings. However, in recent years, emphasis has been placed on production of crops with desirable macro- and micro- nutrients. In developed countries several new foods are being introduced to obtain a balanced diet. In human diet the major source of energy is starch, which is also the predominant storage carbohydrate in grains including cereals and pulses and in tuber crops. Starch is an energy dense molecule present as a water-insoluble granule composed of one-quarter amylose and three-quarters amylopectin, along with traces of lipids and proteins. In spite of this basic uniform structure of starch, it differs in digestibility depending upon the botanical source. Therefore, the energy or calories contribution by different food groups in human diets also differ. Starch digestibility is the first and primary step in carbohydrate participation in human diet. Based on its in vitro enzymatic hydrolysis, rate of glucose release and its absorption in the gastrointestinal tract; starch is classified as readily digestible starch (RDS), slowly digestible starch (SDS), and resistant starch (RS). Results show that size of starch granules, amylose: amylopectin ratio as well as amylopectin chain length distribution are important determinants of the extent of digestibility or, resistant starch in food. The values of hydrolytic and glycemic index can then be used to design diet plans for calorie deficient regions or in the developed countries for weight control, disease prevention and management in people suffering from diet related diseases. For micronutrients, minerals such as iron and zinc and vitamins also need to be improved. Recent results to improve micronutrients will be presented. The proposed strategy is to develop a combination of food grains that not only provide the dietary energy, but also provides balanced macro- and micro-nutrients in diet for the benefit of human health and wellbeing.



Mitigating Climate Change Effects on Yield in Cereal Crops Through Plant Breeding and Biotechnology

ABSTRACT

Wheat is one of the most important cereal crops globally meeting about 35% caloric needs of world population. Wheat is grown in diverse ecological niches worldwide. Wheat crop is exposed to early or late heat stress depending on eco-geographical areas and time of sowing, intermittent water deficit/excess stress due to untimely rains and lodging due to hail storm and/or strong winds. Global mean temperatures will rise 0.3°C per decade during the next century with an uncertainty of 0.2 to 0.5°C as per report of Inter-Governmental Panel on Climate Change (IPCC). Thus global mean temperatures should be 1°C above the present values by 2025. Moreover, global warming effects will vary diurnally, seasonally and with altitude. Heat stress affects at least 15 million ha of spring wheat alone with terminal heat stress (40%) while about 7 million ha are grown in continual heat stress in developing world. The demand for the wheat is expected to grow by approximately 1.6 percent per year worldwide and by 2 percent per year in developing countries by the year 2020. This implies that global warming impact will have geopolitical implications for wheat production per se, wheat trade and food security. High temperature (>30°C) at the time of grain filling is one of the major constraints in increasing productivity of wheat tropical countries like India. Cultivars differ in their relative adaptation to hot environment irrespective of their yield performance in cool environment. Experiments have shown that 1°C rise in temperature above ambient temperature during the period between the end of tillering to the beginning of grain filling reduced the grain yield by 4% under heat stress conditions. This warrants for new and more efficient wheat breeding methodologies to identify the new traits, particularly physiological traits, optimization of basic development with respect to raising yield potential and to complement existing breeding techniques for warmer heat growing regions worldwide. The most important step is to recombine elite genotypes, introgression of genetically diverse source to incorporate *Vrn*, *Ppd*, and *Eps* genes, increase partitioning of photo-assimilates, translocation from stem to grain of soluble carbohydrates (stem reserve), ability to maintain green leaf area duration (stay green) and to improve radiation use efficiency through out grain filling period and to provide genetic plasticity for resilience against environmental fluctuations. Facultative wheat resulting from spring x winter wheat crosses may hold promise. Plant response to heat stress differs from one phenological stage to another. The most thermo sensitive stage is GS₂ (double ridge to anthesis stage). Also, the complex physiological-genetic relationships conditioning heat tolerance must be combined with genes necessary for superior agronomic performance. Therefore, breeders use empirical selection with visual screening traits such as biomass, tillering ability, and leaf senescence. Genes governing different mechanisms for heat tolerance are scattered over multitude of germplasm lines. This paper summarizes recent efforts in breeding heat tolerant wheat varieties. An integrated approach embarking on morpho-physiological and molecular markers would be worthwhile.



Doubled Haploid Plant Production in Different Monocot Specieses: Wheat, Triticale, Spelt Wheat and Rice

Csaba Lantos¹ Lajos Bóna² Mihály Jancsó³ Edit Gregova⁴ Darina Muchova⁵ János Pauk^{1*}

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² Department of Minor Cereals, Cereal Research Non-profit Ltd., H-6701 Szeged, Hungary

³ Research Department of Irrigation and Water Management, National Agricultural Research and Innovation Center (NARIK), H-5540 Szarvas, Hungary

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ABSTRACT

Doubled haploid plant production methods play key role in applied research and breeding of crop plants. The most frequently applied DH plant production methods are anther culture, isolated microspore culture and intergeneric pollination. In our wheat and triticale breeding program, anther culture is an effective tool for doubled haploid plant production. Thousands of anther culture-derived wheat and triticale plants are produced for different breeding programmes. The observed spontaneous rediploidization rate was low in triticale (~13%), while this value was approximately three times higher in winter wheat. Anther culture protocol and isolated microspore culture method was tested with four spelt wheat genotypes. Androgenesis was induced in each of genotypes tested. The low plant regeneration rate and high number of albinos limited the practical application of isolated microspore culture while anther culture was efficient for green plantlets production in spelt wheat. The mean of green plantlets production was high, 41.45 green plantlets/100 anthers (from 20.93 to 83.07). In contrast with the above mentioned species, a lot of microspore-derived calli were produced in anther culture of rice genotypes. Green plantlets were regenerated via organogenesis. The low plant regeneration efficiency and high number of albinos limited the large scale production of antherculture-derived DH rice plants.



Combining Ability and Heterosis Studies in Forage Sorghum Hybrids for Yield, Quality and Their Related Traits

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* Bajra Section, ¹Forage Section, Dept. of Genetics and Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana

ABSTRACT

Livestock sector plays a critical role in livelihood security and the welfare of India's rural population. This sub-sector of agriculture adds almost 32 % of agriculture output in India. India supports 20 % of the livestock population of the world on 2.3 % geographical area only. The country faces a net deficit of 61.1 % green fodder, 21.9 % dry crop residues and 64 % feeds. Forage sorghum hybrids [*Sorghum bicolor* (L.) Moench] have the potential to fill the growing demand of green fodder because they are commonly grown in areas where rainfall is insufficient for corn (*Zea mays* (L.) production. For combining ability analysis, we have used 6 lines and 5 testers for two successive years. High general combining ability effects were observed for lines 637A and 733A and tester HJ 541. The crosses 725A x HC 308 and 467A x IS2389 were found to be high specific combiners for green fodder yield; 2219A x HC308 for no. of tillers per plant and 467A x IS2389 and 733A x HJ541 for plant height. The standard heterosis was observed for cross 467A x IS 2389 for green fodder yield and plant height and cross 2219A x HC 308 high for number of tillers per plant. Combining ability analysis is helpful in identifying the parents which could be used for hybridization programme to produce superior hybrids for forage crop improvement.



Water use Efficiency and Grain Yield and Impact on Photosynthetic and Fluorescence Parameters of Drought Stressed Triticale Genotypes

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ABSTRACT

Triticale combines a high productivity from wheat with good disease resistance and adaptability to marginal environments from rye. Therefore, a high drought stress tolerance is expected from triticale. A drought stress experiment was set up, combining a triticale and two wheat cultivars with different drought tolerance levels. Drought stress was applied during elongation stage or grain filling stage and control plants received optimal irrigation during complete life cycle. The main focus of this experiment was to study and compare photosynthesis and fluorescence parameters, yield parameters and root growth between cultivars and treatments. Data revealed triticale to be least affected by drought stress during both developmental stages. In contrast with wheat, no significant differences between control and stress treatments are detected for net photosynthesis (Anet), stomatal conductance (gs), and chlorophyll fluorescence parameters. Drought stress during elongation stage has most impact on the number of productive shoots, grain yield and number of grains for both wheat cultivars. For triticale, dry conditions seem to affect apical dominance, causing the plants to produce fresh shoots and buffering the reduced number of spikelets that is formed under stress conditions. Triticale's root system was significantly more extensive, when compared with both wheat cultivars. Although the maximal root length was not longest, more roots were formed and root dry weight was highest. Water use efficiency (WUE) is an important trait to assess adaptation of agricultural crops to drought as climate change risk. Carbon isotope discrimination offers potential as a proxy for WUE, but its application is hindered by environmental factors and thus varies greatly among different studies. The use of carbon isotope discrimination as a proxy of intrinsic WUE and grain yield was tested under field conditions in a hot arid, steppe climate of Limpopo in South Africa. Four moisture levels ranging from well-watered to severe stress were combined with four triticale genotypes in a two-year study. The results showed that moisture level significantly influenced grain yield, intrinsic WUE and carbon isotope discrimination in triticale. Well-watered conditions significantly increased grain yield which ranged from 3.5 to 0.8 t ha⁻¹ and 4.9 to 1.8 t ha⁻¹ in 2013 and 2014 respectively. Carbon 13discrimination ($\Delta^{13}C$) was also high under well-watered conditions and decreased with decreasing moisture level while

intrinsic WUE increased with decreasing moisture level. The relationship between $\delta^{13}\text{C}$ discrimination and grain yield was positive ($P < 0.01$) and only significant under water stressed conditions, indicating dependence of the relationship on moisture level. The relationship between $\Delta^{13}\text{C}$ and intrinsic WUE was not moisture dependent but showed a negative relationship when data for all moisture levels was combined. However, no genotypic differences were observed in $\Delta^{13}\text{C}$, showing lack of genotypic diversity in the studied genotypes. The results of this study show that carbon isotope discrimination could be useful as a grain yield predictor in drought prone areas. $\Delta^{13}\text{C}$ also offers potential as a proxy of intrinsic WUE. The negative relationship observed between $\Delta^{13}\text{C}$ and intrinsic WUE means that breeding for lower $\Delta^{13}\text{C}$ could result in higher intrinsic WUE in crops.



Resistance breeding of crop varieties for Integrated Pest Management (IPM) implemented into various agricultural production systems

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ABSTRACT

There is a multitude of Integrated Pest Management (IPM) definitions. This paper will stick one of EU according to which “IPM means careful consideration of all available plant protection methods and subsequent integration of appropriate measures that discourage the development of populations of harmful organisms and keep the use of plant protection products (PPP) and other forms of intervention to levels that are economically and ecologically justified and reduce or minimise risks to human health and the environment”. Each IPM has a strategy to prevent pests from reaching economically damage levels and combines multitude of methods, e.g. biological control methods, host plant resistance, appropriate farming practices, etc. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. It should also be stressed, that IPM is highly complex due to multidisciplinary approach & skills of experts on: Entomology, Acarology, Plant Pathology, Nematology, Pathophysiology, Water management, Economy, Sociology, Politics. To assist Member States in 2011, ENDURE produced a guidance document “On the implementation of the eight principles of IPM”. These are as follows: 1 – achieving prevention and/or suppression of harmful organisms; 2 – monitoring, 3 – decision based on monitoring and thresholds, 4 – non-chemical methods, 5 – pesticide selection, 6 – reduced use, 7 – anti-pesticide resistance strategies, 8 – evaluation. Among the multitude of methods and principles developed to protect plants from pests there is also plant breeding for resistance which supposed to be at the forefront of IPM. It still remains to be determined what role breeding for resistance plays in different agricultural systems. Some agricultural systems are more resilient than other. More resilient production systems based on full exploitation of all the principles of Integrated Pest Management (IPM) might avoid unexpected and severe losses of yield. This work describes gaps and needs to develop arable crop varieties for sustainable and low-input agricultural production systems. Because of farming structure and a high adoption of on-farm resources the major part of the farming systems in Poland is classified as a low-input one. However, a large proportion of Polish farms uses off-farm resources which could thus be classified as high-input farming systems. In general, the farming systems in Poland undergo steady changes and sustainable agricultural approach is being developed. This is especially because plant varieties grown under sustainable and low-input farming systems, not solely in Poland but also elsewhere, are expected to have less pest pressure as such agricultural systems are more resilient to environmental stresses. Many of the methods developed for sustainable and/or low-input

agricultural system are in part also derived from conventional agriculture. For example, Integrated Pest Management, a multifaceted system that uses various pest management methods, considers plant resistance as a key lever for pest management whenever possible although it is not well-known whether the breeding approach for conventional agriculture differs from one performed for IPM. Breeding for resistance is of paramount importance also for agriculture in Poland. It encompasses all crops, “their” diseases and pests what will be the subject of discussion in this paper presented at the 7th IFSDAA International Seminar On Sustainable Resource Management Towards Food, Energy, Environment and Livelihood.



Nanomaterials Based Sensors for Environmental Applications

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ABSTRACT

Rapid industrialization and innovative agricultural practices has polluted the environment considerably. Microbes, heavy metals, pesticides, dyes, organic waste and industrial solvent are the main pollutants present in water bodies. These toxic substances enter into food chain and human system through water sources. Heavy metal contamination is largely and adversely affecting the food, beverages, air, soil and water. A qualitative and quantitative estimation of different contaminants is required essentially to address different issues related to human healthcare. The main techniques used presently for heavy metal detection are atomic absorption spectroscopy, X-ray fluorescence, ICP-MS and stripping voltammetry. All these conventional techniques have certain limitations associated with these like need of laboratory, pre sample treatment, need of expertise, interference from other contaminants and high cost per sample. Electrochemical determination of specific analytes with cyclic voltammetry (CV) and chronoamperometry is gaining high attention among researchers and scientific community. Ease of handling, high sensitivity and selectivity, low detection limit and reproducibility are some key factors electrochemical methods. Enhanced electrochemical response with lowest detection limit can be attained with the help of nanoparticle modified electrode. Large surface area, tuneable band gap, catalytic property and high electron communication feature are some exotic features of metal based nanoparticles. This work deals with the synthesis of metal based nanoparticles with different sizes and morphologies. Characterization of synthesized nanoparticles was carried out with the help of spectroscopic and microscopic techniques. The electrochemical estimation of certain heavy metals has been achieved using nanomaterial modified electrodes. A detection limit in the range of ppb was achieved with the help of fabricated sensor.



