10th International Seminar

on

Harnessing Science and Technology Applications through Capacity Building and Economic Policies for Sustainable Development

September 13 - 15, 2018

at

Mahatma Gandhi House, Göttingen, Germany

Abstract Book

Collaborative Partners

https://www.aasf.de/ifsdaa/2018-international-seminar-germany/

Editors: Machiavelli Singh, K. W. Giorgis, A. Ibenthal & R. K. Behl

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INTRODUCTION

Dear Colleagues,

the United Nations sustainable development goals enshrined in their objectives that poverty was to be halved by 2015 by various nations globally. However, this goal has rarely been achieved by many countries. Much more remains to be done to achieve the targets.

To achieve the UN 2030 agenda objective of ending poverty and hunger everywhere, the following issues are deemed pivotal: 1.) The majority of the Afro Asian population lives in rural areas which are mainly the production sites for raw materials. The utilization of natural resources is injudicious. 2.) In these regions national agricultural productivity is quite low while international investors are able to obtain high efficiency through capital and technology deployment, economies of scale. However the produce is export bound and does not contribute to national needs. 3.) The impact of climate change is soaring, disaster management is in its infancy with regard to research, required dimension and footprint. 4.) The food processing industry is yet to gain pace, hence related economic growth is far below its potential. 5.) Knowhow transfer from international knowledge centers is punctiform. 6.) The need for short-term currency requirements sets priorities over sustainable development strategies on many national agendas.

The philosophy of capacity building is to enable human resources to understand the needs of development and to acquire training through hands on practice for performing tasks necessary for development. The focus, therefore, has to be to minimize theory practice gaps.

With the advent of emerging technologies, it is possible to give pace to the primary production of crops, post-harvest processing of crop produce, manufacturing technologies for developing value added products, science and technology applications for assessment and optimization of natural resources including land, rhizosphere, water, forest, bio diversity etc. Therefore, know-how and guidance in using emerging technologies is valuable to effectively utilize human capital and natural resources. Also, the policies of credit for start-ups, agri-ventures and tax policy have to be pro-development and individual and entrepreneur friendly. Yet it is acknowledged that this is but one dimension towards the UN's Agenda 2030 goals. The success of technology advance needs to be accompanied by economic and political dimensions.

This international seminar is intended to provide a platform for knowledge and experience sharing between developed and developing countries so that the pace of sustainable development can be accelerated in developing countries by sharing knowledge and resources. Three days international seminar shall therefore be organized at the representative campus of the Afro-Asian Studies Promotion Association (AASF), Mahatma Gandhi House, Theodor–Heuss-Str-11, 37075, Göttingen, Germany. The organizers cordially invite you and your colleagues to participate in this seminar in the historic university town Göttingen, Germany.

Er. Dawit Bereket-Ab	Dr. K. Wolde-Giorgis	Er. Esmail Eqbal	Prof. A. Ibenthal
Co-Convener	Convener	President AASF	Chair

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President
African Asian Studies Promotion Association (AASF)
Gottingen, Germany

Message from the desk of

President, African Asian Studies Promotion Association (AASF)

Its indeed a pleasure for me to know that International Foundation for Sustainable Development in Africa and Asia (IFSDAA), HAWK University of Applied Sciences & Arts and African Asian Studies Promotion Association (AASF), Gottingen, Germany are jointly organising 10th International Seminar on *"Harnessing Science and Technology Applications through Capacity Building and Economic Policies for Sustainable Development"* from September 13 - 15, 2018 at Mahatma Gandhi House, Theodor-Heuss-Str. 11, D 37075 Goettingen, Germany.

Capacity building is life long process which needs a perfect blend of concepts, knowledge, and hands on practice to minimise theory practical gaps. With advent of emerging science and technologies the capacity building dimensions are also changing for sustainable development in various sectors. The government policies and people's participation impact the sustainable development most whereas the skill development is an important way to achieve it. I understand that various aspects of science and technology applications for capacity building and economic policy reforms for sustainable development in sectors like agriculture, biotechnology, health will be covered in this seminar. On behalf of AASF, I assure full support to this international seminar as in past and wish the organisers as great success.

I look forward to receive recommendations for continuous efforts of IFSDAA in collaboration with various universities and elsewhere globally to organise joint activities on harnessing science and technology applications for sustainable development through innovative projects, capacity building workshops and international conferences. I wish the delegates of the seminar enjoyable stay in Goettingen and pleasant discussions.

September 13, 2018
Goettingen, GERMANY

Er. Esmail Eqbal
President, AASF

AMITY UNIVERSITY
HARYANA
Established vide Government of Haryana Act No. 10 of 2010

Prof. Rajendra Prasad
Ph.D, FNASc, FASc, FNA
Dean Faculty of Science, Engineering & Technology
Director, Amity Institute of Biotechnology
Director, Amity Institute of Integrative Science and Health

MESSAGE FROM THE DESK OF
Director, Amity Institute of Biotechnology, Dean, Faculty of Science, Engineering and Technology
Amity University Haryana (AUH)

I am delighted to note that an 10th International Seminar on *"Harnessing Science and Technology Applications through Capacity Building and Economic Policies for Sustainable Development"* is being organized by International Foundation for Sustainable Development in Africa and Asia (IFSDAA) and HAWK University of Applied Sciences and Arts, Gottingen, Germany in collaboration with Afro Asian Studies Promotion Association (AASF) at Mahatma Gandhi House, Gottingen, Germany on September 13 - 15, 2018.

Sustainable development goals of the United Nations can be achieved through the judicious integration of science and technology applications in important sectors like Food, Energy, Health, Hygiene, Environment, Space and Communication for Economic policies of societal relevance, livelihood and gender sensitisation. The capacity building is needed for achieving these targets, the needs for capacity building commensurate with diverse sustainable development objectives over different times and hence it has to be up scaled periodically.

The philosophy of capacity building is to enable human resources to understand the needs of development and to acquire training through hands on practice for performing tasks necessary for development. The focus, therefore, has to be to minimize theory practice gaps.

I understand that intensive deliberation on the issues of capacity building through science and technology applications and economic policies will be discussed thread bear during this international seminar in view of the development needs of various countries in Africa and Asia and the options available for effectively utilising the manpower and natural resources.

I congratulate the organiser of international seminar and hope that coherent recommendations will emerge in the meeting for best in the service of mankind with scientific discussions.

Prof (Dr.) Rajendra Prasad **Gurugram – 122413, INDIA**

T H E M E

Capacity Building for Food Security in Sustainable Development

Keynote Lecture

From Agricultural Research to Agribusiness by Factor C^{n}:

Capability, Capacity and Competency Context, Culture, Conscience, Conscientiousness, Commitment, Creativity, Courage, Communication, Consensus, Connectivity, Cooperation, Coordination, Coherence, Continuance, Countability, Capital, Convenience, Customers

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Global Symbol for Capacity Building

ABSTRACT

Between 2015 and 2050 more than a doubling of crop production, a tripling of plant based protein production (food & feed), and a tripling of fruit and vegetable production is necessary to feed 9.3 billion people living on earth.

Africa's population set to double by 2050, but crop production will not. The challenge is: How much improvement in agricultural production will be enabled and how much food has to be imported – at which price?

Nowadays, millions of farmers still work with obsolete agricultural technologies. Consequently, e.g. agricultural losses across the food value chain in Sub-Saharan Africa are 19% for stable crops, 28% for cash crops and 52% for horticulture (*UN, 2017*).

"The low agricultural productivity in poor countries is not due to poor land endowments. These seem like sizeable unrealized gains in productivity. Efficiency improvements in developing countries could dramatically boost crop yields by factor 5" (*Adamopoulus and Restuccia, 12/2017*).

Furthermore, rate of returns per year to food and agricultural R&D investments worldwide are 139.5% for applied research, 42.9% for basic research, and 72.2% for extension service (*Hurley et al., 2016*). Consequently, R&D investments are very profitable and promising.

Today and in future, agricultural innovations, entrepreneurship, capacity building and technology transfer of appropriate and socially adaptable technologies are and will be key essentials for the improvement of agriculture and food industry in developing countries. Nevertheless, it has to be considered, that technologies are parts of the solution, but technologies alone cannot solve the problem of global hunger and poverty.

Furthermore, since centuries it is well known, that "technology transfer in itself will not lead to economic growth. A successful transfer of technologies can occur only, if the recipient is sufficiently capable of maintaining an introduced production system. Without this capability, it is difficult to modify or improve agricultural production systems" (*Madu, 1989*).

A Vision named: "***From Agricultural Research to Agribusiness***" reflecting "**Factor C^{n}**" ("**CCCC CCCC CCCC CCCC CCCC C…**"): **C**apability, **C**apacity and **C**ompetency - **C**ontext, **C**ulture, **C**onscience, **C**onscientiousness, **C**ommitment, **C**reativity, **C**ourage, **C**ommunication, **C**onsensus, **C**onnectivity, **C**ooperation, **C**oordination, **C**oherence, **C**ontinuance, **C**ountability, **C**apital, **C**onvenience, **C**ustomers, will be given for students, scientists, university faculties, agriculture colleges,

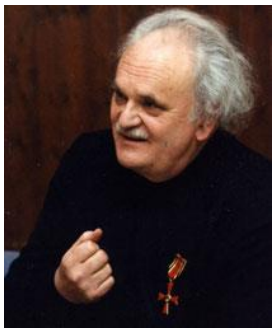
school teachers, extension personnel, private sector, private sector advisers, small and medium enterprise owners, farmers, NGOs, policy makers, media, and the public at large.

By pressing the techno-cultural innovation forward in agriculture through appropriate technologies by creative and responsible scientists, the changing world will be able to address the Vision: "**Factor F^{n}** ("**FFFF FFFF FFFF FFFF**"): **F**uture **F**arming, **F**ood, **F**eed, **F**itness, **F**uel, **F**iber, **F**lowers, **F**reshwater, **F**ishery, **F**orestry, **F**lora, **F**auna, **F**un, **F**ortune, **F**reedom, which are milestones on a roadmap for tackling the challenges of the 21st Century (*Kern, 2010, 2012*).