QTL for leaf morphological traits associated with QTL for leaf carbon isotope discrimination and water use efficiency in sunflower (*Helianthus annuus* L.)

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ABSTRACT

The study was conducted to identify the quantitative trait loci (QTL) controlling leaf area (LA) and leaf area duration (LAD) and to analyze their relationships with QTL for leaf carbon isotope discrimination (CID) and water use efficiency (WUE) in sunflower. The traits were scored in a population of recombinant inbred lines (RILs) from a cross between XRQ and PSC8. The trial was designed as a randomized block with 150 genotypes (148 RILs and two parents) and two replicates. Each replicate consisted of two treatments, well-watered (ww) and water-stressed (ws). A total of 48 QTL was found for the traits investigated. Several QTL were detected to be associated with QTL for CID and WUE which was previously found. We identified common marker location controlling LA and LAD corresponding to linkage group 06 (LG06). Our results showed that identification of QTL for LA and LAD can be used to identify marker location for a physiological complex trait like CID. The association between LA, LAD, CID and WUE in the genomic regions is relevant to marker-assisted selection (MAS) method in plant breeding.

Genotype x Environment Interaction in Cocksfoot Hybrids in Morocco: Growth and Behavior

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ABSTRACT

Changes in climate patterns increase the risk of summer drought and the area of Mediterranean climate conditions. One way to avoid the drought period is by using perennial forage species such as *Dactylis glomerata* or *Festuca arundinacea*. Perennial grasses contribute to the agro-ecosystems sustainability by reducing soil erosion and conserving soil water. Cocksfoot (*Dactylis glomerata* L.) is the fourth most important forage grass in the world, characterized by its good productivity in pure and mixed crops. The present research focused on characterization of some hybrids generated by crossing a summer dormant genotype from the variety Kasbah (*Dactylis glomerata* ssp. *hispanica*) from Morocco and a summer active genotype from the variety Medly (*Dactylis glomerata* ssp. *glomerata*) from France under three different environments. The objective of this research is to study the effect of genotype x environment interaction on summer dormancy and productivity traits to know finally which environment lets hybrids produce well in spring and promotes their dormancy in summer. During this study, we assessed certain parameters dry matter, heading date, senescence, and plant height. After three years, results are promising, revealed significant differences and different responses to each environment.

Root lesion nematodes: ‘hidden enemies’ of crop plants

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ABSTRACT

Food is a fundamental human right, and yet one in nine people around the world (805 million) go hungry every day, so a major challenge in the coming years will be to ensure food security for the ever-increasing human population. Plant parasitic nematodes (PPNs) can reduce crop yields and account for crop losses of up to US\$ 125 billion per year worldwide. PPNs are amongst the five most important groups of plant pest in terms of economic losses in agriculture and horticulture, the others being viruses, fungi and bacteria and insects. Root lesion nematodes (*Pratylenchus* spp.) are important migratory PPNs that attack the roots of more than 400 plant species including economically important crops such as wheat, barley, banana, sugarcane and horticultural crops. Plants respond to pathogen invasion in a complex manner including changes in structure, metabolism, gene expression and/or physiological defences which can prevent invasion, development and/or reproduction of an invading organism. To combat host defences, nematodes have developed a battery of ‘effectors’ which enable them to establish successful parasitism. Such intricate interactions have been studied in sedentary PPNs, but no such detailed research has been undertaken for migratory endoparasitic root lesion nematodes. In this research we have identified a series of effectors of root lesion nematodes that are required for successful parasitism. These are being characterised using molecular tools such as and use RNA interference technology to understand their function. It is expected that this research will provide important new molecular and genetic information on root lesion nematodes – host interactions which could be exploited to develop new forms of resistance in crop plants.



Development of virus resistant transgene-free mung bean plants using CRISPR/Cas9 system

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ABSTRACT

Mungbean yellow mosaic virus (MYMV) disease is one of the most vicious diseases of green gram caused by begomoviruses, popularly recognized as geminiviruses. Both conventional breeding and transgenic strategies face the problem of ‘resistance durability’ brought about by the capacity of geminiviruses to evolve quickly. In the current scenario clustered regulatory interspaced short palindromic repeats (CRISPR)/CRISPR associated nuclease 9 (Cas9) has proved to be versatile technique that has very recently been deployed successfully to control different geminiviruses. Moreover, robustness, wide adaptability, and easy engineering of this system have proved its potential as a tool to control viruses. Cas9 nuclease and single guide RNA (sgRNA), which directs Cas9 to its DNA target, were expressed *in planta* for genome editing. The strategy of viral resistance using CRISPR/Cas technology is site specific genome editing of the host plant factors responsible to maintain viral life cycle. Many genes conferring resistance to viruses are recessive, including the eukaryotic translation initiation factors eIF4E. The association of natural mutations in the eIF4E genes with potyvirus resistance has been observed in various crops and applied to breeding the development of virus resistance in cucumber by utilizing Cas9/sgRNA technology to disrupt the recessive eIF4E gene function. Genome editing permits the introduction of alleles conferring resistance directly into the crop plants, without many backcrosses required by classical breeding. As “gene edited crops” do not necessarily include transgenic segments, they would not need extensive regulation, thereby opening a new publicly acceptable method for breeding of virus-resistant crops. We proposed an inimitable, unique, and broad spectrum controlling method based on multiplexed CRISPR/Cas9 system where a cassette of sgRNA is designed to target & delete a host factor like eIF4E which is strictly required for viral survival for generating novel genetic resistance to MYMV in mung bean. Using CRISPR/Cas9 genome editing, transgene-free mung bean phenotypes with stably-inherited mutations in target gene can be recovered as early as the primary T0 generation for rapid development of virus resistance which will not only benefit health of plant but also increase productivity. This technique is faster than traditional breeding methods and can produce a null segregant line that notably lacks the transgenic insert. The virus resistant genetically edited transgene free mung bean plants developed by this technique will be of prime importance to commercialize & large scale cultivation. The varietal phenotype will be modified only for the targeted feature; no other characteristic aspects of the modified variety will be changed.



Is the different time of emasculatation affect theblack X white rice (*Oryza sativa* L.) hybridization?

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ABSTRACT

In Indonesia, rice is the important staple food. There are three types of rice including white, brown and black rice. Black rice could become a functional-advantageous food because it has high antioxidant content. Black rice is still less cultivated by farmers due to long-lived period and low productivity. One of rice breeding program to solve the problem is hybridization between black rice and a variety of white rice that having short-live period and high productivity. Rice is self-pollinated plant species. Therefore, before crossing the rice, the emasculatation should be done. In this study, emasculatation had been done not only one day before flowering but also two and three days before flowering. The aim of this research was to study the effect of different time of emasculatation upon black and white rice hybridization. The research was conducted in the Dadaprejo village, Batu City, East Java Province, Indonesia, at ± 600 m above sea level, rain level at 1600 mm/year, minimum temperature was 18-24°C and maximum temperature was 28-32°C, humidity was 75-98%, and the type of soil was alluvial. The black rice materials were “Cempo Ireng” and “Jawa Melik”, and the white rice materials were “Ciherang” and “Pandanwangi”. The traits that measured including the percentage of hybridization result (%), flowering age (days), grain filling stage (days after hybridization) and grains color. The principal result showed that the hybridization was not influenced by the different time of emasculatation thus the hypothesis 1 (H_1) was rejected. It means that any emasculatation time yielded the same result. The study suggested that each of parent has same role in hybridization.

The Threat to Food security from Climate Change in Sri Lanka

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ABSTRACT

This paper looks at the threats to food security and biodiversity, their interactions from the impacts of climate change and possible solutions from a Sri Lankan perspective.

Background: Our food import bill has declined from 46% in 1970 to 18.2% in 2008 despite a doubling of the population in this period. Nearly 70% of rice, the staple food, is cultivated in the dry zone where annual rainfall is less than 1250 mm. Climate analysis shows the dry zone is vulnerable to increasing number of dry days and annual rainfall is decreasing by 7 mm per year.

The problem: Water resource are vulnerable to demand on river-flow (irrigation, sanitation, hydro-power), over-exploitation of ground water, and increased evaporation from rising temperature. Food and livelihood insecurity increased demand on ecosystem services from the forest. Reduced water availability affects the survival of fragile fauna and flora in these ecosystems and other species which are a source of food livelihood. The consequences are colonization by invasive species and over-exploitation of eco-resources. Of the total rainfall volume of 122 km³ in Sri Lanka, 31% escapes to the sea through rivers.

Solutions: Besides the traditional strategies of conservation of soil moisture and soil erosion new strategies are necessary to exploit the lack of (droughts) and availability of (floods) water from climate changes developed and practiced by indigenous farmers in regional countries. Bangladesh has developed vegetable cultivation in floating rafts. Indonesia has a system of wells and drains to reduce and divert flood waters. In Sri Lanka a cascade system of tanks, filled by rain water and interconnected by streams and spillways, provides water in the dry season. Villages are based around this tank system using the water for farming, livestock and sanitation. This know-how and indigenous technology should be exchanged and transferred within the regions. A regional network is required, with hubs to inventorize and disseminate this knowledge.

Lectin receptor like Kinase: a boon for salt stress tolerance in rice

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ABSTRACT

Kinases including lectin receptor-like kinase(*LecRLKs*) are known to play important role in regulating most of the important biochemical reactions in the cell including cell signalling pathways. Genes encoding plant lectin receptor like kinases(*LecRLKs*) are majorly intron-less. *LecRLK* proteins are transmembrane proteins which are divided into three domains-amino-terminal extracellular lectin domain, hydrophobic transmembrane domain and carboxyl-terminal intracellular Ser/Thr kinase domain. The role of *LecRLKs* in biotic and abiotic stress tolerance started emerging, however their involvement in stress tolerance in rice is not well studied. In this study the role of rice *LecRLK*(*OsLecRLK*) in salinity stress tolerance has been elucidated. Stress related microarray data of rice also showed the upregulation of few *OsLecRLKs* in salinity stress and their functional validation using real-time PCR confirmed their upregulation which suggests their possible involvement in salinity stress tolerance. Overexpression and knockdown (artificial micro RNA) transgenic rice plant were raised for *OsLecRLK* gene to confirm its role in providing the salinity stress tolerance. Confocal microscopic study of root for the localization of sodium and calcium ion of these lines give a comparative result which strongly suggest that *OsLecRLK* overexpression decrease the sequestration of sodium and calcium ion in roots and provide salinity tolerance. Other physiological tests such as leaf disc assay and chlorophyll estimation under different stresses suggest the key role of *OsLecRLK* in salinity stress tolerance. In order to understand its mechanism in stress tolerance we have initiated the isolation of its interacting partner through yeast-2-hybrid. This gene could also be used in providing the salinity stress tolerance in other crops which may lead to enhanced agricultural productivity.

Wheat Phenotyping for Abiotic Stresses via Complex Stress Diagnostic System

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ABSTRACT

Under Central- and Eastern European continental climate, the most frequent and significant abiotic stress is drought. The selection for tolerant genotypes is difficult because of the lack of permanent water shortage in the seasons and/or proper methods to test the practical drought tolerance of breeding material. Salty soil is another limiting factor in some regions. We have set up a complex stress diagnostic system (CSDS) in the greenhouse of the Cereal Research Non-profit Ltd., where we could analyse the responses of different wheat cultivars to drought and salt stress (separately and combined). The diagnostic system is incorporated between laboratory- and nursery experiments. The presentation will focus on the effect of water withdrawal on our DH mapping population Plainsman V/CappelleDesprez. Moreover, results from a combined abiotic stress experiment with an international (Azerbaijan, Serbia, Austria) wheat germplasm collection will be presented. The examined stresses were drought, salt and combined. Winter wheat plants were grown under ideal (control) water regime (watering to 60% of the 100% soil water capacity) and under drought stress conditions (watering to 20% of the 100% soil water capacity). For watering, a computer controlled half automatic equipment was used. The effect of water withholding on plant growth was tracked by a digital imaging system on the basis of the number of plant green pixels. After harvesting, plant heights, spike lengths, grain numbers and total grain weights were measured and values of well-watered and stressed plants were compared. The most tolerant 15- and sensitive 15 genotypes were selected for further tests. After the phenotyping experiment (greenhouse and nursery tests) of the mapping population, the genotyping will be carried out with DaRT marker technology and QTL analysis. We found differences between the stresses at the 14 international wheat varieties. The combined salt and drought treatment affected cultivars Gallio and Capo differently to the sole salt or water stress. These cultivars were sensitive to both stresses, but gave the best results in the combined treatment.

Characterization of Genetic Resistance to Rust Diseases in Triticale Cultivars

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ABSTRACT

Diseases caused by *Puccinia* species pose a great threat to grain yield both in wheat and triticale. The breeding and use of resistant cultivars offer an economical, safe, and effective approach to protect wheat from these diseases. Although the rust resistance of triticale relies on the genetic resources of wheat and rye, due to the very limited use of primary triticales in recent breeding programs, the genetic base of rust resistance in new triticale cultivars is expected to be increasingly vulnerable. In this study seedling resistances to stem rust and leaf rust were evaluated in 56 triticale cultivars originated from Algeria (5), Australia (7), Austria (2), Bosnia-Herzegovina (1), Hungary (7), Poland (25), Romania (4) and Russia (5) sent for the field demonstration trial of 9th International Triticale Symposium held in Szeged, Hungary. Mixture of pathotypes prevalent to Hungary were used both for leaf and stem rust resistance tests. Molecular markers were also used to determine the presence or absence of five leaf rust resistance genes (Lr9, Lr14a, Lr16, Lr20 and Lr28), four stem rust resistance genes (Sr13, Sr36, Sr38, and Sr39) and four yellow rust resistance genes (Yr5, Yr10, Yr15 and Yr36) located on A or B genome of wheat. Out of 56 entries 8 were resistant to leaf rust: Brat and Svat from Russia, Puzon, Silverado and Preludio from Poland, Yowie from Australia as well as Szilaj and Tátra from Hungary. Thirty-eight cultivars showed susceptible type of symptoms to leaf rust, while rest of entries showed mixed reactions. In stem rust tests, the rate of resistant cultivars was 86%, and that of the S type was 12% (the rest also showed mixed reactions). None of the five Lr genes identified by molecular markers showed linkage to resistance. Among Sr genes only the Sr13 (found in 13 entries) showed a possible linkage to resistance as its marker was not present in susceptible cultivars. According to marker tests the Yr10 and Yr15 resistance genes occurred in a high frequency (36 and 41%) and the rest was low (Yr5: 4%) or absent (Yr36); resistance to yellow rust was not tested. It could be concluded, that leaf rust resistance of triticale needs an urgent improvement, whereas stem rust resistance seems satisfactory. However, we have no information of their resistance against the recently appeared stem rust pathogen race Ug99 and its lineages. Data may help breeders to incorporate effective Sr and Yr genes into new cultivars.



Theme: Resource Management



7th International Seminar 2016

Sustainable Resource Management Towards
Food, Energy, Environment and Livelihood





Why Should Fertilizer for Cereal Production Be Subsidized in all Countries to Meet the Target of 2015 Paris Agreement on Climate Change?

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ABSTRACT

For the mean average temperature of the earth to remain below +2 ° C human induced net emissions are to be divided by two by 2050 and then to reach zero. In the meantime, the global population is going to have about 2 more billion people, e.g. + 1 billion in Subsaharan Africa. This means that fossil fuel is to be eliminated or their emissions sequestered. Food and nonfood biomass are therefore to be maximized wherever possible, provided it is locally acceptable and by avoiding further conversion of grassland and forest land into crop land. It is shown that increasing fertilizer input can help to increase land use efficiency, water use efficiency, mitigate climate change and help to better cope with climate change versus BAU scenarios. During the presentation we shall compare the effect of no mineral input, of organic input and of smart agriculture practices on potential yield increase, avoidance of land use change and reduction of GHG emissions in France, in Benin (a coastal country in Africa) and in semi-arid countries (e.g. in Burkina Faso a locked in country).



Effect of Mineral Fertilization on C and N Contents in Soil of Long-term Fertilization Trials in Halle/S. (Germany)

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ABSTRACT

In five long-term fertilization trials in Halle/S. (Eternal Rye, field F1a, field F1b, field F2a, Soil Formation Trial), mineral fertilization (NPK) compared to the unfertilized variant as well as increasing N rates (0 bis 400 kg N/ha) have shown an increase the C and N contents in the soil. This increase is closely related to the last year's crop yields. It has mainly been effected by the crop residues in the soil. The mineral fertilization contributed to the preservation and improvement of humus content and soil fertility. In the field trials in the last decades, all variants have shown a decrease in soil C and N contents regardless of the fertilization. The reasons for this was mainly the continued deepening of the ploughed layer and a reduce of the C- and N-emissions. The interdependency between plant growth and humus content is rather expressed by the plant yield determining the humus content much more than vice versa.

Bundesverdienstkreuz am Bande für Herrn Prof. Dr. Wolfgang Merbach

Herr Prof. Dr. Wolfgang Merbach wurde am 28. 9. 2016 durch den Bundespräsidenten Gauck das Bundesverdienstkreuz am Bande verliehen. Damit werden seine wissenschaftlichen Leistungen und seine langjährigen Bemühungen zur Förderung der Agrarwissenschaften im nationalen und internationalen Rahmen gewürdigt.



The heavy metal and mineral compositions of grains of some triticale genotypes.

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ABSTRACT

In the current study, mineral and heavy metal contents of several triticale grains were determined by inductively coupled plasma-atomic emission spectrometry (ICP-AES). The phosphorus and potassium contents of triticale grains ranged from 2932.6 mg/kg (Egeyıldızı) to 5667.0 mg/kg (TF5-12) and 5041.4 mg/kg (TMB-15) to 7822.6 mg/kg (TMB-5), respectively. While the highest calcium content was found in the TMB-25 triticale sample (883.3 mg/kg), the lowest calcium content was found in the Karma 2000 sample (304.6 mg/kg). The magnesium contents of triticale samples varied between 1522.2 mg/kg (TMB-1) and 2523.0 mg/kg (Tatlıcak). In addition, iron contents of triticale grains ranged from 49.0 mg/kg (TF5-10) to 4152.7 mg/kg (Egeyıldızı). Zinc concentrations fluctuated between 34.7 mg/kg (TF5-10) and 100.8 mg/kg (TMB-11). The lowest and highest manganese contents of triticale grains were found in Ayşehanım (27.4 mg/kg) and Egeyıldızı (381.7 mg/kg), respectively. The results presented here suggest that triticale grains could serve as a good source of mineral elements.



Plant Growth Promoting Rhizobacteria for Bio control of Plant Diseases: Mechanism of action and use for crop production

ABSTRACT

During this investigation, an attempt was made for *in vitro* production of antimicrobial antifungal substances from various strains of *Azotobacter* spp. and *Gluconacetobacter* spp. and were tested against *Sclerotinia sclerotiorum*. 40% of total strains tested were found to be siderophore positive. The antibiotic substances produced were extracellular, proteinaceous in nature and seems to be associated with some complex material. In addition to antifungal antibiotic Pyocyanin, various unidentified substances appeared in the supernatant of the culture (TLC). Out of ten cultures, four exhibited “chitinase” enzyme activity. During our studies, it was observed that plant exudates play an important and significant role in control of plant fungal diseases by helping the bacteria in its establishment and colonization on the plant. Three *Azotobacter* spp. and three *Gluconacetobacter* spp. were found to be promising in biological control of fungal diseases of wheat and mustard. Bacterial inoculation led to % reduction in disease intensity of flag smut of wheat (var. C-306) from 43.7-69.6% with increase in seed productivity from 4.10- 19.70 % under field conditions. Inoculation with *Azotobacter* spp. AVK42 and 103 showed increase in germination of mustard crop and 28.43 and 23.6% reduction in disease severity of white rust and *Alternaria* leaf blight, respectively under field conditions. Different mechanisms by which the bacteria suppress the growth of pathogen, showed that not one, but number of factors are involved in the development of an effective and efficient bio control agent and can also be used as bio fertilizer.



Theme: Resource Management



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Photosynthetic efficiency and antioxidative defense mechanisms induced by AM fungi in wheat (*Triticumaestivum*L.) under terminal high temperature stress

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ABSTRACT

The present research was carried out to study relative performance of wheat genotypes grown under timely and late sown. The late sown was inoculated with *Arbuscular mycorrhiza*. The AM fungus (*Glomus mosseae*) was introduced in the crop seeds with the fungi before seeding. The flag leaf was analyzed to assess the physiological traits like photosynthetic rates, chlorophyll and membrane stability, canopy temperature depression along with biochemical properties like ROS content, catalase, peroxidase and superoxide dismutase for stay green and senescence associated traits in all the treatments. Photosynthetic rate decreased significantly with late sown condition while transpiration rate increased. The reduced gaseous exchange parameters under late sown condition might be due to lower CSI, chlorophyll fluorescence and higher CTD. The high photosynthetic and transpiration rate was maintained by WH 1021 in all environments and observation stages suggested the tolerant nature of this genotype. The higher transpiration means cooler leaves and higher stomatal conductance favoring net photosynthetic rate and crop duration. CTD values were significantly changed among normal sown and late conditions in all the tested genotypes. The WH 1021 maintained cooler canopy under late sown condition also with the inoculation of AM fungi showed higher grain yield. The major role of transpiration is leaf cooling, CTD and its reduction relative to ambient air temperature is an indication of how much transpiration cools the leaves under a demanding environmental load. The lowest CTD value observed in WH 1021 suggested that genotype had relatively greater capacity for taking up soil moisture and maintained a better plant water status. It showed that this genotype remained photosynthetically active for longer period and stay green than other genotypes. Antioxidants like lipid peroxidation and reactive oxygen species were enhanced under terminal high temperature stress in late sown environment. AM fungi inoculated plants possessed less antioxidants and maximum reduction of 19.2% and 27.2% in MDA and ROS content respectively, at 21 days after anthesis was observed in WH 1021 under late sown condition. Due to increase in antioxidants, antioxidant defense system also turned active and there was increased activity of enzymes like peroxidase and superoxide dismutase till 14 days after anthesis and the decreased at 21 days after anthesis. Enhanced catalase, peroxidase and SOD activity observed in WH 1021 which was 18.6%, 24.1% and 13.9%, respectively with AM fungi treatment under late sown condition. AM fungi inoculation being more effective in all parameters studied under terminal warm environment. Among the tested genotypes, WH 1021 performed better

in terms of physiological, biochemical and yield related traits under late sown condition. Use of AM fungi as seed treatment, WH 1021 maintained stay green characters and delayed senescence for longer duration during reproductive period under terminal high temperature stress.



Achieving Food Security in the Chittagong Hill Tracts: Denmark's support to Agriculture in the Region

ABSTRACT

The Chittagong Hill Tracts (CHT) is located in the south east of Bangladesh. The region is home of 12 different ethnic groups in addition to the Bengali inhabitants, and has a population of over 1.6 million (1 percent of the national population). The CHT is geographically distinct from most parts of plain land Bangladesh, characterized by very steep, rugged mountainous terrain and dense jungle in areas. Poverty, land and population pressure, water scarcity, remoteness, poor service delivery, weak market linkages and pressure over natural resources are big challenges for the development in the Chittagong Hill Tracts. The land capability assessment for the Chittagong Hill Tracts indicates that it has only 6.0% good and moderate agricultural land, 15.6% poor agricultural land and 78.4% very poor and non-agricultural land. The creation of Kaptai Lake as part of the construction of the Kaptai hydroelectric dam in 1960 and the subsequent flooding of the fertile valleys took about 700 sq. km of the area's best agricultural land (40% of the best arable land) and permanently left the CHT as a cereal deficit area. Approximately 100,000 people, mostly indigenous, who used to cultivate the plane lands, were displaced. Most of them moved to higher hills of the region and had to adopt *Jum* cultivation for survival. In-migration of people from plain districts increased the pressures on the remaining agricultural land. From 1972 to 1997, a low intensity guerrilla war was waged in CHT in reactions to violations and suppressions of the rights of the indigenous people. The conflict was brought to an end in 1997 by signing the CHT Peace Accord. The Peace Accord is yet to be fully implemented. A review of basic socioeconomic indicators for the CHT shows a region that suffers from both income and human poverty. Poverty in CHT remains prevalent, despite significant progress in Bangladesh. The MDG Progress Report 2013 shows that proportion of population below upper poverty line varies from 33.2% to 50.5% in three hill districts, which are higher than the national average of 31.5%. A key indicator of poverty is food security. The population in CHT experiences moderate to severe food shortages on a seasonal basis, with nearly 65 percent of households having sufficient quantities of food from their own production for less than six months per year. Food shortages are often seasonal and reflect a dependence on agricultural cycles. According to a FAO assessment, 79% of the households in CHT are severely food insecure. Bangladesh Bureau of Statistics data show that per capita per day food consumption recorded as 1949 Kcal which is significantly lower than the national average of 2318.3 Kcal/capita/day. On an average, per capita income is about 40 percent lower than the national average. The majority of the people in CHT depends on agriculture for their livelihoods, with much of it being subsistence-oriented and focused on the traditional technique of a shifting cultivation called *Jum*. One of the reasons for food deficit is declining productivity of *Jum* cultivation because of shortened fallow period, afforestation programme of Forest Department & extension of reserve forests to *Jum* areas.

and commercial plantation by outsiders. *Jum* will continue to be the major agricultural practice in CHT, though *Jum* is already difficult and will continue to be increasingly difficult. *Jum* alone will not be sufficient to meet the livelihood and food security needs of the indigenous people in CHT. Agricultural research and extension should focus on necessary support services for *Jum* system improvement, gradual shift from *Jhum* to mixed fruit gardening and intensive vegetable agriculture. Participation of *Jum* people in improved natural resource management should also be introduced. Danida has been supporting the Agriculture and Food Security Project in the Chittagong Hill Tracts since 2009. Improving food security situation in CHT is one of major targeted outcomes of the project. The project targets valley agriculture as well as *Jum* agriculture. With support from this project, farmers are increasing and diversifying agricultural productions through integrating resources. Increased and diversified farm productions are leading to enhanced consumptions and increasing income from sales of produces. Better income further leads to better purchasing capacity and contribute in improved livelihoods.