The all over all key challenges ahead of all stakeholders should be kept in mind: "We have to deliver "values" in time to farmers, agricultural production systems, to the society and the environment!

Last, but not least: "If I have the belief that I can do it, I shall surely acquire the capacity to do it even if I may not have it at the beginning" (*Mahatma Gandhi, 1869-1948*).

3rd Karl Fritz Heise Memorial Lecture



Dr. Karl Fritz Heise (1925 - 2004)
Mitbegründer der AASF e.V.
Geschäftsführer der AASF e.V.: 1959 - 2004
Verleihung des Bundesverdienstkreuzes: 1996

Why should the Green revolution take place in Africa and why has it not yet taken place?

Arthur Riedacker

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ABSTRACT

In the past, during the last ten thousand years, every time when the population did increase, either crop production had to be intensified our people had to migrate to other regions less densely populated to go on with agricultural practices requiring low labor input. According to Ester Boserupt this was the general situation in the Pre-industrial world. The slash and burn agriculture was the practice requiring the least labour input, while being at the same time the most land demanding per capita. It coexisted with intensified practices, more labour but less land demanding practices. And thus food production followed, up to now, more or less the population growth.

Today because of the threat of climate change the situation is to evolve: agriculture as well as forestry are to be intensified upfront, not only to meet decently, up to 2050, the basic needs of a much higher world population than in the 1950s', but also to produce much more vegetable biomass to replace massively fossil fuel, wherever this cannot be done, more easily and economically, with other alternative solutions such as increasing renewables energies (e.g. electricity from photovoltaics, wind etc.), less land demanding.

This may require specific national policies. According to the US government of Barack Obama and US lead authors of the special IPCC report on land use, reinforcing food security will require the removal of all economical barriers in order to allow everybody, and particularly the poorest people, to access to least cost food supply! According to us this approach has three main drawbacks: it will not favor increasing food and non food biomass production to both meet the basic needs of a much more populated planet than today; it will also not decrease enough net GHG emissions (not only from agriculture but mainly from other sectors) to stabilize the climate by 2050; and finally it will also not help to increase enough national productions to equilibrate national balances of trade while creating jobs within each country. Historically this can be illustrated with four examples: the establishment, after the Second World War, of the European protectionism with the Common Agricultural Policy which allowed France to become self sufficient in wheat and even export grain ; the establishment in the 18th century, and the repealing in the 19th century, of the Corn Laws in England which changed the flow of grain imports; the Indian agricultural policy, which with the Green Revolution and specific positions in negociations under the WTO, succeeded up to now to keep up with food production. To combat climate change we are now to increase biomass production without further converting forests and grassland into cropland, e.g. increase land use efficiency in agriculture and forestry wherever possible. This will probably require much stronger awareness and involvement, not only of policy makers, agronomists, economists and research workers, but also of anthropologists, in particular in Africa and industrialized countries.

Brigitta Benzing Commemorative Lecture

Policy interventions for Sustainable Development through upscaling of Community Embedded Skills and Indigenous Knowledge in Africa

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ABSTRACT

Since times immemorial, community embedded skills and indigenous knowledge of artisans, small enterprises and skilled & semi-skilled workforce has important in the civic society and for rural and urban development. The particular skills have been community embedded and has been influenced strongly by caste system world over. The caste system by itself in many countries including Europe, Africa and Asia have been based on community embedded skills like mason in construction, blacksmiths in metal works, goldsmith in gold work, farmers in farming, weavers etc. The community embedded skills transcended from one generation to the other through informal education and hands on practice without knowing the science and technology aspects determining the skill efficiency with advent of industrial revolution. The community embedded skills have been enhanced through science and technology based applications and knowledge flow through international migration. Though the caste system in many countries especially developed countries have weakened to a great extend but in developing countries it is still exists. It's easier to upscale particular skills if the work force from various communities knowing traditional skills are chosen for further training to use scientific method for production of goods at small, medium and large industrial scale.

Horizontal mobility or shifting explains the transition of an individual from one social group to another of the same level, for example, the transition of an individual from one citizenship to another, from one family to another, from one factory to another in the same occupational status. By vertical mobility is meant the relations involved in a transition of an individual from one social stratum to another. In order to study inter- generational occupational mobility, it should be examined if the occupational position of an individual is influenced by that of his father. 'Changes in the traditional occupational structure result from both external and internal forces. The external factors are comprised of land reforms, secularization, industrialization, urban contacts, means of communication and modem education. Due to the impact of industrialization, the occupational structure has been multiplied leading to a lot of differentiation. As a result of ascriptic occupational stratums have been broken and an achieving society has gradually come into being. Education has transferred certain occupations into professions which require special training, a prescribed educational standard and skill. Modem professions are equally the product of education as well as industrialization. During the nineteenth century when most of the present professions were in the process of rise and growth, they did not require so much specialization and training, but these days there is a definite indication that one after the other, different occupations are being transformed into professions demanding skill and standard. IFSDAA and AASF are engaged in enhancing scientific mobility to give base to the knowledge transfer for skill development and capacity building for sustainable development in Africa and Asia.

T H E M E

Resource Management

Keynote Lecture

Development of yield level in Eternal Rye Trial in Halle (Saale), Germany, since 1879

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ABSTRACT

- In Eternal Rye Trial of Halle/Germany the yield development is considered for winter rye 1879 - 2010 and for maize and potatoes 1962 - 2010 at 4 fertilizer treatments.
- The winter rye yields decreased up to 1922, thereafter they remained until the 1960 years and then they increased up to present on all variants.
- The causes of the yield drop in the first 40 years after the start of trial were mainly the negative effects of monoculture and the use of seed of the trial plots.
- The yield increase after 1960 were caused mainly by cultivation of new, higher- yielding rye varieties, regular use of plant protection products, deepening of ploughing zone , and perhaps also by elevated atmospheric CO2 concentration.
- The maize and potato yields increased only after 1980 and only at NPK resp. farmyard manure application (high yield- varieties with strong nutrient demand).
- Crop rotation with potatoes increased rye yield (phytosanitary and nutrient mobilization effects?)
- The Eternal RyeTrial supplies not only results about the long-term effects of fertilization on yields and soil ecology, but also knowledge about the long-term influence of agrotechnical measures (e. g. use of plant protection products), crop rotation and breeding success on the plant yield development.

Keynote Lecture

Between Past and Future – Towards an African Perspective on Technology Development

Prof. Dr.-Ing. Achim Ibenthal

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ABSTRACT

African culture is traditionally geared toward self-sustainability, efficient use of natural resources and small-scale economies. Historically, apart from medieval trade routes and technological/academic strong-holds like Egypt, Al Quaraouiyine or Sankore, oral traditions and personal references determined day-to-day living. These differences are still existing today between urbanized and rural regions, even though technology bringing personal benefits is embraced wherever available and affordable. Rural technology deployment is constrained by local infrastructure, living conditions, lack of tools and lack of technical education.

By examining the example of Ethiopia, education and the introduction of new technologies are viewed from a historical perspective: social and cultural aspects in the educational system, the tradeoff between quantity and quality in a rapidly growing academic environment, the challenges of introducing standard solutions to a nation with 80 languages and more than 200 ethnic groups.

From example projects related to mechanization, solar energy, bicycles and cultural interface design, integral factors in sustainable technology development and deployment are stated. Most notable are methodologies for robust system design, consideration of a maintenance infrastructure and business models adapted to local needs and capabilities.

Effect of different levels of rejuvenal pruning on tree canopy, yield and quality of ber

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ABSTRACT

The present investigation entitled "Effect of different levels of rejuvenal pruning on tree canopy, yield and quality of ber" was carried out at experimental orchard, Department of Horticulture, CCS Haryana Agricultural University, Hisar during the year 2011-17 after seven years of rejuvenation. Forty years old plants of Umran and Kaithli planted at 8 x 8 m were used as experimental material. The plants of Umran and Kaithli were headed back at 1, 1.5 and 2 m from point of emergence of main limbs during 2009. Each treatment was replicated thrice with single tree as experimental unit in randomized block design. Ber plants headed back at 2 m level produced maximum growth in terms of plant height (12.21 m) and plant spread (9.32 x 9.62 m). Maximum fruit yield (83.00 kg/plant), fruit size and quality was also recorded in 2 m heading back. Among cultivars, plant height (11.60 m) was maximum in Kaithli. However the fruit yield and quality was better in Umran. Powdery mildew was observed in traces in Umran. For rejuvenation of old ber (Umran and Kaithli) orchards, the plants should be headed back at 2.0 meter level from the point of emergence of main limbs.

Key words: rejuvenal, pruning, heading back, ber

Bael (*Aegle marmelos* L.) coatings preserve the bioactive compounds and enhances the shelf life of tomato (*Lycopersicum esculatum* M.*)*

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ABSTRACT

Tomato is a climacteric fruit and has a relatively short postharvest life. Every year approx. 25-40% tomato losses occur due to lack of suitable methods of post-harvest storage. It is considered protective as well as productive food because of its special nutritive value and wide spread production. Tomato is the richest source of nutrients, dietary fibres and antioxidants like lycopene and beta-carotene. It is a rich source of vitamin A and C and also contains minerals (iron and phosphorus). It is also known as poor man's orange. Therefore, because of its economic importance, the present study was planned to study the effect of bael (*Aegle marmelos* L.) coatings on the bioactive compounds and shelf life of tomato during storage. A progressive increase in the physiological loss in weight, total soluble solids and total sugars was observed while fruit firmness decreased throughout the storage period. All the treatments resulted in enhancement of reducing and non-reducing sugars in the tomatoes as compared to control but the maximum increase was observed in 5% bael coated tomatoes. The lycopene content in 5% bael coated tomatoes stored at 25˚C was 150.18 while at 10˚C it was 167.94 mg/kg f.wt. The total phenolic content of control tomatoes stored at 25±1˚C and 10±1˚C on 6th and 9th day after storgae was 11.73mg/100g and 12.76mg/100g whereas for 5% bael coated tomatoes, it was 17.44mg/100g and 17.51mg/100g but this high value of total phenolic content was obtained on 9th and 15th day of storage at 25±1˚C and 10±1˚C. Among the coating treatments, 5% bael coated tomatoes showed the least decrease in crude protein. The total flavanoid content of 5% bael coated tomatoes (25±1˚C & 10 ±1˚C) on 9th and 18th day after storage were 2.89mg/g and 3.21mg/g respectively. The control had 2.48mg/g total flavanoid content on 3rd day after storage at 25±1˚C and at 10±1˚C it was 3.12mg/g on 9th and 18th day after storage. The levels of ascorbic acid increased with the storage period and also with the increasing concentrations of bael. Thus, bael coatings delayed changes in all the studied parameters which were more in the control as compared to treated tomatoes. The results suggested that 5% bael was most effective in preserving the bioactive compounds and delaying the ripening related changes at 25 ± 1◦C and 10 ± 1◦C.