Aluminium Tolerant Isolates of Ectomycorrhizal Fungi for Reclamation of Bauxite Mined Out Acidic Soils

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ABSTRACT

Acid soil infertility is a major limitation to crop production on highly weathered and leached soils in both tropical and temperate regions of the world. In addition, soil acidification induced by the activities of mankind has become of increasing concern in recent years. Two fundamental factors limit the fertility of acid soils; nutrient deficiencies e.g. phosphorus, calcium, magnesium and the presence of phytotoxic substances e.g. soluble aluminium and manganese. The tolerance of vascular plants to aluminium is now a major area of concern worldwide because aluminium is the third abundant element after Silicon and oxygen in earth crust approximately 8.8% of its weight. The response of mycorrhizal fungi to toxic metals is of importance in view of interest in their reclamation of bauxite mined out or polluted sites and influence on plant growth and productivity. The association of ectomycorrhizal fungi with tree roots greatly alters both root morphology and physiology. They have been shown to enhance seedling growth and alter patterns of ion uptake and plant nutrition. The ectomycorrhizal fungi improve the metal tolerance of their host plants by primarily accumulating metals in walls of extramatrical hyphae and extrahyphal slime, thus passage of metals to shoot is restricted. In the present study, different isolates of ectomycorrhizal fungi *Pisolithus albus* isolated from the basidiomata associated with Eucalyptus plantations in the Coastal areas of Chennai, Lignite mines of Neyveli and bauxite mining area of National Aluminium Company, Orissa, India were screened for their tolerance to aluminium. The influence of aluminium tolerant isolates on the growth and mineral nutrition of the host plants was studied *in vitro* as well as in bauxite mined out soil. The results showed that with increasing concentration of aluminium in the culture medium reduction in growth, increase in acid phosphates activity, decrease in calcium and phosphorus content of the mycelia was observed in all the fungi. The growth of *E. tereticornis* plantlets *in vitro* was significantly inhibited with increasing concentrations of aluminium but the presence of ectomycorrhizal fungi improved the growth of ectomycorrhizal plantlets as compared to nonmycorrhizal plantlets. The ectomycorrhizal plantlets showed significantly higher foliar concentrations of phosphorus, calcium, magnesium and potassium in their plant shoot tissue when compared to nonmycorrhizal plantlets at all aluminium levels. The results of nursery trial showed better survival of ectomycorrhizal inoculated plants of *E. tereticornis* in bauxite mined out soil as compared to uninoculated plants. The inoculated plants accumulated significantly less of aluminium in their roots thus protecting the plants from its detrimental effects. The soil after harvesting the plants was found rich in organic carbon, available phosphorus content in soil. The aluminium content was more in ectomycorrhizal fungi inoculated soil than uninoculated soil but was less than initially found in bauxite mined out soil.

On-Farm Research in Western Siberia: Potential of Adapted Management Practices for Sustainable Intensification of Crop Production Systems

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ABSTRACT

Western Siberia is of global significance in terms of agricultural production, carbon sequestration and biodiversity preservation. Abandonment of arable land and changes in the use of permanent grasslands were triggered by the dissolution of the Soviet Union in and the following collapse of the state farm system. The peatlands, forests and steppe soils of Western Siberia are one of the most important carbon sinks worldwide. These carbon stocks are, if deteriorated, an important source of radiative forcing even in comparison to anthropogenic emissions. This situation is aggravated by recent and future developments in agricultural land use in the southern part of Western Siberia, in particular in Tyumen province. The increase of drought risk caused by climate change will lead to more challenges in these water-limited agricultural production systems. The German-Russian interdisciplinary research project “SASCHA” aims to provide sustainable land management practices to cope with these far-reaching changes for Tyumen province. In particular, on farm scale agricultural strategies are being developed for increased efficiencies in crop production systems. Therefore, a 3-factorial field trial with different tillage and seeding operations was installed with spring wheat on 10 ha under practical conditions in 2013. Within all combinations of tillage (no-till/conventional), seed rate (usual/reduced) and seed depth (usual/shallower) various soil parameters as well as plant development and yield components were intensively monitored during the growing seasons. Results after 3-years show significant impacts of the tillage operation on soil moisture and soil temperature. Also a higher trend in nitrogen mineralization could be observed without tillage. Plant development in terms of phenological growth stages took place simultaneously in all variants. Under no till regime we measured slightly higher grain yields and significant advantages in protein yields. In conjunction with progressing climate change there seems to be high potential for enhanced production efficiency by no-till systems for the study region in Western Siberia. This way of sustainable intensification of agricultural production will also preserve carbon stocks and biodiversity as there is no need for expanding cropland area into currently natural ecosystems.



Theme: Poverty. Ecosystem & Energy



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Facing the Challenges of Poverty of Hunger and Migration

ABSTRACT

Tackling poverty, malnutrition and exodus which affect one-third of the world's population and serving the needs of the unserved should be our priority. We have the knowledge and the technologies to achieve these goals. What is needed is for all to be honest, faithful and credible – to ourselves as well as to others – to live in peace and dignity. Not only for a part of the world, but for all. The roots of migration are multi causal: Poverty, natural disasters, ethnic conflicts, wars, climate change, economic dislocation, lack of perspectives and bad governance. Lack of sufficient energy supply leads to lack of development. It is in countries and regions with energy shortages that populations suffer the most. It is imperative that with the era of fossil-fuel coming to an end, that future initiatives for energy supply be based on renewable energy. We from different regions around the world and with our respective fields of work should face the urgent challenges rapidly mounting on our horizon. Among them, front and center, the devastation of poverty that bears down on one-third of our neighbors, in both North and South. In East, as well as West. The kind of poverty that has become the root cause of hunger, malnutrition, economic dislocation and a host of related ills and imbalances. That degrades not just the every-day lives and dignity of those directly impacted; but also those who may feel they are far-removed from such conditions. Though in fact we are all victims of the crises brought on by unjust or ill-conceived policies and conflicts. Facing Forward: It is no secret that we have reached, perhaps passed, a tipping point when it comes to the indiscriminate use of fossil fuels and related technologies that help the balance-sheets of a few – while leaving the many to cope with the consequences. Among these, hazards to health and security; dwindling public services; lack of access to the basic wherewithal of life and living and educational opportunities that are mal-adapted to the world we are in. We are obliged persevere, each in our own way, nurtured by the cultural well-springs, and intelligence that are our heritage, whether from Asia, Africa, Europe, South and North America or elsewhere. As well as to join hands and work together, inspired, re-energized and committed. We need sustainable frameworks that really function: Autonomous sites (communities, villages and settlements) for decent living, economic development, production, trade, mobility, education, energy, water and food. Our Autonomous Site Project in Germany is one of the most suitable and workable option for tackling poverty, malnutrition and migration.



Achievement of CDEFs securities in high carbon/water reservoirs ecosystem by tropical peatland restoration

ABSTRACT

Natural wet-peatland is defined as high carbon/water reservoirs ecosystem, which ensure high carbon assimilation (high biomass productivity) and high carbon sequestration even in El Niño year. However, if high carbon/water reservoirs ecosystem has been destructing by impact on 1) Deforestation, 2) LULUCF, 3) Drainage for plantation, and 4) Climate change, water regime should drastically change, then high carbon/water reservoirs ecosystem transfer catastrophically into low carbon/water reservoirs ecosystem following 1) Carbon emission by fire, 2) Carbon emission by microorganism's oxidation, 3) Carbon loss thorough drained water, and 4) Reduction of carbon assimilation. Wet-Peatland has naturally high potential of Natural Capital such as 1) High Carbon Reservoir, 2) High Water Reservoir, 3) High Biomass Productivity, 4) High Biodiversity. If Wet-Peatland transfer into Dry-Peatland by drainage (or canal construction), these Natural Capital degrade quickly, gave several damage to climate, economy and social system in global scale. If Wet-Peatland is managed as "Sago based Ecosystem", CDEFs Securities achieve highly. CDEFs securities are as follow.

- 1) Climate Change security: Mitigation as Carbon Emission Reduction & Adaptation as High Biomass Production (enough water) against El Niño,
- 2) (bio-)Diversity security: High biodiversity by mix-planting and nature-conservation around peat dome,
- 3) Energy security: Biomass energy from sago starch and residuals, and other biomass materials in Sago based Ecosystem,
- 4) Food/Feed security: Sago starch for food and feed (animal husbandry and fish culture), and
- 5) social security: PES and CSR&CSV by several Credit (REDD+, JCM) and Foundation (GCF, CIFOR-Japan, FAO, so on).



Wind Energy as a Lever for Community Development

ABSTRACT

Especially after the COP21 in Paris in 2015 the world community realizes the liabilities of climate change are vast and therefore are supportive of renewable energy solutions. According to IRENA, International Renewable Energy Agency, in 2013 of world total of new installed power generation capacity, renewables covered 58%, leaving 42% for non-renewables (fossil and atomic energy). The transition when purposely organized can have a strong impact on the development of local economic development and infrastructure. Often when we speak about renewable energy projects supporting local development we refer to the creation of new jobs (usually related to the construction and maintenance of the installations) or, less frequently, to economic benefits for local cooperatives and other associative forms of ownership. Due to its decentral nature, renewable energy not only has the possibility to democratize energy policies and the energy sector, which have long been monopolized. At the same time renewable energy has the potential to democratize society through associative democracy leading to the solar age and the age of energy democracy. This will especially be beneficial for marginalized communities and the unserved populations in the developing countries. However, renewable energy projects can advance the development of the local communities where they are installed. Practical experience shows that wind and solar projects can support local development when appropriate ownership models are applied. Community ownership models reinvest the income generated from selling renewable energy to satisfy the needs of local communities –e.g. through improvement of infrastructure, creation of new jobs, energy renovation of public buildings, support to local associations, to provide support for local organizations, for environmental projects, local public e-transport, etc. In short, to provide benefits not just for a few investors but for everybody in the community with the consequence they all see renewable energy as a local infrastructure improvement. Local support of community ownership models is essential for the growth of renewable energy to its full potential worldwide. The case of Denmark: Also countries with a tradition for commitment to the transition from the fossil fuels are advancing their plans. In 2015 the share of wind power in Denmark (5,5 million inhabitants) increased to 42% of the total needs for power while the accumulated share of renewables increased to 58%. Compared to 1980 fossil fuels delivered 100% of the demand for electricity. The wind power installed capacity in Denmark by end of 2015 was 5 000 MW. Plans have been announced over the coming decades to increase to 20 000 MW which will allow wind energy to cover much more than the demand for electricity in Denmark of around 35 TWh per year. Of this wind power in 2015 was 14 TWh. With a factor four increases in the capacity wind energy besides fully covering the demand for electricity will also be supplying a significant share of the energy needs for heating of buildings and for mobility. In Denmark enjoys the general support of more than 80% of the population. However, at the local level a growing movement refuses to have large wind turbines near their homes. In many areas local protests (in Denmark we find more 200 local protest groups)

are opposing the development of new onshore wind power projects. However, we find examples in Denmark as well where wind turbine projects earlier faced strong local opposition and were cancelled while recent community owned projects have been fully accepted by the same residents that opposed them – even though the new wind projects use bigger machines on the same location and have similar technical characteristics to those wind projects that were originally rejected.

Conclusion: The key to addressing opposition and increasing community support is local ownership of wind turbines and other renewable energy initiatives using a development approach that clearly shares the benefits of projects throughout the local community. Wind projects can be developed by different ownership models, which lead to different results. Currently various definitions of community ownership are being used around the world. In my presentation, community ownership is focused on the objective of using the income generated by renewable energy projects to benefit the residents of local communities, i.e. the main objective is achieving the common good.



Perspectives and Challenges of Solar Energy Applications in Haryana

ABSTRACT

Haryana holds unique geographical position which favours harnessing solar energy for domestic, agricultural and industrial usages. However, its adoption is slow. This paper examines perspectives and challenges associated with solar applications in Haryana/ India. Energy is one of the major inputs for the overall development of any country. Main sources of renewable energy include sectors such as; Solar, Wind, Biomass, Small Hydro, Waste to Energy, Bio Diesel, OTEC (Ocean Thermal Energy), Wave Energy, Geo-thermal energy etc. The average annual energy demand per capita in India is 631 kWh(~ 1.7 kwh/day). State wise gross annual consumption in KWh is highest in Dadar and Nagar Haveli union territory (11567.67), Daman and Diu(8300), followed by Pondicerry (2589.25), Goa(1970.08), Delhi(1766.94), Chandigarh(1551.96), Punjab(1436.79), Gujarat(1283.77), Haryana(1090.39), Tamilnadu(976 and Maharashtra(934.43). In remaining states, it ranges from 80.86(Bihar) to (723.10) Andhra Pradesh. Thus, power consumption is apparently correlated with sustainable development. Generally, the power consumption is higher in economically better states with development. Global climate change emerges from a fact that we the civil society are not living in harmony with nature. For natural harmony and sustainable development, we need to find approaches towards solution and not problems, increase supply of power by harnessing renewable resources, reduce demand by judicious use of resources, use environment friendly green technologies. Rightly said that “the earth, the water and the air are not gift to us from our parents but a loan for our children”. The Department of Renewable Energy is responsible for formulating policies and programmes necessary for popularizing the applications of various non -conventional and renewable sources of energy in the State. It is implementing various schemes concerning utilization of solar energy, biogas, micro hydel, biomass Energy etc. The Department is also acting as a State Designated Agency for the implementation of the Energy Conservation Act, 2001 in the State for taking full advantage of fiscal and financial incentives made available by the Ministry of New & Renewable Energy (MNRE), Govt of India and Indian Renewable Energy Development Agency (IREDA) and to give impetus to the process of implementation, State Govt. has set up a new agency called Haryana Renewable Energy Development Agency (HAREDA) in May, 1997. This agency is acting as a nodal agency to implement the various centrally and state sponsored schemes/ projects in the area of renewable energy in the State. This paper examines research and development priorities of IREDA vis-à-vis HAREDA and steps needed in future to upscale the production and use of renewable energy in Haryana in particular and in India in general. Also, perspectives and challenges associated with energy use for sustainable development are viewed and needed policy interventions are identified.