Key words: Bael, bioactive compounds, coatings, shelf-life, tomato.

Removal of lead and chromium using tea waste as an adsorbent

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ABSTRACT

Increased in industrialization and globalization has led to the production and disposal of large amount of heavy metals in the environment. Contamination of water with heavy metals is one of the great problems of modern societies. These heavy metals are kept in the water storage and by the process of biomagnifications cause serious threat to human and environmental health. So the heavy metals are of great concern due to their longer persistent in the environment. There are numerous methods used for the removal of heavy metals from waste water like membrane filtration, ion exchange, solvent extraction, chemical precipitation, carbon adsorption, electroprecipitation, coagulation, flotation, ultra filtration etc. These methods have high cost. So there is urgent need of effective and low cost methods. Adsorption technique is a highly efficient and low cost method for heavy metals removal.

Tea (Camellia sinensis) is the most widely consumed beverage in the world. The global production in 2007 was 3.60 million tonnes. With such a great production and consumption, a large quantity of tea waste are discarded into the environment. Now a day's tea waste is gaining a much attention by researcher because it is very suitable biosorbent in removing heavy metals like iron (II), Cr (VI), lead and nickel. Based upon the experimental condition, it has been found that removal of lead ion form their aqueous solution could attain 99.5% ,when 15g/L dose of tea waste used with contact period of 60 min. at 25o C whereas chromium removal was noted as 75.7 % at same condition. Our study shows that tea waste is highly efficient, low cost biomass used for the removal of toxic metals like chromium and lead. It has been concluded that in future tea waste has been utilized in agricultural field to enhance the production under heavy metal stress.

Harnessing bacterial applications through plant growth promoting traits for Sustainable Development

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ABSTRACT

First time the term Plant growth Promoting Rhizobacteria "PGPR" was used by Joseph W. Kloepper. Normally the rhizobacteria are very beneficial to the host plant. They act as very good biofertilizers and are time tested. They can be defined as root colonizing bacteria having symbiotic relationship with many plants. Some of them also form root nodules, some are free living while others are associative types. Some of the examples include *Rhizobium*, *Azotobacter*, *Azospirillum etc*. The origin of word "rhizobacteria" is from Greek *Rhiza* whose literal meaning is root. The PGPR are very specific towards their host plants. They may be endophytic, rhizospheric and phyllospheric in nature. Throughout the world, the rhizobacteria provide almost 60% of the nitrogen fertilizers. Therefore the present investigation was proposed to test various plant growth promoting (PGP) traits of the rhizobacteria from local soils of Haryana state in India. The various PGP traits such as Antibiosis, Biofilm formation, Biological nitrogen fixation, Exopolysaccharide production, Induced systemic resistance, K solubilization, Lytic enzyme production, Phosphate solubilization, Phyto hormone production, Siderophore production, antifungal properties, bacteriocin production, bio surfactant production, bio control agent, bioremediation and biodegradation related to PGPR were studied. The various properties exhibited by these mini creatures and their applications for sustainable development will be discussed in detail during the presentation.

T H E M E

Genetic Resources and Plant Breeding

Keynote Lecture

Crop Genebanks – The Maintenance of Natural Resources for the Future

Börner A.[1,*], Nagel M.[1], Agacka-Mołdoch M.[1,2], Börner M.[1,3], Lohwasser U.[1]

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ABSTRACT

Plant genetic resources for food and agriculture (PGRFA) play a major role for global food security. The most significant and widespread mean of conserving PGRFA is *ex situ* conservation. Most conserved accessions are kept in specialized facilities known as genebanks maintained by public or private institutions. World-wide 7.4 million accessions are stored in about 1,750 *ex situ* genebanks.

Plant *ex situ* genebank collections comprise seed genebanks, field genebanks as well as *in vitro* and cryo collections. Species whose seed can be dried, without damage, down to low moisture contents can be conserved in specially designed cold stores. Such "orthodox" seeds can be expected to maintain a high level of vigour and viability for decades. Field genebanks, *in vitro* and cryo storage are used primarily for species which are either vegetatively propagated or which have non-orthodox seeds that cannot be dried and stored for long periods. In addition, perennial species, for example certain forage species, which produce small quantities of seed, and long-lived plants are also maintained this way. It is estimated that worldwide, less than 10% of genebank holdings are stored *in vivo* in the field, and less than 1% are conserved *in vitro*/cryo. Clearly, seed storage is the predominant mode of plant genetic resources conservation.

With a total inventory of 150,000 accessions from 3,212 plant species and 776 genera, the 'Federal *ex situ* Genebank of Germany' in Gatersleben holds one of the most comprehensive collections worldwide. It comprises wild and primitive forms, landraces as well as old and more recent cultivars of mainly cereals but also other crops. Starting in the 1920's material was accumulated systematically. Seed storage is managed in large cold chambers at -18°C. Seeds are kept in glass jars, covered with bags containing silica gel (active collection) and in aluminum bags under vacuum (base collection).

The maintenance of the collection requires regeneration. Each year between 8 and 10% of the collection is grown either in the field or in glasshouses. Regeneration becomes necessary when: (1) the quantity of stored seed has dropped below a pre-set threshold, due to supply to users, (2) viability falls below a pre-set threshold, (3) phenotypic evaluations of the accessions need to be conducted or (4) new accessions, which require multiplication and characterization, enter the collection. Regeneration is carried out locally to ensure genetic integrity and to minimize genetic erosion. Voucher specimens, photographs and written documentation are used to monitor the identity of the material. Special attention has to be given to out-pollinating species, which are either multiplied in small glasshouses or in isolation plots in the field.

Since the majority of genebank accessions globally are stored in the form of seed, seed longevity is of particular importance for crop germplasm preservation. At the IPK research was initiated for a range of crops stored in the genebank over decades. Variation between and within crop species was detected.

Keynote Lecture

Triticale: a cereal crop with a prosperous future

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ABSTRACT

The purpose of this presentation is to overview triticale characteristics which make it competitive and suitable to grow and to improve for future generations. First of all the cereal species grows well in different soil types. It doesn't require many inputs and it is still able to handle a number of biotic and abiotic stresses much better than any other small cereal grain. It also does well in poor as well as in heavily manured soils – it is less prone to lodging than barley and its parents - wheat and rye. World triticale production in 2016 was 15.2 million metric tons (m mt) produced on 4.2 million ha (m ha) harvested area as summed up for about 40 triticale producing countries. Top producers were following: Poland produced 5,1 m mt on 1,4 m.ha; Germany produced 2,4 m mt. on 396,1 thousands ha (th ha), Belarus produced 1.6 m mt. on 0.5 m ha, France produced 1.4 m mt. on 334.2 th ha, Russia produced 0.62 m mt. on 223 th ha and Hungary produced 0.5 m mt. on 139,1 th ha (FAO Stat). Among the advantageous production factors there are also some constraints which haper triticale breeding and production. To these constraints belong emerging susceptibility to diseases of its parents, eg. ergot, Fusarium head blight (FHB), rusts, powdery mildew and leaf spots. Other production constraints include later maturity than wheat, preharvest sprouting, triticale grain downgraded for end uses. Lower feed classifications of triticale reduces economic returns.

Nevertheless, significant improvements were made in modern triticale cultivars with respect to agronomic performance, resistance to biotic and abiotic stresses and quality, in particular for human consumption and wider adoption as a viable commercial corp. In the past decades, new breeding tools and novel technologies (doubled haploid, marker assisted selection, genomics selection, transgenic, functional genomics, and targeted genome editing) have been refined or developed anew and are successfully exploited in triticale improvement. Through the integration of these tools and technologies with conventional plant breeding approaches, triticale biological potential is being enhanced to make this small grain species an economically successful crop worldwide. It is successfully grown in developed and less developed countries and contributes to reduction of malnutrition, poverty and hunger.

Key words: Triticale characteristics, growing potential, grain production, malnutrition

Keynote Lecture

Grain legumes for sustainable agriculture development in Australia

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ABSTRACT

Australia is the driest continent in the earth. The most agriculture production in southern Australia is based on dryland agriculture. The coastal area generally gets over 500 mm rainfall, but grain farming is away from the coastal area where the rainfall can be as low as 200 mm. There are no big rivers and the irrigation is a rare commodity. Almost all farms store rain water in their farm as small dams and use it as needed for animal and if surplus for irrigation. Farmers have naturally become resilient and innovative to survive and prosper in this harsh land. Summer is hot and most crops are grown over winter. The common winter crops are wheat, barley and canola. Rice and cotton are grown in restricted area over summer where the irrigation is available. Sorghum and maize are grown in limited areas. Farm produce contribute $60 billion to the economy and 77% of the product is exported.

Every day the net increase in the world population is over 75 million every year. The agriculture production has to be doubled by 2050 to feed the extra mouths. But the production has to come sustainably. Sustainable agriculture should maximise reliance on natural, renewable and on-farm inputs. It requires proper care for sustaining the production without compromising on soil and water resources. Crop diversification, mixed farming and integrating crops and livestock can boost in sustainable production. Grain legumes are relatively new crops in Australia dating back to the late 20th century. Within a short period, they have established as a major component of the cropping system which was dominated by cereals after cereals. Chickpea, faba bean, lentil, field pea and lupins are the major winter grain legumes in Australia whereas mung bean is for summer. Although groundnut and soybean cultivated in the sub-tropical north during summer are treated as oilseed crops, they also contribute in the sustainable cropping system as legumes.