Solar Lamps for Ghanaian School Children as Incentive for Sustainable Tree Planting in the context of North-South School Partnership

ABSTRACT

The impact of increasing forest degradation in West Africa is remarkable and unfortunately this deforestation has direct consequence for rural forest dwelling communities and particularly school children in these areas in Africa as a whole. In Ghana, for instance, the rain forest decreased from 8 to 1, 4 million hectares within a period of less than 100 years. In previous times, there were shade trees on school compounds and rural community settlement areas where school children and adults could sit, play and study. However, many of these places are now void of trees, become eroded and dusty, exposing health risks to these children. Reforestation is therefore extremely necessary if children and the people living in the country side are to have a secured future. In 1995, the Project “Tree Planting on School Compounds in Ghana” was therefore initiated by Dr. Essiamah, a Forest Research Scientist, Chairman and Project Coordinator of an Association “School Forests for West Africa”, based in Germany, with 4 schools. The number of participating schools has since increased to 75 mainly in the Central Region. The school children plant and tender for shade trees, donated by the Association in Germany (s. Homepage: www.schulwaelder.org) and German Partner Schools and supervised by the Partner Organisation in Ghana “Youth and Environment Club” together with their teachers. The aim is to change the negative attitude of children (the future generation) towards trees or Rain Forest so as to slow down the degradation or stop it in future. Since 1997, solar equipments are being introduced into the Project as incentive to motivate the children and teachers to involve themselves in the tree planting Project. In the presentation, “Introduction of solar lamps as incentive to tree planting”, for a successful implementation of the project will be discussed. By combining tree planting with solar lamps, a school child qualifies for a free solar lamp after planting four trees and catering for them for six months while parents also contribute to half of the price of the lamp with micro-credit. This is to enable children and their families to have decent light at night to study and to replace thousands of kerosene lamps which are unhealthy but at the same time ensure the reforestation of degraded areas. The Project is therefore being presented as a lighthouse project to serve as a model for other African countries to promote reforestation through school children and to focus on solar as the future energy source for Africa.



Theme: Technology



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Sustainable Intensification - the future of agriculture?

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ABSTRACT

To ensure the food security for a growing world population with the possible repercussions of climate change is one of the major challenges to agriculture. This leads to constant pressure on crop production systems in order to enhance food quantity without increasing environmental degradation. Since the Royal Society released their report “Reaping the benefits” in 2009, the concept of sustainable intensification (SI) is known as a way to match these issues. That means to enhance efficiency of agricultural production, either by increasing yields without additional negative environmental impact as well as without expansion of cropland or by reducing negative external effects under constant yields. Several highly regarded studies and reports pointed out that sustainable intensification is the only possibility to ensure future food security and quantified the global potential of SI by projections and modelling. Against this scientific background, transferability and applicability of sustainable intensification has to be discussed: How does the framework fit to various geographic regions, spatial scales or different farming systems (high/low input)? Within the wide range of implementing a general approach like SI in the diverse systems of worldwide agriculture, finally an application example will be explained: A scientific experiment on farm scale evaluates adapting strategies of production systems in terms of SI under climate change conditions.



Technology Intervention for Sustainable Developments

ABSTRACT

An initiative aiming at improving the rural livelihood through technology dissemination by upgrading the traditional methods of production and improving product quality while reducing drudgery are undertaken. The project on Rural Technology, which is essentially demand driven, is meant for bridging technology gaps, technology up gradation, technology training and demonstration and being implemented in four eastern states (West Bengal, Odisha, Bihar and Jharkhand) of India. Implementing of this Rural Technologies project have eliminated the drudgery in the life of rural women and increased the production. Some examples are Integrated muri making machines increased the production 10-15 times. Mechanized Dhenki for paddy processing increases the productivity by 5 times. Motorized Sabai grass roping making machine increased the rope making by 15 times. Pedal driven potter wheel raised the production by 7 times. Several workshops and training programs are organized to disseminate these tested technologies among the rural peoples who can derive benefits out of them. The developed technologies are disseminated with the help of a large number of Non-Governmental Organizations (NGOs) interested to leverage on science and technologies to improve rural livelihood. People are presently exploiting several rural technologies emerging from this initiative across the four eastern states of India. These technologies have helped villagers not only to improve their income but also to generate employment opportunities at village level; this has helped to reduce migration of villagers to cities in search of job. As a result of successful demonstration of sustainable production technologies at the farmers filed average rice yield increased from merely 2.5 to 7.4 ton per hectare is a significant contribution in ensuring food security of villagers. Also the farmers could realize higher return from other crops such as sweet corn, peanut, and sesame with less fertilizer, labor and water besides improvement of soil health.

Value Addition and Processing: A Study of Barley Based Cookies

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ABSTRACT

Bakery products which are very much popular among the youth have a varied portfolio of products including cookies, cake and other products. Cookies are liked very much by the children and they can be enjoyed with different tastes, aroma and ingredients. They are one of the most popular bakery products in the world, which is usually sweet, baked and made of refined wheat flour, due to its gluten content. Cookies are composed of protein, fats and carbohydrates but with low levels of other nutritious compositions, so incorporating super healthy grains like barley to the ever-loved cookies can not only make it more delicious but better bakery product from the health point of view. The present study is an attempt to incorporate barley supplementation, using barley genotype namely BH-942 along with chickpea and wheat (with variations in combinations of 40:50:10, 50:40:10 and 60:30:10 for barley flour, chickpea flour and refined flour); in order to prepare cookies that too with three types of food processing techniques, viz. soaking, popping and malting. The objective of this study was to assess the quality of cookies made by partially substituting refined flour with barley flour in combination with chickpea flour. Their physical, sensory and nutritional characteristics were recorded in the present investigation and it was found that highest mean score of overall acceptability was recorded from malted flour based cookies along with the control cookies. Cookies having the malted barley flour also had the highest crude protein, crude fiber and ash contents. Similarly, the total soluble sugar and reducing sugar contents were highest in the cookies containing malted barley flour.

Agri-preneurship: Sustainability in Food and Environment

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ABSTRACT

The two concepts of food security and sustainability contribute and complement each other in respect of several attributes. Environmental Sustainability and Food Security are both vital strategic aims for any developing country like India in today's contemporary global scenario, but to establish equilibrium between the two is essential to be attained. This paper is an attempt to jeopardise the issues, policies and consequences that lay an emphasis on how these two sides of a coin can retaliate and result into an economy which is not only financially sound but socially developed, which can be achieved through promotion of green-preneruship or agri-preneurship in the country. Numerous differences in opinions and disagreements are occurring when all worldwide, countrywide and neighbourhood industries and sectors aspire to attain food security both in its supply and delivery, along with sustainable usage of the natural resources involved in food production. The purpose of the present paper is to line up and synchronize all such ideas together and by observing the assimilation, linkages and gaps amid food security and sustainability.

Imperatives of Teaching Elements of Sustainability at Undergraduate Level for sensitizing youth

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ABSTRACT

Elements of sustainability includes biodiversity including plants and animals, flora, fauna, rhizosphere, biosphere, lithosphere, environment, climate, livelihood, access to food and energy. This is recognized by all civilizations and societies for coherence in civic order. Most natural resources are finite and their over exploitation may have serious environmental consequences. It is our moral duty to leave enough resources for next generations to live in congenial and conducive environment. This would necessitate inculcation of sense of social responsibility particularly among youth. In the age of information technology era, expansion of information pool and knowledge has become much easier. However, that is limited up to information flow. A serious call to action is needed to sensitize civic societies about dos' and donot dos' so that wastages could be avoided and reduce, recycle and reuse processes are integrated to ensure maximum use of natural resources. Teaching elements of sustainability in periodic and chronological order is easy if these are covered as a part of syllabi at school and college levels. Collection of biodiversity can be best done by school and college goers particularly in rural areas. Likewise, a multipurpose education mode integrating class room teaching with a vocation can lead to capacity building to ensure livelihood. Youth can also sensitize their kins and kiths not to burn residues in field and organize campaigns to create awareness about cleanliness and societal coherence. Save Planet Earth has been a matter of several debates at village, district, state and national levels in India. Often spot paintings on this matter have been organized. However much remains to be done to cover sustainability aspects in theory and practice sessions at school and college levels. The Honorable Supreme Court has intervened to include a comprehensive general course on environment and disaster management in all the State Agriculture Universities. A similar action by Indian Council of Agriculture Research (ICAR) and National Council of Education, Research and Training (NCERT) to include sustainability as a module for teaching would pay rich dividends to sensitize young minds to build on strengths for creating awareness among general masses. Learning through interaction with international community of scientists and development functionaries will help broaden vision to frame a strategy.



Sustainable rice production in India

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ABSTRACT

Rice is the dominant kharif crop of north western zone of India. In Rice–wheat (RW) rotation, rice is of immense importance for the food security and livelihoods in India. The widespread adoption of high-yielding rice varieties along with improved management practices led to drastic increase in its productivity but at same time it makes us to think about the cost at which we are obtaining this and can we sustain it in future. Raising yields on existing farmland is essential for saving land for nature, but the prospects for yield increases comparable to those of the past 40 years have narrowed down. In order to further enhance the rice production and maintain self-sufficiency we should focus on farm mechanization. Due importance was not given to farm mechanization until the beginning of the century. Earlier, only large scale farmers came up to fabricate simple manually operated machinery like weeder, thresher, winnower etc. With due course of time and the growing demands for foods, it was realized that agriculture will have no other alternative than to adopt mechanized cultivation to feed over increasing population. Moreover, agricultural machinery must be brought to use in for rice cultivation for increasing the quality of products and reducing the huge cost of its production and thereby minimizing the over exploitation of resources. Thus, this paper summarizes the role of farm mechanization in sustainable rice production in India.



Abstracts of Intended Presentations



7th International Seminar 2016

Sustainable Resource Management Towards Food,
Energy, Environment and Livelihood



Influencing Factors on Land Use for Edible Protein of Animal Origin

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ABSTRACT

The present period is characterised by a growing world population and a higher demand for more and better quality food, as well as other products for an improved standard of living. In the future there will be strong competition for arable land and non-renewable resources such as fossil carbon-sources, water, and some minerals as well as between food, feed, fuel, fibre, flowers and fun (6 F's) for arable land. Proteins of animal origin such as milk, meat, fish, eggs and insects are very valuable sources of essential amino acids, minerals and vitamins, but their production consumes some non-renewable resources including arable land and causes considerable emissions. Therefore, the objective of present studies was to calculate the land use (arable land and grassland) for production of edible animal protein taking into consideration important animal species/categories, levels of plant and animal yields, the latter estimated with and without co-products from agriculture and the food/biofuel industry in animal feeding. Furthermore, the human-edible protein fractions of feeds were calculated and compared with the edible fraction in food. There are large differences between animal species/categories, animal production systems, plant and animal yields, use of grassland and the portion of co-products in animal rations as well their potential to produce edible protein. The highest amounts of edible per kilogram body weight are produced by fattening chickens (up 5 g/kg and day) followed by laying hens and dairy cows; the lowest yields in edible protein (<0.4 g/kg and day) and the highest land need were observed for beef cattle. The results show that a clear description of study conditions or the base of calculations is a very important prerequisite to compare results concerning land use between authors. More complex calculations, considering parameters of efficient use of limited resources and reduction of emissions, seem to be helpful to find a certain optimum in the production of food of animal origin. Lower plant and animal yields need more arable land for edible protein. The utilisation of co-products can reduce the land needed and improve the human protein output by food producing animals. An efficient use of grassland or perennial crops by ruminants may also reduce the need for arable land for edible protein and increase the human-edible protein output. The following parameters and measurements should be considered in future calculations:

- Use of arable land (competition between various users)
- Output of human-edible protein (should be >1) should be compared with input via feeding
- Efficient use of water for feed and animal production
- Minimisation of the use of fuel and other limited natural resources in the food chain
- Utilisation of permanent grassland and co-products from agriculture and industry
- Reduction of greenhouse gas emissions per product or per kg of edible protein and along the food chain
- Plant and animal breeding as the starting points of the human food chain
- Evaluating the potential of edible insects as protein sources for food and feed Calculation of land use per inhabitant considering eating patterns of the population
- Reduction of food wastage (presently equal to about 1.4 billion ha land or 30 % of the world's agricultural area)

Utilization of Bael (*Aegle marmelos*) Mucilage for Reduction of Oil Uptake in Fried Products

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ABSTRACT

Aegle marmelos, commonly known as bael also Bengal quince, golden apple, Japanese bitter orange stone apple, or wood apple, is a tree species native to India. It is present throughout Southeast Asia as a naturalized species. The tree is considered to be sacred by Hindus and its fruits are being used in traditional medicine and as a food since times immemorial. The fruits can be eaten either fresh or after being dried. The juice is also strained and sweetened to make a drink similar to lemonade and is very popular summer drink in almost every Indian household. The fruit of *A. marmelos* possesses high nutritive value and is used to make juice, jam, jelly, toffee and other products. The seeds of *A. marmelos* contain a high proportion of mucilage and it is also being used for various therapeutic purposes. The mucilage is also widely used in the food industry as a thickening agent, texture modifier and plays a significant role in the improvement of appearance, quality and value of foods. In this study Bael fruit pulp was precipitated with different solvents to maximize the yield of mucilage and hence to optimize the solvent. The mucilage thus obtained was oven dried, powdered, sieved and stored in an airtight container. The potato chips were manually prepared and air dried. These chips were then subjected to coating by mucilage solutions at concentrations varying from 0.5% to 2.0%. The untreated sample was taken as the control sample. The treated samples were again air dried and then they were fried in soyabean oil at about 200°C. The studies revealed that the bael mucilage coated potato chips exhibited a decrease in percent oil uptake during frying and had a greater acceptability.

Promoting Value Addition Through Development of Honey Based Ginger (*Zingiberofficinale*) Candy

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ABSTRACT

India's diverse climate ensures availability of all varieties of fresh fruits and vegetables. India ranks second in fruits and vegetables production in the world, after China. As per National Horticulture Database during 2014-15 India produced 86.6 MMT of fruits and 169.5 MMT of vegetables. India is the largest producer of ginger (*Zingiberofficinale*) and okra amongst vegetables and ranks second in production of potatoes, onions, cauliflowers, brinjal, cabbages, etc. Amongst fruits, the country ranks first in production of Bananas (22.9%), Papayas (44.1 %) and Mangoes (37.6%). The vast production base offers India tremendous opportunities for export. However, 25-30 per cent of fruits and vegetables and 5-7 per cent of food grains in India are wasted as per a March 2015 report of the Indian Council of Agricultural Research (ICAR). In financial terms the post-harvest losses of farm produce, especially of fruits, vegetables and other perishables, have been estimated to be over Rs. one trillion per annum (about 15 crore USD), 57 per cent of which is avoidable wastage. The solution to the problem lies in effective processing and value addition of fresh produce that is quite perishable in nature. On these lines, studies were conducted for preparation and quality evaluation of Honey based Ginger Candy. In this study two varieties of Honey were used in place of sugar syrup for impregnation in fruit pieces and different combinations were prepared. The Physico-chemical analysis of the prepared product was carried out and the optimum sample was chosen in terms of best sensory attributes and overall acceptability. The storage studies were conducted in LDPE Pouches and Glass Jars at room temperature. During the studies it was observed that the ascorbic acid content decreased whereas the reducing sugar, TSS and Browning Index increased. It was found that the Glass Jar was a better option for storage of these Honey based Ginger Candies and they could be safely stored for two months at room temperature. This study revealed that the post-harvest losses in Ginger could be prevented by promoting value addition through the development of Candy and also utilizing the natural health benefits of Honey and Ginger in a synergetic manner.

Climate resilient wheat: Temperature perspectives

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ABSTRACT

Wheat (*Triticumaestivum*L.em. Thell.) accounts for about 30% of the world area with over 220 Mha cultivated worldwide often under abiotic stress. The rising temperature impacts are found at lower altitudes. Population is to be expected to be Nine billion by middle of the century. Projected weighted average yield of grain crops is -1 to +1percent in most of the countries as on account of impact of global climate change. To feed this much world population about 50 % more food production will be needed. Production and productivity of Wheat is approximately 715.0 m tonnes and 3.2 tonnes/ha worldwide respectively (FAO 2015). Upto 50% of the agricultural productivity is lost due to abiotic stresses, while biotic stresses accounts for nearly 10-20% comparably. Most part of Abiotic stresses in impact is covered mainly by drought. Drought has potential interaction with heat. Germplasm generation for heat tolerance in wheat is one of the aspect which can be done through MAGIC (Multi Parent Advanced Generation Intercross) breeding population which will yield advanced generations with fine scale mosaics of contributions from all the founder parents which further can be useful in linkage mapping and marker-trait association mapping for targeted heat tolerance ultimately climate resilience breeding.

Agro-Genetic Restructuring of Bio-diversity in tropics to sustain Green cover to encounter global warming

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ABSTRACT

Gradual increase in temperature on earth surface (Global Warming) is of immense concern to living being in International society in different walk of life. Of several known factors, greenhouse gasses have been emphasized and ascribed to changes in climate and fragile weather. Besides, there seems also a positive role in involvement of green cover in afforestation programme in tropics / sub-tropics to moderate rising temperature during hot summer. Leaves (green foliage) physiologically active during hot summer are important in tropics / sub tropics to moderate atmospheric temperature in its surrounding. The biomass without green cover (leaves) may not show appreciable impact on temperature during hot summer.

Affore station with tree species if tend to defoliate in summer will have hardly much effect on lowering temperature. It would be regarded as good as naked hills without vegetation. Of course, defoliation (leaf fall) during summer and water stress conditions provide natural in built mechanism being adaptive to minimize water requirement. Preliminary observations recorded on a mixed tree shrubs species (100) planted over about 5000 sq.m. show beneficial effects of green cover to moderate rising temperature to an appreciable extent during hot summer (April-June 2013-15) in Jabalpur. This suggests to plan and restructuring tree species for afforestation to have balanced green cover during hot summer in tropics.

Indian tree species especially, *Azadirachta indica*, *Ficus glomerata*, *Ficus bengalensis*, *Ficus religiosa*, *Terminalia arjuna* & *Acacia* species are suggested to make balanced green cover with economic forest tree species in afforestation programme. However, it necessitates verification of impact of green cover at larger dimensions / area / regions in vicinity to biomass representing forests, orchards, agro- forestry.

Solar Powered Water Pumping System: Techno-economic Analysis

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ABSTRACT

There are many types of pumping systems in the world, for irrigation in agricultural fields, domestic gardens, and civic amenities, which are either electricity or fossil fuel based. Presently water is pumped with the help of grid power supply resulting huge energy consumption. In developing countries electricity generation is grossly deficit and fuels are very costly. Because of these major impediments, solar powered water pumping systems offer great promise as the solar power is free and the costs involved are for the solar panels, Photovoltaic battery and their maintenance. Photovoltaic pumping systems provide a welcome alternative to grid power supply based water pumping systems. They provide the most water precisely when it is needed the most that is when the sun shines the brightest. As solar water pumping system is ecofriendly, apart from economic advantages, therefore an attempt has been made to develop SPV based water pumping system to meet daily water needs. The idea is to make the PV batteries last longer which can be automatically recharged. The solar energy is absorbed by the solar panel to generate the power. The power that had been absorbed by the panel can be used either directly by the motor of the pumping system if the power matches the power requirement or the motor will use the power from a battery. This system will make water pumping system work without electricity and fuel. The method thus involves switching a conventional electric powered water pumping system to Solar-Powered water pumping system that is powered by an electric motor which gets its supply from photovoltaic (PV) panels. The PV panels must be mounted and installed at the solar powered irrigation pumps without compromising its working efficiency. The method employs a small electric motor that are easily connected and separated for ease of pumping. A solar collector is connected to the rechargeable batteries for collecting solar energy and converting such energy to electrical power that is delivered to the rechargeable batteries. A rechargeable battery is operable connected to DC motor for providing electrical power to drive the motor. Thus this system also complements with conventional system of water pumping during night hours and /or when fossil fuel based conventional electricity supply system is not available. A techno-economic analysis of SPV based water pumping system and comparison of proposed system with the conventional one shall also be discussed in this presentation.

Status of Fluoride Content in Groundwater of Haryana State (India): A Critical Review

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ABSTRACT

Fluoride is present universally in almost every water with varying concentration however higher concentrations are found in groundwater, earth crust, many minerals, rocks etc. Fluoride beyond permissible amounts (0.6 to 1.5mg/l) in groundwater is a worldwide problem. Excess fluoride intake through water, cause to create fluorosis. The high consumption of fluoride being harmful for humans and animals was noticed in India in 1937 and since then, a lot of work is done on fluoride concentration in groundwater in many parts of India and across the world. There are 20 states of India, which includes more than 100 districts across the country having fluoride concentration in groundwater more than the permissible limit. Haryana is one of them. It is a small state in north India and presently has 21 districts. Recent studies indicate that 14 districts in Haryana have fluoride in groundwater more than optimal limit (1.5 mg/L). The districts of Haryana such as Faridabad, Sonapat, Panipat, Bhiwani etc have samples that have high values of fluoride ion. In these districts, 30 to 40% of the investigated sites are having fluoride ion more than permissible limit, consequently not safe for human health. This paper presents a review, which focuses on the status of fluoride in ground water of Haryana (India) and different control measures.

Availability and issues of water in Bangladesh, challenges in sustainable agriculture: An intensive review

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ABSTRACT

Water is considered as the main component for sustainable agricultural development worldwide. The economy of Bangladesh and the livelihood of the majority of the rural population largely depend on agricultural activities and trade. Bangladesh is considered as one of the richest countries in surface water. Around 250 small and big rivers have formed the most complex river-network where more than 50 rivers are trans-boundary. However, lack of proper monitoring and planning from responsible institutions, the surface water resource is polluted by domestic waste and uncontrolled industrial waste in most of the municipal areas. On the other hand, almost 80-90% of water demand for households and agricultural sectors (especially dry season irrigation) has been fulfilled by groundwater in this country. The consumption of water and food demand have been increased over last few decades due to rapid population growth and urbanisation. As a result, the level of groundwater is declining by 2-3 meters per year in most of the big cities of Bangladesh. Each branch of agriculture possesses high demand for water such ca. 1500 liters of water is required to produce one kilogram of grains. The current scenario of water shows a significantly lower water productivity in Bangladesh due to intentional and unintentional activities by internal and external bodies (Alauddin et al., 2014). The dependency on groundwater has been increasing due to polluted surface water in most of the cities (Alauddin and Sharma, 2013). Nevertheless, reuse of greywater and rainwater-harvesting is considered as potential responses to the water resources problem in the cities and municipalities. In this study, water availability, demand, problems and responses in Bangladesh with an intensive focus on municipalities are extensively analysed.

Molecular Cloning and Characterization of a Dehydrin Gene Involved in Abiotic Stress Tolerance from the C4 Plant *Pennisetum glaucum*

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ABSTRACT

Salinity and drought stress are the major contributors in the abiotic stress leading to huge crop losses every year worldwide. In addition, due to salinity significant amount of arable land is rendered unfit for agriculture. Therefore, a wide range of new alternatives and mitigation strategies are required to cope with such impacts. One of the possible ways to overcome this grave situation is development of new crop varieties resistant to salt and drought stress. Dehydrins (DHNs) or group 2 LEA (late embryogenesis abundant) proteins play a protective role in plants under different abiotic stress conditions like drought, salinity, cold and heat stress. *P. glaucum* is a stress tolerant crop and is well adapted to fields with limited soil fertility, drought, and heat stress conditions. Therefore, owing to its stress resistant nature, *P. glaucum* is contemplated to be equipped with better defence mechanisms to combat different abiotic stresses. In the present study, we have isolated a dehydrin gene, PgDHN from *P. glaucum*. The expression of PgDHN is upregulated in response to drought, salinity and heat stress. Its role in rendering tolerance to salinity and heat stress is further indicated by its expression analysis in *E. coli* and yeast cells. These results indicate that PgDHN plays a protective role under various abiotic stress conditions especially drought and salinity, and could be used as a tool to improve the abiotic stress tolerance of crop plants.

Carbon Nanotubes Based Modified Electrodes for Sensing of Mercury

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ABSTRACT

Nanotechnology is a multi-disciplinary field that deals with a variety of materials at the nanometer scale produced through different physical, chemical, and biological routes. Nanomaterials possess novel properties that are typically not observed in their bulk counterparts. Hence, they offer potential solutions to overcome many limitations associated with existing products in the market in terms of cost, functionality, fabrication strategies, and overall performance. In modern healthcare, nanomaterials have been investigated intensively as carriers in light of their tunable surface properties. Carbon nanotubes (CNTs), in particular, have several interesting properties in regard to their structure, morphology, functionality, stability, ease of modification, and affinity toward hybrid materials. Release of harmful chemicals and toxins into the water bodies without proper treatment has raised severe health concerns in recent times. These toxins include heavy metals and other harmful non-biodegradable chemicals. Out of all these toxins, heavy metals especially mercury cause a serious issue to health and environment. Different sources of mercury in the environment are coal burning power plants, breaking mercury products, spilling mercury, medical waste incinerator, alkali metal processing, tanning industries, volcanic eruptions, vaporization from water bodies and flood. Mercury has direct influence on the behavioral, developmental and reproduction related abnormalities in human beings. Although several techniques like AAS, ICP-MS, and XRF are present for estimation of mercury in laboratory and real samples but all these techniques are associated with certain limitations like laboratory bound, higher cost per sample, costly instrumentation, requirement of skilled personnel, and large sample volume. In view of above given facts, electrochemical technique has been explored for direct redox sensing of mercury. Carbon nanotubes has been synthesized by chemical vapour deposition method and further utilized for modification of working electrode. Electro-deposition of conducting polymer aniline and carbon nanotubes has been carried on a glassy carbon electrode. This fabricated electrode is further characterized well with microscopic techniques and evaluated towards direct redox sensing of mercury ions using CV (cyclic voltammetry) technique.

Study showing effect of saline condition on the plant height and germination of Linseed

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ABSTRACT

Linseed (*Linum usitatissimum* L.) is a member of family Linaceae is an important oil seed and fibre crop cultivated in arid, semi-arid as well as temperate climates and has around 100 species distributed throughout the world. India ranks 8th among the nine major Linseed producing countries. In India five wild species of *Linum* have been reported viz. *L. perenne*, *L. stricutum*, *L. mysorensense*, *L. grandiflorum* and *angusti folium*. The productivity of linseed is lowered due to saline irrigation water in the arid and semi-arid regions of Agra and Bundelkhand districts of the U.P., the main linseed producing region of India. Enhanced salinity levels were found to cause reduction in plant heights. In this study sixty varieties of linseed from different research stations viz. Kanpur, Jabalpur and Palampur were planted. Nine varieties have been identified as good performer at various salinity levels at our agriculture research farm. These varieties are DPL-121, T-397, C-429, Hira, K-2, Garima, Subhra, Neela and LCM-929. Neelum has been subjected to hybridization and further experimentation for seed germination and plant height. Hybrids were shown to increase in height over their best parents under saline conditions. The tallest plant observed was the hybrid of Neelum x LCM-926 under best water conditions. These results could be of great agriculture significance.