The farmers have realised the benefits of using legumes in their crop rotation as nitrogen benefit and breaking disease cycle in the predominately cereal based farming. Therefore, it has become an integral part of the cropping system. Currently, less than 10% of total cropping area is under legumes and the plans are underway to at least double the area in the near future. Use of grain legumes can be an avenue for sustainable agriculture production. Legumes improving soil health, increase water use efficiency, provide nutritious food, lessen burden on the fossil fuel and decrease environmental pollution.

Agriculture production is a complex issue and require multi disciplines to work together for a better outcome. Faba bean (*Vicia faba* L.) is one of the major winter grain legumes worldwide cultivated for food and feed purposes. It has a crucial place in the cropping system as a break crop among cereals in rotation for breaking disease cycles, fixing atmospheric nitrogen and thus ameliorating the soil condition. It is the second biggest winter grain legume after chickpea in the subtropical region of Australia.

In addition to improved yield and disease resistance, we are focussing on tolerance to frost, drought and heat to mitigate the effect of climate change. We run an active breeding program and our varieties are readily accepted by farmers. Faba bean rust, caused by *Uromyces viciae-fabae*, is one of the major diseases in this region and every genotype is screened against rust under artificially created epidemic conditions. Similarly, genotypes are subject to frost, drought and heat conditions and evaluated at multi-locations for 4-5 generations before recommending for release. Newer varieties namely PBA Warda and PBA Nasma have increased more than 15% production than the older varieties. In addition, all these varieties are resistant to rust and tolerant to frost and bean leaf roll virus, a major viral disease in this area. Thus, farmers need not spend much in growing these varieties for plant protection and nitrogen fertilizer.

Augmenting groundwater irrigators' knowledge for adaptation to climate change impacts on groundwater in North East Ghana through formal government institutions

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ABSTRACT

Groundwater irrigation is a major livelihood activity especially in the dry season for some people in Ghana. It provides food and generates income for households as well as creates job opportunities. This activity is organised on the basis of local knowledge solely. Although considered important for promoting livelihood activities under climate change and its impact in the country, local knowledge of irrigators is not sufficient enough for adaptation in Atankwidi catchment. This is premised on empirical data obtained through field research as part of doctoral studies in Ghana. There are however, no studies available at the moment that examined local knowledge for adaptation in the catchment to the best of our knowledge. It is therefore important to carry out this study. The study recognises the importance of formal government institutions because they do not only regulate but also conduct studies on groundwater resources in the catchment. The paper therefore, examines those aspects of local knowledge which are inadequate for adaptation. It again, assesses the ways by which formal government institutions can augment this knowledge to boost groundwater quantity through demand management and recharge for effective adaptation. A descriptive survey design was adopted with the Atankwidi catchment made a case. Results of the study show that knowledge of irrigators only permits them to exploit groundwater as much as they can. Irrigators are least knowledgeable about traditional or artificial methods of augmenting groundwater storage. They also construct wells without any criteria as this has implications for aquifers' sustainability. Harnessing, validating and documenting local knowledge is the first step to adaptation, which should be captured in policy documents. Workshops, community durbars and other knowledge based platforms should be created by the agencies like the Water Resource Commission (WRC), the Council for Scientific and Industrial Research (CSIR), the Ghana Irrigation Development Authority and the Environmental Protection Agency (EPA) at the catchment level to build capacities of catchment dwellers. The implementation of Managed Aquifer Recharge (MAR) and other technologically advanced methods of boosting groundwater availability should be encouraged but anchored on local knowledge. It concludes that local knowledge of groundwater irrigators though not enough can be augmented by formal government institutions for adaptation. This can be done by diffusing scientific knowledge into the catchment by formal government institutions through social interactions, training and participation of irrigators in groundwater decisions at the catchment level.

Key words: Groundwater; irrigation; knowledge; Ghana; climate change; adaptation

A Study on understanding the mechanisms of capsule dehiscence in Sesamum indicum L. (Sesame)

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ABSTRACT

Sesame is one of the most ancient crops grown in tropical and subtropical areas of the world. Sesamum indicum is the most cultivated species, originated in India. The most important Sesame producers are India, Sudan, Myanmar with 68% of the world production (Bedigian et al., 1985). The sesame seeds have 40-60 % of oil content. The most of the Sesame capsules have four rows of seeds, with approximately 70 seeds per capsule (Akhila et al., 2011). Early dehiscences/bursting of capsule is the major problem in Sesame crop which brings substantial yield loss (Sharma et al., 2011). Dehiscence is brought by differential tension in the capsule wall due to repeated moisture absorption and drying. The difference between indehiscent and dehiscent property is due to presence of many cell layers between median vascular and epicarp at the capsule suters of non-dehiscent Sesame (Jones and McQueen-Mason 2004).

The amount of shattering was reduced with the introduction of "improved non-dehiscent" cultivars in 2009 (Langham 2011). The majority of the world's sesame is still shattering type with 99% of the manual harvest (Grichar et al. 2012 ; Couch et al. 2017) and need attention on managing seed loss. The suppression and overexperession of expansin has very important role in plant growth and crop improvement (Marowa 2016). Expansin is the very important component of cell wall. The loosening of capsule cell wall happen due to dessication which bring about the busting of fruits and the role of expansin in dessication is well mentioned. In some plants dehiscence of capsule considered as the mechanism of seed dispersal but in Sesame it is responsible for significant yield loss.

Our efforts are focused on probing the problem of Sesame capsule dehiscence physiologically. In preliminary experiment the effect of Auxin and ABA inhibitors spray was explored on capsule dehiscence during kharif and Rabi crop cultivation of Sesame. The inhibitors were sprayed in different concentration (10mg -1g/l) after 25 days of capsule formation at regular interval (1-5 days) to understand the role of expansin and further confirmation shall be done with immunohistological electrophoretic, fluorescent and confocal laser microscopy methods.

T H E M E

Technology Development

Keynote Lecture

Sustainable Energy for the Twenty-First Century

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ABSTRACT

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 Developing the energy supply leads to solve automatically the major issues of sustainable development: Poverty, job creation, income levels, access to social and economic services, gender disparity, population growth, agricultural production, climate change, the environment, security issues and migration.Today, around 2 billion people still lack access to a reliable supply of electricity: Our challenge in the 21st Century is to provide energy for close to 5-7 billion more people, while cutting our emissions by half.

By 2050, humanity will need three earths to cover its consumption of resources, if we continue to manage our resources as business as usual, an option which does not and will never exist!

Worldwide demand for energy is predicted to spike by 49% over the next 15 years, and fossil fuel plants are expected to shoulder the bulk of the load. Yet many power plants worldwide face efficiency issues, emissions restrictions, and the risk of system failures. 2 billion people expected to move to urban cities by 2050; about 48% growth in world energy demand by 2040 and 78% of world´s energy by fossil is still fuels by 2040.

The International Energy Agency (IEA) estimates that to achieve the below 2-degree scenario, energy efficiency (EE) investments need to reach $560 billion/year over the next 15 years, an increase of over four times the current level.

The future sustainable energy systems will be impossible to operate without the technologies of industry 4.0. and energy 4.0. These are invented today in the manufacturing industry acting as pathfinder into a fascinating and rich digital future.

As of 2015, renewable energy provided an estimated 19.3%i of global final energy consumption. Of this total share, traditional biomass, used primarily for cooking and heating in remote and rural areas of developing countries, accounted for about 9.1%, and modern renewables increased their share relative to 2014 to approximately 10.2%. In 2015, hydropower accounted for an estimated 3.6% of total final energy consumption, other renewable power sources comprised 1.6%, renewable heat energy accounted for approximately 4.2%, and transport biofuels provided about 0.8%. 98.2 percent of Costa Rica's electricity came from renewable sources in 2016.The EU is well on the way to reaching its expansion target of 20 percent by 2020. Front-runner in Europe is Sweden with a share of 53.8 percent. Finland came in at 38.7, Latvia 37.2 percent.

Keynote Lecture

The heavy metal and mineral compositions of some Triticale grains

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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.

Key words: Triticale, heavy metal, minerals, ICP-AES

Technological Interventions for Post-harvest Food Grain Processing

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ABSTRACT

Transformation is needed today for changing the socio-economic status of rural India through innovation and implementation of new techniques. An initiative executed under technology interventions among rural sectors of the country. Improving the livelihood through technology dissemination by upgrading the traditional methods of production and improving product quality while reducing drudgery are undertaken. NGOs and SHGs working in the areas of Science and Technologies for bridging technology gaps, technology up gradation, technology training and demonstration.

The key research domain includes – Design and development of machines and technologies for reducing drudgery and improving productivity; Improved machines/equipment and technologies useful for rural industries and artisans; Capacity building for rural and cottage industries; Improved product quality of rural and cottage industries; Increased employment, and entrepreneurship opportunities in rural areas.

Implementing of this Rural Technologies based on processing of post-harvested food grain have eliminated the drudgery in the life of many rural women and increased the production and the major revenue generating food product of eastern India.

Examples are – Integrated puffed rice (muri) making machines both biomass and LPG based as fuel, which increased the production 10-15 times and a main sample snacks. Mechanized dhenki for paddy processing increased the productivity by 5 times. Rice flaking machine a low cost, small power requirement. The physical and chemical properties of flakes obtained from the current machine was better than available market flakes. The glyceamic index of the flakes is less than 55, which confirms it to be a low glyceamic food and produces 15 times. Low-cost portable paddy de-husker can be used by individual households. Machine increases the productivity 8 times more brown and black rice and improves the product quality while reducing drudgery.

Several workshops and training programs organized to disseminate the tested technologies among peoples who can derive benefits out of them. These technologies have helped villagers not only to improve their revenue system but also generated employment opportunities at village level; this has helped to reduce migration of villagers to cities in search of livelihood.