Evaluation of Wheat Germplasm Accessions for Phenological and Yield Attributing Traits under Rainfed Conditions

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ABSTRACT

In this present investigation 1485 accessions of bread wheat germplasm obtained from National Bureau of Plant Genetic Resources (NBPGR), New Delhi were evaluated during 2015-16 at CCS, Haryana Agricultural University (Hisar) research farm in augmented design with five checks HD2967, Raj.3765, C 306, WH1080 and WH1105 under rainfed conditions. Large data sets were statistically analysed and clusters of accessions on the basis of similarity in traits were identified. There was distinct pattern of clusters, some genotypes were of very early types, other were of medium maturity range and few of them were of stay-green types and late maturing. Likewise accessions for disease incidence namely yellow and brown rusts. The accessions varied from highly resistant to completely susceptible e.i. 0 to 100s. Based on plant height the accessions could be grouped into distinct categories <60cm (Triple dwarf), 61 to 100 cm (Semi-dwarf), 101 to 115 cm (Medium tall) and 116 to 150 cm (Tall types). Similarly, accessions varied for tiller number per metre length from 50 to 165, grain number per spike ranging from 30 to 89 grains per spike and thousand grains weight (TGW) 37g to 65g. The accessions lines showed marked differences for biological yield (110 to 630 g) and grain yield (70 g to 235 g) per metre row length. Thus the accessions indicated vast spectrum of variation for phenological and grain yield attributing traits in wheat. This data set enable identification of wheat accession lines depicting very high rank for important traits, thus furnishing formidable material for crossing for further wheat improvement in rainfed condition for sustainable wheat production.

Role of Women in Environmental Security in India

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ABSTRACT

The environment is the most transnational of transnational issues and its security is an important dimension of peace, national security and human rights. Over the next 100 years, one third of current global land cover will be transformed, with the world facing increasingly hard choices among consumption, ecosystem services, restoration, and conservation and management.

Environmental security is central to national security, comprising the dynamics and interconnections among the natural resource base, the social fabric of the state and the economic engine for local and regional stability. While the precise roles of the environment in peace, conflict, destabilization and human insecurity may differ from situation to situation and as such are still being debated in relation to other security and conflict variables, there are growing indications that it is increasingly an underlying cause of instability, conflict and unrest. Women play an essential role in the management of natural resources, including soil, water, forests and energy and often have a profound traditional and contemporary knowledge of the natural world around them.

Whereas women were previously neglected or ignored, increasing attention has been paid in recent past to the impact of women on the natural environment and in return, the effects the of environment on the health and wellbeing of women. The gender environment relations have valuable ramifications in regard to the understanding of nature between men and women, the management and distribution of resources and responsibilities and the day-to-day life and wellbeing of people.

Brassica Straw -Cow Dung Based Value Added Vermicompost and Its Proximate Analysis

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ABSTRACT

Vermitechnology is a system harnessing earthworms for bio- conversion of organic waste into vermicompost which has extensive application in waste management and sustainable organic farming and has proved to be one of the efficient methods of managing organic wastes. The main objectives of the present study were to access the potential of earthworm species (*Eiseniafoetida*) in composting *Brassica juncea straw* amended with cow dung in different ratios for the production of nutrient rich vermicompost. Percent response from compost to vermicompost ratios showed that pH values of vermicomposts were lower than those of their respective control ratios. EC of vermicomposts were higher than those of their respective control ratios. Ratios with earthworms showed up to 138 % increase in 70:30 ratios. Maximum increase in N concentration among vermicompost ratios was observed in 60:40 (0.543 %) ratio. Maximum increment in P content was observed in 90:10 vermicompost (0.268 %) ratio, Maximum increase in K concentration among vermicompost ratios was observed in 60:40 (0.543 %) ratio. Maximum rise in Ca content was observed in 60:40 and 80:20 vermicompost (2.1 %) ratios. Thus it is evident from our experiments that the N, P, K, Ca and moisture content of the agricultural waste can be improved simultaneously through vermin-technology. The use of earthworm's species for the conversion of agricultural waste into vermicomposting can truly bring in 'economic prosperity' for the farmers and the nations with 'environmental security' for the earth.

Targeting physiological variation in *T. aestivum* for heat stress tolerance under late sown environment – identification of resilient germplasm

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ABSTRACT

In future the area under wheat is likely to increase and therefore, breeding efforts should be focused on developing short duration varieties that have faster growth rate and tolerant to heat stress at reproductive stage of plant growth. An important factor when considering this new genetic resource is whether it may offer beneficial alleles for increased yield potential. Keeping in view five hundred twenty-eight non-cultivated and cultivated genotypes belonging to *Triticum aestivum*, were evaluated for Cell membrane stability (CMS), Chlorophyll fluorescence, heat susceptibility index (HSI) and grain yield under late sown conditions for two years (2014 – 15 & 2015-16). The current study was aimed to identify significant genetic diversity with regard to heat tolerance among wheat lines based on physiological traits and yield analysis. Majority of the interaction effects were significant for almost all of the traits. This suggested the variable responses of genotypes, over the environments and years for the traits under consideration for heat tolerance. Correlation coefficients revealed that CMS was the most important trait under heat stress. Since wide variation for heat tolerance of physiological traits are available among the wheat, these can be used for improving specific yield components of cultivated wheat.

Heterologous expression and biochemical characterization of a highly active and stable chloroplastic Cu/Zn-superoxide dismutase from *Pisumsativum*

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ABSTRACT

Cu/Zn-Superoxide dismutase (SOD) is a unique enzyme, which can catalyzes the dismutation of superoxide anion into molecular oxygen and hydrogen peroxide. The recombinant expression of this protein in its enzymatically active and stable form is highly desired and hence optimization of culture conditions and characterization of the related biochemical properties are essential to explore the significance of the enzyme in physiological, therapeutic, structural and transgenic research. High-level expression of the chloroplastic isoform of *Pisumsativum* Cu/Zn-SOD was achieved at 18°C, upon IPTG induction. Both crude and purified protein fractions display significant increase in activity following supplementation of defined concentration Cu²⁺ and Zn²⁺. Yield of the purified recombinant protein was ~ 4 mg L⁻¹ of culture volume and the bacterial biomass was ~ 4.5 g L⁻¹. The recombinant protein possessed nearly 6-fold higher superoxide dismutase activity and the peroxidase activity was also 5 fold higher as compared to commercially available Cu/Zn-superoxide dismutase. The computational, spectroscopic and biochemical characterization reveals that the protein harbours all the characteristics features of this class of enzyme. The enzyme was exceptionally stable as evident from pH and temperature incubation studies and maintained SOD activity upon prolonged storage. The strategy describes an efficient protocol for the production of a highly active and stable Cu/Zn-superoxide dismutase in its recombinant form in *E. coli* system. The strategy can be utilized for large-scale preparation of active Cu/Zn-superoxide dismutase and thus has wide application in pharmaceutical industries and also for elucidating the potential of this protein endowed with exceptional stability and activity.

Utilization of Indigenous Food to Combat Micronutrients Deficiency Disorder among Rural School Children Age 10-12 Years

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ABSTRACT

Micronutrient deficiencies are caused by inadequate dietary intake, increased losses from the body and/or increased requirements. Besides inadequate consumption of nutrient rich foods; dietary taboos, lack of access to health care and inefficient utilization of available micronutrients because of infections and parasitic infestations are also among other causes. Micronutrient deficiencies are especially relevant in school children since they are in a growth and development phase and have nutritional requirements that vary according to the stage of growth and that are greater and clearly differentiated from those of adults. The present study was done to assess the prevalence of micronutrient deficiency in Villages of Kanpur district. This study was conducted among 4 Government schools using interview techniques and anthropometric and clinical examinations. Results of the present study revealed that most of the children belong to low income group (60%) and middle income group (32%). About 36% of the parents of the children were agricultural farmers. Vitamin A deficiency (clinically seen by absence or presence of Bitot spot, and other symptoms present in eyes) was seen in 26 percent of children. Nutritional anemia (by pale, dry skin, and symptoms present in the nails) was seen in 66.7 percent. Vitamin C deficiency (symptoms present in gums and lips) was seen in percent and calcium deficiency (as seen by symptoms shown in the teeth such as caries, chalky and mottled enamel etc) was found in 65.3 percent of the children. Product prepared in laboratory mainly through pearl along with other material.

Modernization in plant breeding approach with special reference to biotic stress resistance in Maize (*Zea mays* L.)

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ABSTRACT

Biotic stresses are major threat to global food security. Biotic stresses are caused by living organisms like viruses, fungi, bacteria, nematodes, insects and weeds to plants. The development of new pathogens and insect races by change in climatic and genetic factors is a major opportunity for plant breeders to breed new resistant varieties. Losses due to these stresses have resulted in malnutrition and food insecurity among 800 million people globally. We have to keep in our mind that we may need 70 per cent more food in 2050, so reduced yield due to biotic stresses and increasing food demand may put international food security at risk. Earlier, classical breeding approaches like introduction, hybridization, composite crossing, multiline and backcross breeding were utilized to increase the yields. However, these methods were slow, expensive, and hectic for developing resistance. Furthermore, breakdown of resistance due to fast evolving pathogens could not be coped with using these time consuming methods. Therefore, molecular genetics approaches like mutation, marker assisted selection (MAS), genomics, recombinant DNA technology, targeted induced local lesions in genome (TILLING), and virus induced gene silencing (VIGS) were adapted by breeders to develop effective resistance in maize crop plants in a shorter time. TILLING, being a non-transgenic method, is expected to become the most powerful tool in future. Maize cultivation is affected by several leaf diseases, which, individually or together, can cause significant damage to yield and grain quality. The damage depends on the level of genetic resistance of the genotype, climatic conditions during the growth cycle and the production system (Reis *et al.* 2004). Northern Corn Leaf Blight (NCLB) and South Corn Leaf Blight (SCLB) are common diseases of maize in many parts of the world including India. These diseases are most prevalent and severe diseases in maize in Eastern United States, Western Brazil, Latin America, China and India. In Indian scenario, these diseases are prevalent in the states of Karnataka, Himachal Pradesh, Uttar Pradesh, Uttarakhand, Orissa, Andhra Pradesh and North Eastern Hill states. Both also affect the *Rabi* maize in the plains of India including Uttar Pradesh. NCLB and SCLB can be severe when the condition is favorable. High humidity associated with low temperature and cloudy weather is conducive conditions for the disease development on the host plant (Singh *et al.* 2004). Heavy dew on the growing plant has also being cited as one of the factors leading to disease severity. Ceballos *et al.* (1991) reported disease severity is high for early maturing maize varieties than late maturing varieties. Keeping this back ground in view, we are reporting in this manuscript about a study involving, Molecular Markers, Developing Mapping Population, Mapping Genes, New QTLs etc for maize diseases especially NCLB and SCLB.

Sustainable Quality Protein Maize Cultivation in Diverse Agro Eco Environment of Eastern Part of India

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ABSTRACT

Maize (*Zea mays* L.) is an important cereal crop belongs to the tribe; Maydeae and family; Poaceae. The plant is native to South America and had been domesticated about 8000 years ago. Maize being C₄ plant, have high yield potential, easy to process, readily digested and cheaper than other cereals, offers the best option to greatly enhance the food and feed availability of any country. Maize provides at least 30 per cent of the food calories to more than 4.5 billion people in 94 developing countries, which highlights the importance of maize to ensure global food security. It needs more than 50% of total water requirements in about 30 to 35 days after tasseling and in adequate soil moisture at grain filling stage results in a poor yield and shriveled grains. Maize is grown throughout the year in India. It is predominantly a Rainy Season (*Kharif*) crop with 85% of the area under cultivation in the season. Maize is third most important cereal crop in India after rice and wheat. It accounts for about 9 % of total food grain production in the country. Maize is both the primary crop in majority of the farming systems and the staple food of the rural population especially in mountainous regions. The fact that maize grain is poor nutritionally, is well known and the need for improving its nutritional (lysine and tryptophan) value was acknowledged long time ago. The low amount of lysine and tryptophan, are two essential amino acids, possess a problem to meet the daily balanced protein requirements. In developing countries, about 32% of preschool children are stunted and 20% are underweight due to this protein malnutrition. Maize with improved protein quality due to its superiority in lysine and tryptophan content as compared to normal maize occur due to opaque-2 gene, is referred to as Quality Protein Maize (QPM). Lysine levels vary across genetic backgrounds from 1.6 to 2.6% in normal maize and 2.7 to 4.5% in their α_2 converted genotypes and tryptophan range varies from 0.2 to 0.5% in normal maize and 0.5 to 1.1% in QPM counterparts. The cultivation, environment and agronomic package of normal maize cultivation have been well defined and characterized. The cultivation of QPM in normal irrigated system has been initiated but in other environments such as Rain-fed and *Rabi* (winter) season needs to be standardized. The proposed QPM will combine the enhanced level of lysine and tryptophan along with high grain yield and desirable agronomic traits. These QPM could be grown in normal (Irrigated), poor environment (Rain-fed) and new environment (*Winter*), which will bring high level of food and nutritional security in South East Asia including in India. Keeping in view of above information through the present investigation we are reporting about environment and parameters helpful in sustainable cultivation of QPM hybrids in different Agro Eco Environments. Further characterization and standardization will be performed and environment specific QPM hybrids will be reported for cultivation.

Nutritional evaluation of newly released wheat varieties

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ABSTRACT

The present study was carried out to assess physico-chemical properties and nutrient composition of two newly released varieties (WH-1080 and WH-1025) and one conventional (C-306) wheat varieties. The results of study indicated that the newly released wheat varieties WH-1080 and WH-1025 contained significantly higher levels of crude protein (12.51% and 12.36% respectively), starch content (69.16%) and higher iron content (5.7 mg/100g) as compared to the variety C-306 (11.83%). Fat content in all the three wheat varieties ranged from 2.41 to 2.56 %. Crude fiber content range from 1.74%-2.46%. The phytic acid content of wheat varieties ranged from 234.5 mg/100g to 253.9 mg/100g a polyphenol from 307.56 mg/100g to 386.4 mg/100g with lowest value in variety WH-1080. The variety WH-1080 has the highest protein digestibility (*in vitro*) (71.60%) and starch digestibility (36.74 mg maltose/g). The albumin fraction of all the three wheat varieties ranged from 1.63% to 1.78%. Glutelin and prolamin content was found to be highest in the variety WH-1080 (2.97%) and (2.92%), respectively. Crude fiber content increased in all the processing methods with the highest increase in sprouting method (20.11% -25.75%). Sprouting significantly increased the protein content and total soluble sugar content of all the varieties (38.46% to 59.4%). Antinutrients decreased significantly in all the processing methods and decrease was highest in sprouting method and *in vitro* protein and starch digestibility increased in all the processing methods.

Potential Perspective of Nanotechnology in Food Processing and Nutraceuticals

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ABSTRACT

Nanotechnology is a new emerging rapidly growing field which finds its wide application in food technology in terms of food processing, quality and safety. In advent of increasing demand for healthier food, nanotechnology opens the possibility of developing food products with improved nutritional values, flow properties, enhanced taste and stability. With the help of nanoencapsulation it is possible to reinforce the food additives such as vitamins, minerals, antioxidants to the nanocomposites polymer for better targeted delivery, absorption and bioavailability. Nano food packaging materials may extend food life, improve food safety, alert consumers that food is contaminated or spoiled, repair tears in packaging, and even release preservatives to extend the life of the food in the package. Food nanosensing and food nanostructured ingredients are emerging fields for innovation. In the former field, better food quality and safety evaluation can be achieved by using nanotechnology. In the latter, food processing can be largely improved in the aspects of smart delivery of nutrients, bioseparation of proteins, rapid sampling of biological and chemical contaminants, nanoencapsulation of nutraceuticals, solubilization, delivery, and color in food systems. In this presentation, we intended to cover some of the developments in nanotechnology and their applicability to food and nutraceuticals systems.

Genetic polymorphism analysis of cotton genotypes using microsatellite marker

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ABSTRACT

Cotton (*Gossypiumhirsutum* L.) is an important fibre crop and plays a vital role in commerce of many countries. It contributes about 65 % of raw material for the textile industries. In India, cotton production, processing and trade of cotton goods provides livelihood directly and indirectly to over 60 million people and accounts about 16 % of India's export earnings. To make the productivity of Indian cotton comparable to other countries like USA and China, there is a need to give more emphasis on the magnitude of heterosis, *per se* performance and stability of genotypes. India is a pioneer country in exploitation of heterosis breeding by using conventional technique of hybrid seed production as well as genetic male sterility system. Selection of diverse parents is very important to achieve the target. Therefore, study on genetic diversity among parents is essential. Simple sequence repeats or microsatellite marker study was done for this purpose. This is the most preferred and reliable molecular marker system. The present study consisted of nineteen diverse cotton genotypes from Department of Genetics and Plant Breeding of CCS Haryana Agricultural University, Hisar in India, by employing forty-nine SSR primers. These genotypes were raised during kharif 2015 and DNA isolation in leaf tissue was done using CTAB method. PCR and PAGE analysis revealed DNA polymorphism for this trait among the genotypes. Based on 0/1 matrix of allele scoring, genetic similarity coefficient was calculated to estimate pair-wise similarity in the amplification product for all genotypes using "SimQual" sub-programme of NTSYS-pc (version 2.02e) software. Dendrogram was constructed by using distance matrix by Unweighted Pair-Group Method with Arithmetic average (UPGMA) sub-programme of NTSYS-pc. Two hundred and six alleles were amplified by using 49 SSR primers, resulting in 4.20 alleles/ primer. Genetic similarity coefficients ranged from 0.59 to 0.83. The least similarity (0.59) was observed between genotype H1156 and H1098-i, while the genotypes H1463 and CSH3075 showed maximum similarity coefficient of 0.83. The Polymorphic Information Content (PIC) value for SSR marker ranged from 0.10 (NAU 2697) to 0.86 (NAU 1093). Thus, from this study, it may be concluded that SSR NAU 1093 can be used further for larger germplasm diversity analysis and the information regarding the similarity coefficient, obtained from the present study, can be used to select divergent parents for future breeding programs.

Tap root induction in *Jatropha curcus* using *in vitro* shoot tip grafting technique

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ABSTRACT

Jatropha curcus (L.) commonly known as physic nut or Ratanjot belonging to family Euphorbiaceae is a drought resistant and potential biodiesel producing perennial shrub found in tropic and sub tropic regions of the world. The *Jatropha curcus* oil has been identified as an efficient renewable substitute to be used as eco-friendly biofuel for diesel engines. *Jatropha curcus* being highly cross pollinated, seed raised plants easily forms artificial and natural complexes and poses a problem to genetic purity. Availability of cuttings for vegetative propagation is seasonal and the plants propagated by cuttings possess a lower longevity and produces pseudo-tap roots that may penetrate to a shallow depth in the soil as compared to seed grown trees. These shallow rooted plants are easily uprooted due to high wind velocity resulting in reduced yield and making *Jatropha* cultivation unsustainable. The major objective of the present study was to develop a rapid *in vitro* shoot tip grafting (STG) technique to increase recovery of *Jatropha* plants from *in vitro* regenerated shoots having tap root system. As far as we are aware this is the first report of *in vitro* shoot tip grafting (STG) technique on *Jatropha curcus*. The grafting success rate was higher in 6-8 mm stock-scion diameter followed by 8-10 mm irrespective of the grafting method used. Among different grafting methods, maximum success (90%) was observed in top cleft grafted plants followed by side cleft grafted (81.4%). Scion of smaller size had a lower success rate than larger scions. Top cleft grafting at 30-40 mm height was found most successful (92.0%) while side cleft grafting exhibited higher success rate (80.6%) at 20-30 mm height from the base of root stock. The graft survival was also found to be influenced by root stock age and best results were obtained when 15-25 days old *in vitro* raised seedlings were used as root stocks. Media supplemented with BA (3mg/L) and IBA (1mg/L) + Additives (adenine sulphate (50mg/L) + Glutamine (100mg/L) + L-Arginine (25mg/L) + Citric acid (0.0025%) + Ascorbic acid (0.005%) exhibited the highest shoot tip grafting success (93.3%). Shoot-tip grafting is a fast and reliable technique of recovering *Jatropha* shoots which do not root under *in vitro* culture conditions. The technique was also found capable of tap root induction and better than hormonal or other *in vitro* root induction methods.

Synergistic Effects of *Ocimum sanctum*, *Adhatodavasica*, *Allium sativum*, *Pipperlongum* and *Aloe vera* Against *Mycobacterium tuberculosis* H37Rv

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ABSTRACT

In present study we analyzed the combinations of 5% (w/v) aqueous extracts of *Ocimum sanctum* + *Aloe vera* + *Allium sativum*; *Ocimum sanctum* + *Adhatodavasica* + *Pipperlongum*; *Ocimum sanctum* + *Allium sativum* + *Adhatodavasica*; *Ocimum sanctum* + *Aloe vera* + *Pipperlongum*; *Ocimum sanctum* + *Aloe vera* + *Adhatodavasica*; *Ocimum sanctum* + *Allium sativum* + *Pipperlongum*; *Ocimum sanctum* + *Adhatodavasica* + *Allium sativum* + *Aloe vera*; *Ocimum sanctum* + *Adhatodavasica* + *Allium sativum* + *Aloe vera* + *Pipperlongum* to analyze the synergistic effect of *Ocimum sanctum*, *Adhatodavasica*, *Allium sativum* and *Aloe vera*. Combination of all four medicinal plants (*Ocimum sanctum* + *Adhatodavasica* + *Allium sativum* + *Aloe vera*) exhibited inhibition of 78.06% of *Mycobacterium tuberculosis* H37Rv growth while the combination of *Ocimum sanctum* + *Adhatodavasica* + *Allium sativum*; *Ocimum sanctum* + *Aloe vera* + *Allium sativum* and *Ocimum sanctum* + *Aloe vera* + *Adhatodavasica* exhibited shows the inhibition of 74.82%, 68.16% and 62.96% inhibition of *Mycobacterium tuberculosis* H37Rv growth respectively. All the results show that *Ocimum sanctum*, *Adhatodavasica*, *Allium sativum* and *Aloe vera* have the strong antimycobacterial activity in combination and could be the potential source for the development of anti-tubercular drugs.

Production and Export Potential of Basmati Rice from Haryana, India

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ABSTRACT

Basmati, the unique aromatic quality rice is a nature's gift to Indian sub-continent. Epicureans acclaimed its delightful fragrance, taste and texture which makes it the best among the aromatic rices of the world. The word "Basmati" appears to have been derived from two Sanskrit words i.e., vaas (fragrance) and matup (possessing). Vaasmati pronounced now as Basmati appears to mean the one that "possesses fragrance." In North India "va" is often pronounced as "ba", and that is how the word "vasmati" must have become "Basmati". The plant of Basmati rice is very tall and weak and hence prone to lodging. Basmati rice is photo-period sensitive and susceptible to most of the insect pests and diseases. Basmati rice is grown in traditional areas due to congenial environment, soil and water factors. Now a day's water is coming a scarce commodity, hence farmers are growing Direct Seeded Rice (DSR) in some parts of Haryana and elsewhere in India. The farmers of this sub-continent have been growing the scented rices for centuries. It is cultivated on the foot hills of the Himalayas in the northwestern parts of Indian sub-continent comprising the states of Haryana, Punjab, Uttaranchal, Western Uttar Pradesh, Jammu & Kashmir. Typically, the delicately curved, long grained, highly aromatic rices which elongate and cook soft and fluffy were the ones which were categorized as Basmati and enjoy privileged treatment both in domestic and international markets. In the export markets still the traditional tall basmati variety Taroari Basmati followed by Basmati 370 and Type 3 (Dehradun) have supremacy over other varieties due to their exclusive quality features. However, among evolved basmati varieties, Pusa basmati 1121 due to its extra-long slender grains along with Pusa Basmati 1 have carved a special niche in the international market. In India major states producing Basmati rice are Punjab (27.23 lac tons), Haryana (24.26 lac tons) and Uttar Pradesh (17.53 lac tons). **India** is the leading exporter of the **Basmati Rice** to the global market. The country has **exported** 40,45,796.25 MT of **Basmati Rice** to the world for the worth of Rs. 22718.44 crores during the year 2015-16. Major **Export** Destinations (2015-16) were Saudi Arabia, Iran, United Arab Emirates, Iraq and Kuwait., Jordan, Yemen, Australia, Belgium, Canada, Germany, Italy, Netherlands, U.K, USA etc., The exports can be further promoted if the government policies become more liberalized and there is incentive for exports. Agriculture Produce Export Development Authority should sensitize farmers and millers about the quality of raw produce and standard of processed products so that rice can fetch more prices in international market. Continuous survey should reveal demand and supply chain strengths so as to build on exports.

Biodegradable Nanocomposites for Active Food Package Application

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ABSTRACT

Biodegradable nanocomposite opens up a new class of ecofriendly and sustainable food package material replacing the conventional non biodegradable plastic material. Biopolymer such as starch, cellulose & gelatin when incorporated with reactive Nano filler like ZnO, Ag, TiO₂, CNT, and nanoclay results into nanocomposites with enhanced mechanical, thermal and barrier properties. These also add desirable function and application to it like antimicrobial agent, oxygen scavenger, biosensor and enzyme immobilization, which are of utmost importance in keeping the food fresh. These nanocomposites have potential for future application like 'smart' food packaging (including biosensors, freshness indicator etc), as well biopolymer infused with Nano encapsulated substances that allows to modify food as per the required nutritional needs and taste. This article presents the properties, method of preparation and various applications of these biodegradable nanocomposites used in field of food packaging.



Sustainable Development Issues in the East-African Context regarding Energy

ABSTRACT

Ethiopia belonged during the course of the last century a country to those countries which were economically less developed and since the beginning of this century is showing a double digit economic growth. This presentation shows in historic perspective how Ethiopia has begun using her potential in generating hydro power contributing to alleviating and even triggering economic development for an ever growing population of 3% per year and urbanization of 4%. At present Ethiopia's population is around 100 million and the urbanization lies at 17%. Ethiopia has begun using her potential of using hydro energy at the river Nile and other rivers thus being capable of offering electricity to neighboring country. Egypt, Sudan and Ethiopia, countries that are geographically interconnected by borders have the chance of embarking on economic integration based on energy, water and land to boost agricultural production. Considering the industrial potential of Egypt, availability of arable land in Sudan and Ethiopia and Ethiopia's high potential of generating hydroelectric energy, these factors could realistically provide a sustainable development and even create political stability in the future. There are positive signs from all three countries after a long debate about the sharing of the Nile water to agree on substantial issues from which all three countries can only gain.

Mahatma Gandhi-House, Göttingen, Germany



Entrance

Floor from the student hostel to the seminar rooms, office rooms and the club rooms



Student hostel