Key words: Drudgery, NGOs, Income, Employment

Solar Energy for Sustainable Development in Haryana

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ABSTRACT

In agrarian states like Haryana, it is felt that with steady increase in urbanization, industrialization, reduced organic inputs as well as increased use of inorganic chemical fertilizers there is a need to have an alternative technology for sustenance and maintenance of soil health for crop productivity by biological inputs. The biological efficiency of organic inputs like farm yard manure, animal excreta and farm waste can be improved by use of simple technology like biogas production, vermicomposting etc., The biogas production (methane production from animal excreta can be conveniently adopted by marginal farmers even.

Traditionally animal excreta (commonly known as Dung) are used either as fuel (burning of dung cakes directly) or preparation of farm yard manure by composting. Both of these methods are of low energy yielding processes and takes longer periods. Te crop residues not fed to animals may be utilized for composting. The resulting manure as such has a wide C/N ratio and low contents of other nutrients. Both these limitations can be overcome by the use of biogas technology which effectively utilize dung and farm waste.

Biogas technology not only increases nutrient availability but also has many direct and indirect advantages, after producing biogas. First and foremost is it can be used as alternate energy source for cooking and power generation on farm houses, resulting in substantial saving of petroleum based fuel. Secondly improves soil fertility as the resulting slurry after methane generation is rich in nutrients like nitrogen, phosphorus and other minerals with low C/N ratio. The manure prepared from biogas slurry has buffering property that maintains soil pH. Many other indirect advantages are availability of nutrients for long duration, improvement of soil biological health, reduction in soil erosion, ecofriendly atmosphere besides protection against soil borne pathogens.

In India, the central and the provincial governments encourage farmers by providing subsidy for establishment of biogas plants. This is a humble step towards making Indian farmers self sufficient and create awareness towards soil fertility and healthy crop produce as well.

NBIOT for Agriculture

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ABSTRACT

In the next few years the number of Internet of Things (IoT) devices is predicted to increase rapidly, and many of these Internet-connected devices will rely on a wireless connection. Agriculture is as yet an untapped market, but the size is such that it cannot be ignored anymore from a business perspective. It only serves to say that now with smart metering and smart lighting, smart agriculture is the next bastion to conquer. Today's large and local farms can use monitoring systems, such as leverage IoT to remotely soil monitors, atmospheric monitors, aerial drones that can detect soil moisture, crop growth and livestock feed levels, remotely manage and control their smart connected harvesters and irrigation equipment, and utilize artificial intelligence based analytics to quickly analyze operational data combined with 3rd party information, such as weather services, to provide new insights and help farmers to make better decisions. Soil monitors can detect variables like ground temperature and moisture levels. Atmospheric monitors can detect weather conditions in pinpointed locations. Flyover drones can indicate, if seeds have sprouted and animal monitors can track not just location but also provide indicators of potential illness. This system, based on Long Term Evolution (LTE) technology, supports most LTE functionalities albeit with essential simplifications to reduce device complexity. Further optimizations to increase coverage, reduce overhead and reduce power consumption while increasing capacity have been introduced as well. The design objectives of NB-IoT include low-complexity devices, high coverage, long device battery life, and massive capacity.

Important Aspects of Fly Ash Use in Civil Engineering, Environment and Agriculture

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ABSTRACT

Fly ash also known as flue ash is the byproduct of power generation in coal fired power stations. Fly ash is a very fine, powder material composed mostly of silica nearly all particles are spherical in shape. Fly ash is generally light tan in colour and consists mostly of silt-sized and clay-sized glassy spheres like Talcum powder. Fly ash includes substantial amount of silicon dioxide (SiO_2) and calcium oxide (CaO). These oxides produce large amount of pollution in the atmosphere. Fly ash is, alone, a waste product and its responsible disposal pose a huge problem. Generally fly ash is captured by electrostatic precipitators. Now this fly ash can be used in agriculture field to improve soil fertility.

We can handle fly ash for gainful utilization which directly supports to secure our environmental condition. Use of fly ash in manufacture of cement, part substitution of cement in concrete/mortar, manufacturing brick etc. other utilization of fly ash like in construction of road for reclamation of low lying areas and mine filling. By using fly ash we can save generation of carbon dioxide by 25 million tonnes, good quality of lime by 35 million tone and coal by 15 million tons per year. Using fly ash we can clean the waste water which saves to control the water pollution. We can use the fly ash in agriculture as in the reference of pesticide.

Fly Ash is being very effectively and economically used in building components such as bricks, doors, door-frames, etc. Fly Ash is also being used in construction of roads and embankments with some design changes. It is also used as raw material in agricultural and wasteland development programs. Fly ash has shifted from "Waste Material" category to "Resource Material" category. India is a traditional market for clay brick with an annual demand of about 360 billion bricks. Fly ash-lime bricks had been introduced about two decades back in India in the interest of bringing to fore alternate products.

Fly-ash has great potentiality in agriculture due to its efficacy in modification of soil health and crop performance. The high concentration of elements (K, Na, Zn, Ca, Mg and Fe) in fly-ash increases the yield of many agricultural crops. But compared to other sectors, the use of fly-ash in agriculture is limited. Agricultural lime application contributes to global warming as Intergovernmental Panel on Climate Change (IPCC) assumes that all the carbon in agricultural lime is finally released as CO_2 to the atmosphere. It is expected that use of fly-ash instead of lime in agriculture can reduce net CO_2 emission, thus reduce global warming also.

Bio Concrete

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ABSTRACT

In Concrete, cracking is a common phenomenon developed due to relatively low tensile strength. High tensile stresses may be developed in concrete due to external loads, imposed deformations, plastic shrinkage, plastic settlement and expansive reactions. Proper and immediate treatment should be done in order to prevent expansion of cracks which may eventually be of higher cost. For crack repair, a variety of traditional repair systems are available which possess a number of disadvantageous aspects such as different thermal expansion coefficients, environmental and hazards of health. Bacterially induced calcium carbonate precipitation has been proposed as an alternative and environmental friendly crack repair technique. It is found that microbial mineral precipitation as a result from metabolic activities of favourable bacteria in concrete improved the overall behaviour of concrete. It is expected that further development of this techniques will result in a more durable, sustainable and crack free concrete that can be used effectively for constructions in wet atmospheres where corrosion of reinforcement affects the durability, permeability and strength of concrete.

Evaluation of anti-inflammatory activity on hRBC for iron nanoparticles synthesised from Holy basil - *Ocimum tenuiflorum* L.

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ABSTRACT

Ocimum tenuiflorum, commonly known as *holy basil or tulsi,* is an aromatic perennial plant in the family *Lamiaceae.* It is native to the Indian subcontinent and widespread as a cultivated plant and is integral part of every house hold of India for its medicinal and herbal properties. It is used to synthesize green nanoparticles with diverse inorganic metal and evaluated for their antimicrobial, anti-inflammatory and antioxidant activities. Green synthesis of silver, zinc, platinum and copper metals form leaf extract of *Ocimum* sp. has been reviewed in literature. The green nanoparticles (NPs) of silver were tested for their efficacy against *Staphylococcus aureus, S. pneumonia, P. aeruginosa, E. coli* and *Vibrio sp*. A greater conversion of platinum ions to nanoparticles of 23 nm size was achieved by employing a tulsi leaf broth with a reaction temperature of 100^0C. The similar hydrogen evolution potential and catalytic activity like pure platinum was observed with reduced platinum which potentially can be used in water electrolysis applications. Banerjee et al., 2014 prepared nano-composite of silver NPs with the soil and applied for adsorption of dye, showed higher removal of reactive turquoise blue dye from effluent solutions.

In the present study we explored the potential of iron nanoparticles synthesized using Response Surface Method (RSM) approach form Tulsi leaf extract and observed that activity of synthesized FeNPs increased with increase in molarity, this may be due to excess of Fe ions available at higher molarity leading to increased number of synthesized FeNPs. The size and stability of synthesized FeNPs have impact on anti inflammatory activities.

The maximum anti-inflammatory activity of Fe nanoparticles were observed, when they were synthesized using 0.1 M molar concentration of $FeSO_4$ solution having pH 8.0 at temperature of 25ºC. The stabilization of human red blood cells (hRBC) membrane was observed as a measure of the anti-inflammatory activity. The synthesized iron nanoparticles showed the most significant percentage membrane stabilization of 36.71% and 44.048% with comparison to Diclofenac sodium which showed 13.85% and 12.47% at 200 and 100 µg/ml respectively. Hence, it was observed that anti-inflammatory activity of extracts was dependent of diverse parameter viz...pH, temp and molarity.

T H E M E

Crop Improvement for Sustainable Agriculture

Keynote Lecture

Participatory Plant breeding: Perspectives for the Sustainable crop improvement

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ABSTRACT

The concept of Evergreen Revolution involves enhancement of productivity in perpetuity without associated ecological and/ or social harm. To achieve such a revolution in farm productivity, there is need to mainstream sustainability parameters in research and development. In the area of plant breeding, this implies the conservation of genetic diversity and its use for breeding varieties which are adapted to the local agro-climatic and agro-economic conditions as well as culinary preference. Varietal homogeneity enhances genetic vulnerability to pests and diseases and hence genetic heterogeneity is vital for sustainable agriculture. Participatory plant breeding is an effective pathway to develop strains of crop varieties adapted to local conditions and to maintain genetic diversity among the varieties cultivated. Wherever participatory methods of breeding and knowledge management have been effectively used, the result has been the development of varieties which are adapted to local agro-climatic condition, efficient in the use of the available water and nutrient resources, and amenable to agronomic practices like integrated nutrient supply and integrated pest management. The NERICA Rices developed by the West African Rice Development Association (WARDA) provide a good example of the effectiveness of participatory plant breeding in achieving yield and production breakthrough. The recent emergence of the PPB movement represents a response to weaknesses of the traditional global approach to plant breeding..

he plant breeders and farmers worked together to produce improved varieties of maize for the low-resource farmers of the Panchmahals district of Gujarat, India. Initially, farmers tested a range of maize varieties in a participatory varietal selection (PVS) programme. In 1994 a participatory plant breeding (PPB) programme was begun to generate new, more appropriate varieties. Yellow- and white-endospermed maize varietieswere crossed that had been either adopted to some extent following PVS or had attributes, such as very early maturity, that farmers had said were desirable. In subsequent generations, the population was improved by mass selection for traits identified by farmers. In some generations, farmers did this in populations which were grown by breeders on land rented from a farmer. Soil fertility management was lower than that normally used on the research-station. The breeding programme produced several varieties that have performed well in research-station and on-farm trials. One of them, GDRM-187, has been officially released as GM-6 for cultivation in hill areas of Gujarat state, India. It yielded 18% more than the local control in research-station trials, while being seven days earlier to silk. In farmers' fields, where average yields were lower, the yield advantage was 28% and farmers perceived GDRM-187 to have better grain quality than local landraces. PPB produced a variety that was earlier to mature than any of those produced by conventional maize breeding, and took fewer years to do so. The returns from PPB, compared to conventional breeding, are higher because it is cheaper and benefits to farmers are realised earlier.

Key words: agricultural research, genetic resources, participatory research, plant breeding, research methods

Features of winter resistance of collected samples of winter wheat in the conditions of northern Forest-steppe of Ukraine

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ABSTRACT

At present, the actuality of the problem of creating new winter wheat varieties with high productivity and stability has increased significantly. One of the ways to solve it is to improve the winter resistance of genotypes, in which this feature must be realized at the minimum level required for a particular region.

The research was conducted during 2011-2016 in the field experiment in the northern part of the forest-steppe of Ukraine. 140 collected samples of bread wheat of various ecological and geographical origins were studied in the experiment. Collection samples were manually sown. The area of the site is 1 m2. Standards were Podolianka and Myronivska 808 (UA). The frost resistance of seedlings was estimated by the method of G.A. Samygin. During 2011-2016, weather conditions were as follows: 2012, 2014, 2015, unfavourable, 2011 and 2016 are favourable, 2013 - extreme for the growth and development of soft winter wheat.

Results. Collections samples of wheat were grouped by countries and breeding centres of origin. For six years, among the studied varieties of different ecological and geographical origin, the variation in winter resistance from the highest - 7.11 points to the average 4.75 points in samples of Wx-wheat has been established. Highest winter resistance (7.00 points) was noted in varieties of breeding of PMR "Tiras" (UA), from Iran and Romania. Somewhat lower winter resistance was observed in samples of NSC "Institute of Agriculture of NAAS"(UA) (6.86 points), Myronivsky Wheat Institute (UA) (6.77 points), Institute of Plant Cultivation (UA) and from Canada (6.67 points) and Germany (6.50 points). Samples from Russia and the Institute of Plant Physiology and Genetics (UA) had an average winter resistance of 6.41 points, Bulgaria - 6.17 points. The average winter resistance was observed on the sample of soft spring wheat from Australia (4.27 points) that was sown before the winter.

For six years the index of winter resistance was higher in samples of breeding of the Bilotserkivska DSS (UA), however, the extreme weather conditions of 2013 made their adjustments on this characteristics. In 2013 winter resistance of wheat varied from the highest (varieties from the NPO "Bor" (UA)) to the complete destruction of the plants (0 points) - in the varieties of foreign origin (Germany, Bulgaria, Australia) and samples of Wx-wheat. Extreme factors (cool weather and excessive humidity in the autumn, hard winter with excessive snowfall on unfreeze soil, exhaustion, freezing and sprouting of plants, snow molds) led to a significant loss of plants in the spring. The average number of plants in the autumn was 207.21 pcs. / M2, in the spring - 62.51 pcs.

Conclusions. It has been established that for six years of research in collections samples winter resistance varied from 4 to 9 points, and in extreme 2013 - from total plant death to 9 points. In the conditions of the northern Forest-steppe in 2013 (especially for resistance to snow mold), better were samples of breeding of the Myronivsky Wheat Institute (UA), Bilotserkivska DSS (UA) and NSC "IZ NAAS" (UA). The best frost resistance of sprouts had varieties Copylivchanka and Polisska 90 (NSC "IZ NAAS").

Key words: soft winter wheat, winter hardiness, frost resistance, snow mold.

Transformation of soil properties after stopping tillage

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ABSTRACT

The problem of optimizing of land use is not new and has planetary character. One of the key principles of sustainable development of agriculture is introduction of ecologically, economically and socially efficient system, development of highly efficient, energy and resource-saving technologies. World experience shows that the efficiency of agriculture is possible only in condition to intensive use of highly fertile soils and reduces investments into unproductive land.

Researches were conducted at fallow that was removed from cultivation in 1987 in Forest-steppe zone of Ukraine. Soil is greyic luvisol.

Study shows that for first 15 years of removing from tillage had been restored natural vegetation of investigated areas. Withdrawal of arable land from cultivation led to restoration of agronomically valuable structural units contents of old plowed horizon. After removing increased soil acidity (pH_{KCl}) (from 5.9 to 5.1), humus content and content of hydrolyzed nitrogen (from 72 to 100 ppm). Content of mobile phosphorus (more than 50% compared to the original data) and exchangeable potassium decreased. The gross chemical analysis shows that after withdrawal rearranges content of total nitrogen (increased to 0,11-0,14%), phosphorus (to 0,06-0, 12%) and fixed potassium (to 0,17-0,22%) and corresponds to parameters specified in ISO 4362 for greyic luvisol soil of Forest-Steppe zone.

Removing of areas from tillage promoted to the restoration of the formation of zonal soil absorbing complex as in top 20-cm layer and in the whole soil profile: extension of cation-exchange capacity, increasing of acidity and organic matter content (to 2%) in the soil. Over the first 14 years of restoration were redistributed nutrient content in the soil: content of flexible and increased content of fixed fractions decreased that contributes potential fertility of greyic luvisol. The transformation of soil properties will continue according to the next stages of succession of biogeocenosis.

Key words: soil transformation, stop tillage, greyic luvisol soil.

Development of an ultrasensitive assay for detection of Deoxynivalenol in Fusarium infected cereal crops

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ABSTRACT

Deoxynivalenol (DON) is a heat-resistant type B trichothecenes produced by genus *Fusarium* and is considered as one of the most potent cereal grains contaminant worldwide. It is devastating for both humans as well as animals and is disseminated in food chain due to feeding on *Fusarium* infected cereals. Its ill effects of deoxynivalenol include reduction in animal body weight, productivity and quality of cereal products. It also ruins human health by causing neurotoxicity, immune system deficiencies, necrosis of the digestive system and possible birth defects on consumption of highly contaminated food. The early detection of deoxynivalenol is crucial to reduce unnecessary transmission of morbidity. The currently available assays such as enzyme-linked immunosorbent assay (ELISA) and t*hin-layer chromatography* (TLC) cannot detect especially when target is present in low concentrations. Nowadays, an ultrasensitive method of antigen detection immuno-PCR (I-PCR) is used for detection of deoxynivalenol. This method has the versatility of ELISA along with immense amplification capacity of PCR, thus leading to an enormous increase in sensitivity in comparison to an analogous ELISA. I-PCR assay involves the cascade of chimeric conjugates of specific antibodies and nucleic acid molecules, which are used as markers to be amplified by PCR. Hence, the enormous efficiency of nucleic acid amplification in I-PCR leads to at least 100-1000 fold increase in sensitivity. The unravelling of the whole genome sequence of *Fusarium* reveals many antigens for diagnosis of infection, but for the present study deoxynivalenol is selected as potential antigen for the diagnosis of *Fusarium*-infected cereal crops. I-PCR has already been explored for the detection of various food-borne pathogens such as *Staphylococcus aureus* enterotoxin H in contaminated food. However, till date, no reports are available on the utility of I-PCR for the detection of deoxynivalenol in infected cereal crops. Currently, used ELISA has the detection limit of 1 nanogram per ml, while I-PCR could detect 1 femtogram per ml level of antigen, hence considered as a relatively more reliable and advanced assay for detection. At the same time, we can quantify the amount of antigen in the sample by using real-time I-PCR (RT-I-PCR). Thus I-PCR/RT-I-PCR can be used for qualitative and quantitative analysis of deoxynivalenol in cereals, so that effective measures can be implemented to detect contamination in the food chain.

Effect of liquid bioformulation (Plant Force Advance) on the growth and yield of BT Cotton variety RS 2013 in field conditions.

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ABSTRACT

India's agriculture sector is growing at 2.1 per cent in 2017-18. The economic survey indicated that the government is keen on doubling farmers' income by 2022, for which it has launched several new initiatives that encompass activities from quality seed to marketing of outputs. The government initiatives like Soil Health Card, Input Management, Per Drop More Crop under Pradhan Mantra Krishi Sinchai Yojana (PMKSY) boostened the new approaches towards novel bio-based fertilisers in existing farm practices. Due to intensive involvement of labour in different farm operations, the cost of production of many crops is quite high. The increased crop production largely relies on the type of fertilizers used to supplement essential nutrients for plants, which has also led to an increasing dependence on chemical fertilizers. The over exploitation of chemical fertilisers during several last decades has led to environmental problems. So, there is a dire to switch to natural biological based organic inputs as an alternative to agro-chemicals and the search to explore the cheap waste materials as new resources.

Human hair is rich source of nitrogen-containing (~16%) organic material predominantly made up of keratin proteins and the foliar application in the form of protein hydrolysate provides organic and readily available nitrogen to the plants. This approach has led to utilization of human hairs to produce a liquid nitrogenous biofertilizer involving their chemical hydrolysis. The liquid formulation "Plant Force Advance" of Floritech Organo Industries, Nagpur was tested for its efficacy in RS2013 variety of Bt-cotton under field conditions in Sri Ganganagar district of Rajasthan. The approved package of practices of cotton for Rajasthan State, Department of Agriculture was followed and the agronomic and biological parameters were studied in the cotton crop grown in one acre at Research Farm of Surender Kaur Memorial Agricultural College, Padampur, during Kharif 2017. The test plots were given the foliar spray of liquid formulation (having approx. 8% (v/v) nitrogen and diluted 1:200 with water) 45 days after germination of the seeds followed by three more sprays each after the interval of 15 days. The control plots were given foliar spray of water only.

The results showed increase in height of the test plants by 17% as compared to control, enhancement in the chlorophyll content of plant leaves by 14%, increase in weight of balls per plant by 16% as well as 17% reduction in immature ball formation per plant. The total yield showed an increase of 12% with the foliar spray of liquid formulation. Our study concluded that the application of foliar spray of Plant Force Advance along with recommended package of practices improves the productivity of Bt-cotton under the field conditions.

Key words: PMKSY, Biofertilizers, RS2013. waste human hairs, hydrolysate.

Abstracts of Intended Presentations

Salinity stress induced changes physiological and reproductive behaviour of chickpea genotypes

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ABSTRACT

The experiment was carried out on three chickpea genotypes *viz*. CSG 8962, HC-5 and C235 to study the salinity induced changes in plant water status, biochemicals, ionic composition and reproductive changes at harvesting stage.

The ψ_w of leaf and ψ_s of leaf, root and nodules became more negative with increasing the level of salinity stress. With the induction of salinity, RWC (%) of leaf, root and nodules declined in all the genotypes. Dry weight decreased with increase in salinity, decrease being less in CSG 8962 in leaves, stem and root than the genotypes HC-5 and C235. Salinity induced accumulation of total soluble sugar and proline content in leaves, root and nodules and accumulates more in CSG 8962 than HC-5 and C235. Na^+ and Cl^- content increased with the induction of salinity in all the genotypes. K^+/Na^+ ratio decreased in all the parts, decrease being minimum in CSG 8962 and maximum in C235. Pollen viability, *in vitro* germination and tube length decreased with increase salinity in all the genotypes while salinity did not affect ovules number and its receptivity. Total soluble sugars in stamens + pistil were more in CSG 8962. Na^+ and Cl^- content increased in stamens + pistil were more in C235 and least in CSG 8962.

Key words: Osmotic potential, total soluble sugars, minerals, proline.

Socio-Economic Dimension of Sustainable Livelihood in Subaltern Perspective in Reference to Arsi Zone, Ethiopia

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ABSTRACT

This paper discusses the challenges of sustainable livelihood for the youth in Arsi zone of Ethiopia. An in depth interview was conducted with the youth who migrated to Adama city from Arsi zone rural areas by taking advantage of their concentration in one area of the city. The interview identified that the migrants are predominantly from the highlands of Arsi. The main cause of migration is found to be shrinking land size per household. A large family size makes it impossible to transfer land to children as they grow up to start their own family. Moreover, Irregular rainfall hampers the productivity of the land in a predominantly cereal producing highlands of Arsi. Lack of income generating activity during the non –farming season is another push factor for youth migration from the rural areas of Arsi. The urban life is not pleasant for the migrant youth either and they are willing to go back to their village given support system is developed for them. After scrutinizing the challenge and also identifying opportunities, the paper suggested a capacity building framework focusing on the introduction of Aquaponics, greenhouse and a local innovative ladder agriculture system to mitigate the challenge and capitalize on the opportunities identified. This will give a Sustainable livelihood for the youth in the highlands of Arsi zone.

Key words: Migration, Sustainable Livelihood, Capacity Building, Agriculture

Comparative Evaluation of Wheat Germplasm Accessions for Grain Yield and Its Components under Rainfed Conditions

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ABSTRACT

The present investigation was carried out on 1200 accessions of bread wheat germplasm obtained from the National Bureau of Plant Genetic Resources (NBPGR), New Delhi. The germplasm accessions were evaluated during the *Rabi* 2016-17 in augmented design with five checks namely, HD 2967, Raj 3765, C-306, WH 1080 and WH 1105 under rainfed condition in paired row of 1.5m. The data were recorded for the characters namely, tiller number per meter row length, number of grains per spike, 1000 grain weight, biological yield, grain yield and yellow & brown rust infestation. The results revealed that the tiller number per meter length ranged from 50 to 165, number of grains per spike varied from 30 to 95 and 1000 grains weight ranged from 27g to 65g. The accessions under study showed marked difference for biological yield (70 to 650g) and grain yield (45g to 240g) per meter row length. For yellow and brown rust infestation the accessions observed highly resistant to completely susceptible (100S). Out of 1200 accessions 150 were found resistant to yellow and brown rust (<10S), 75 accessions with tiller number more than 150 per meter length, 225 accessions with number of grains more than 60 per spike, 72 accessions with 1000-grain weight (g) more than 50g and overall sixty five accessions were identified superior under rainfed condition on the basis of grain yield per meter length more than 200g and disease resistance as compared to checks which were retained for further utilization in breeding programme.

Key words: Wheat, Rainfed, Germplasm accessions, Grain Yield & *Triticum aestivum*

Phytoremediation potential of native flora of saline soil fully fledged in Northern India

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ABSTRACT

Investigations were carried out to study the performance of 20 plant species (*Achyranthes aspera, Aerva tomentosa, Aeluropus lagopoides, Arundo donax, Atriplex amnícola, Atriplex lentiformis, Atriplex nummularia, Calotropis procera, Chenopodium album, Chenopodium ambrosoides, Chenopodium murale, Heliotropium ramossimum, Parkinsonia aculeata, Portulaca oleracea, Salsola baryosma, Setaria glauca, Suaeda fruticosa, Suaeda nudiflora, Trianthema portulacastrum* and *Xanthium strumarium*) under salinity stress. Plants were raised in leak proof polythene bags (12 x 20 cm) with 30 cm diameter. Each bag was filled with 6 kg sandy dune soils (*Typic Torripsaments*). The soil was artificially salinized with different level (from Control to 16 dS m^{-1}) of Cl^- dominated salinity using NaCl, $MgCl_2$, $MgSO_4$ and $CaCl_2$ salts (maintaining 1:1::Na: Ca+Mg ratio, 1:3::Ca:Mg ratio; and the $Cl:SO_4$ ratio being 7:3 on meq. basis). About 30 seeds of each species were sown in the nursery bed using farm yard manure (soil: FYM, 1:1). Twenty days old seedlings were transplanted in the artificially saline polybags. When seedlings got established in the polythene bags containing different salinity levels, thinning of seedling was done so as to maintain 5 uniform plants per polybags with three replications. Cumulative shoot length, fresh and dry shoot biomass decreased with the increasing levels of salinity (from control to 16 dS m^{-1}) whereas ash content of stem and leaves, total dissolved solids followed the reverse trend. The cumulative salt ionic accumulation ($Na^+ + K^+ + Ca^{2+} + Mg^{2+} + Cl^- + SO_4^{2-}$) in the above ground biomass was enhanced with every increment of salinity levels except in case of *Xanthium strumarium* and *Parkinsonia aculeata* which diminished the total salt ion contents in comparison to their respective controls. Maximum ion accumulation was observed in *Aerva tomentosa* (4074 mg potted $plant^{-1}$) followed by *Suaeda fruticosa* (3001 mg potted $plant^{-1}$) and *Salsola baryosma* (2977 mg potted $plant^{-1}$) and minimum in case of *Parkinsonia aculeata, Setaria glauca, Xanthium strumarium* and *Arundo donax* at 16 dSm^{-1} salinity. Due to the added salinity levels from 0 to 16 dSm^{-1} total ionic contents in soil ($Na^+ + K^+ + Ca^{2+} + Mg^{2+} + Cl- + SO_4^{2-}$) showed an increase with every increment of salinity. The total ionic contents in the soil of all the potential hyperaccumulator plants declined to a large extent in *Suaeda* species, *Atriplex* species and *Salsola baryosma*. Conclusively, *Suaeda* species, *Atriplex* species and *Salsola baryosma* perfomed well under salinity stress.

Nanotechnology enabled Point-of-Care diagnostic kits for detection of pathogenic and parasitic diseases

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ABSTRACT

Infectious diseases caused by pathogenic microorganisms severely influence human as well as animal health throughout the world. The worldwide distribution of pathogenic or parasitic diseases in domestic animals have extensive impact in the form of economic losses due to high morbidity and mortality. Thus, predictive diagnosis of pathogens and parasites assume significance in medical diagnostics. The conventional detection methods include microscopy, immunology, culturing, polymerase chain reaction (PCR), enzyme-linked immunosorbent assays (ELISA), fluorescence-based assays based on organic dyes, are time consuming, labour and material intensive as well as require costly instrumentation and laboratory. Therefore, there is urgent need to develop efficient diagnostic tools that provide accurate, sensitive, specific, low-cost, rapid and early diagnosis of infectious diseases, related biomarkers and, thus, provide appropriate treatment to prevent outbreaks. The innovations in technology development for the rapid detection of various pathogens, biomolecules, food contaminants, harmful toxins etc. can play important role by reducing risks to society. The nanomaterials based diagnosing techniques provide excellent opportunities for the rapid and early stage detection. The sensitive as well as selective sensing systems have already been developed by incorporating different types of nanoparticles in conjunction with various biological recognition elements such as antibodies, biomarkers, aptamers, enzymes, DNA, recombinant proteins, receptor molecules etc. The unique properties of various types of nanoparticles like gold, silver, zinc, copper and iron nanoparticles help in integration with different bio-entities to make efficient multifunctional systems for use in diagnostics, treatments, and therapies. Nanotechnology based platform enable not only early detection of microorganisms, but also have potential for single cell analysis by using different semiconductor quantum dots (QD), carbon nanotubes, nanowires. Currently, development of user-friendly, nanotechnology-based point-of-care devices with low-cost instrumentation is in trend, which provide rapid, sensitive and accurate detection at early stages with lower sample consumption. We report development of a lateral flow assay for the diagnosis of parasitic disease in equines for field investigation, with comparable sensitivity and specificity to ELISA.

Current taxonomy of rhizobia infecting legumes to develop better inoculants

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ABSTRACT

Legumes have the capacity to establish N_2-fixing symbiosis with nodule forming bacteria commonly referred as rhizobia, this plant family and their bacterial symbionts are the focus of intensive investigation due to improvement of the N-fertility of soils for sustainable agriculture. To discriminate rhizobia in to species and sub species, identification and classification of bacteria and particularly rhizobia using polyphasic approaches is becoming the most accepted technology. Phenotypic and biochemical analysis includes: Gram staining, cell morphology and motility, oxidase and catalase activity, Biolog tests, NaCl tolerance, antibiotic, pH and temperature profiling, fatty acid composition, nodulation and nitrogen fixation studies. Genetic analysis including DNA–DNA hybridization, G+C content, PCR analysis using large number of genes including housekeeping genes. Sequence analysis of 16SrRNA, 16-23S rRNA ITS region, other housekeeping genes and complete sequencing and comparison with existing data base using various bio informative techniques is frequently being used. Further multilocus sequence analysis (MLSA) and matrix-assisted laser desorption/ionization time-of-flight MS (MALDI TOF MS) are also being widely used.

In early seventies only one rhizobial genera (*Rhizobium*) with 6-7 species was recognized. But now use of these multiple approaches has resulted into the identification of 16 α and β rhizobial genera. These genera belong to α and β proteobacteria - *Rhizobium, Shinella, Ensifer (Sinorhizobium), Aminobacter, Neorhizobium, Allorhizobium, Mesorhizobium, Phyllobacterium, Bradyrhizobium, Methyllobacterium, Microvirga, Azorhizobium, Devosia, Ochrobacterum, Burkholderia, and Cuprivadus* belonging to seven families. To date 176 species belonging to these rhizobial genera from different parts of World nodulating different legumes has been reported. Most of the Indian legumes including pulse crops are nodulated by more than one species belonging to one or even more than one genera, though reports from India are very limited. Fabaceae consists of about 751 genera and about 20,000 species of trees, shrubs, vines, and herbs and with a distribution over a broad range of ecological conditions in the world. The available information indicates that, out of all the legume species, only a portion (about 20%) have been examined for nodulation and shown to have the ability to fix atmospheric N_2. The situation in India is still worse as only 1200 species of legumes are known. So lot of efforts are needed to exploit all the legumes and wealth of rhizobial genera.

Role of Information and Technology in Sustainable Development

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ABSTRACT

Over the past few year, concern about environment and development have become a topic of debate and study. It's not only the responsibility of the government but emerging as an issue involving the civil society as well. People across the world are releasing that there is an urgent need to adopt a more proactive approach in the sustainable development Undoubtedly, *Information and communication technology have an important role to play in achieving sustainable development*

Even in the 21stcentury, people of developing nation are facing challenges concerning sustainable development bought on by changing global economy, environmental degradation, political changes and demographic pressures. Considering all these aspects sustainable development operational through program that can cater the need of the community while protecting the environment and empower the poor is difficult. The wide gap between world's have and have nots is clearly reflected in the gap between people with access to information and those without. To deal with this challenge and to effectively bridge the knowledge gap-improved information and communication technologies have a significant role to play.

Access to information and in fact it's the first step towards making an effective decision at any level. Information and communication rest on the strong belief that communities have knowledge and expertise which need to be synchronized with the existing information, in the context of decision making and initiating effective action for sustainable development.

The onus lies on intermediary institutions to provide the crucial link between information and its users and encourage nations to invest in information and technology infrastructure so they can meet he expected social and economic benefits

Key words: Information and Technology, Developing Nation, Effective Action, Social and economic Benefits

Performance of *Clitoria* genotypes for fodder yield attributes with quality parameters in north west and central zone of India

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ABSTRACT

Clitoria ternatea has a long traditional use in Ayurvedic medicine. Phyto-chemical screening of the roots showed the presence of ternatins, alkaloids, flavonoids, saponins, tannins, carbohydrates, proteins, resins, starch, taraxerol and taraxerone. Butterfly pea is a good forage source for the hot and semi-arid regions of India due to its adaptability and resilience under drought conditions, and to its potential for regrowth soon after the onset of the rainy season. Its roots fix nitrogen and, therefore, this plant is also used to improve soil quality.

This paper evaluates fodder *Clitoria* in the Central and North West Zone of India. Due to inadequacy of green fodder availability in India, cultivation of perennial legume pasture offers good prospects of a high green fodder yield coupled with high protein content. So, *Clitoria* can be included into farming systems for the betterment of farmers as well as of the livestock. It can be one way to reduce the gap between demand and supply of the green fodder by incorporating the *Clitoria* in waste lands as it is a promising forage crop.

Wheat abiotic stress management – a genomics perspective

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ABSTRACT

Crop production is mainly effected by the climate changes hindering the growth and development of the plants due to unfavourable environmental factors, which is the main challenge to the agriculture. Major abiotic stresses to plants includes the temperature either heat or cold, drought and salinity, which are causing a huge productivity loss and are the main concern for the agricultural scientists to combat climate change for food security to the ever-growing population. Although plants have intrinsic molecular regulatory mechanisms to develop resilience and tolerance to these abiotic stresses, which are the focus to increase crop productivity.

Since the green revolution, the scientists are working on enhancing and engineering plants mechanism against abiotic stresses to increase the productivity. Wheat is the world's third largest cereal crop cultivated in 220.1 million hectare area with the production of 749.5 million tonnes, with an average yield of 3.3 tonnes/hectare (FAO, 2016). There is a need to increase wheat production by 1.6% annually by 2020 to meet the projected demand of 760 million tons. New high yielding and climate resilient varieties must be developed to improve agricultural production of wheat. The conventional breeding approaches are slow and inaccurate to simultaneously select for and combine putative loci from different genetic backgrounds for such a huge improvement demand. High-throughput phenotyping tools and marker-assisted selection provided a new opportunity for improving the selection efficiency and pyramiding of genes conferring tolerance to abiotic stresses.

Recent advances in next generation sequencing have transformed molecular breeding to the genomics-assisted breeding. Functional genomics approaches are identifying genes and/or QTLs responsible for the abiotic stress in crop species as well as in wild relatives. High-density marker arrays like SNP and InDels etc. from next generation sequencing facilitated the genotyping-by-sequencing; the genome wide association studies and the genomic selection approaches, which are superior to conventional phenotypic selection for discovering novel genes for abiotic stress tolerance. Whole genome sequence assembly revolutionised the field with the genome of the reference hexaploid wheat line 'Chinese Spring' with assembled 21 constituent chromosomes. It will be possible to identify target genes, examine their expression pattern across hundreds of RNAseq samples, determine their haplotypes in diversity collections and order knockout mutants using targeted genome editing.

This extensive fundamental research of plant stress tolerance could improve commercial crop yields. In wheat, major QTLs have been identified for drought; heat and cold stress; salt tolerance, which will provide novel opportunities for abiotic stress tolerance and for a more targeted search for novel alleles in wild germplasm. There are increasing number of germplasm resources including precise near isogenic lines as well as next-generation populations such as multi-founder populations (e.g., multi-parent advanced generation intercross populations), which have been developed to facilitate validation of climate-smart crops.

New variation incorporated into elite backgrounds from landraces, ancestral or wild crop relatives also offers potential for discovery of functional variation. The CRISPR/Cas9 genome-editing technology can be a useful integral component of functional genomics to study the genetic basis of abiotic stress in the large and complex wheat genome by knocking out or silencing target genes or genomic regions. Further transgene free targeted gene editing has been demonstrated in wheat which could generate elite

cultivars of with durable climate resilience. Enhancing photosynthesis efficiency in wheat through modification of key enzymes (e.g. Rubisco) will be the key to increase wheat yield potential. The difficult to predict climate impact on crops could be reduced with the advanced genomics technologies, but it requires a multidisciplinary and integrated approach to more effectively develop genotypes that are more resilient to climate change for food security in future.

Evaluation of Faba Bean Elite Genotypes for Seed Yield and it's Attributes under Semi-Arid Conditions

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ABSTRACT

Faba bean (*Vicia faba* L.) is an important herbaceous often cross pollinated pulse crop, it belongs to family Fabaceae. It is cultivated for food, feed and fodder purposes. The field experiment was conducted in RBD by using newly developed genotypes of Faba bean including checks during *rabi* 2017-18 at Research Farm of MAP Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar. In the present study, wide genetic variability was observed for plant height (cm), days to maturity, number of branches/plant, pod length (cm), seeds/pod, clusters/plant and seed yield (kg/ ha)., except number of seeds/pod. Out of 22 genotypes, the genotype HB-14-21 recorded the highest seed yield (45.47q/ha) followed by HB-14-20 (43.79q/ha), HB-14-18 (42.36q/ha), NDFB 13-2 (41.72 q/ha) and HB-14-18 (41.71q/ha) against better check HFB-1 (38.64 q/ha). These genotypes have good potential for commercial cultivation, but to be tested over time and space before recommendation for commercial cultivation.

Key words: Seed yield, attributes, variability, faba bean (Vicia faba L.), elite genotypes

Assessment of Modified Double Slope Solar Still

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ABSTRACT

Productivity of distilled water from conventional solar stilled is very limited. Improvement of the conventional solar still is essential to increase its productivity. This study focuses on an experimental work to improve the productivity of the conventional solar still. This was done by using three improvement methods namely, increase in the condensation surface, integrated with the collector/storage solar water heater and reflective panels, and integrated with fins at the basin plate. For this purpose, two solar stills models were fabricated and these were conventional solar still and the modified solar still. The models were tested during the period from February to July 2017 under different weather conditions in Baghdad city, Iraq (latitude of 33.33 and longitude of 44.43). The results show that the productivity was increase by 48%, 35% and 43% when the methods of increase in the condensation surface, integrated with collector/storage and reflective panels, and integrated with fins at the basin plate were used respectively.

Keywords: Assessment, productivity, solar still, modified design

Evaluation of Competitiveness of Rice Cultivars: Effect of Signaling Compound Mesa on Competitiveness of Cultivars

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ABSTRACT

Weed infestation is one of the most severe problems primarily affecting rice production worldwide. However, current weed control practices are either costly or pose a threat to the environment. Hence, for sustainable rice production and integrated weed management systems, use of competitive rice cultivars seems to be a suited strategy.

Methyl jasmonate (MeJA) and methyl salicylate (MeSA) are important signaling molecules that induce plant defense against insect herbivores and microbial pathogens Therefore, present investigation was carried out to enhance the competitive ability of the rice genotypes, with the foliar application of elicitor compound methyl salicylate (MeSA) on two competitive (UPR 2962-6-2-1 and Govind) and one non-competitive (UPR 2992-17-3-1) genotypes of rice. The results obtained proved the enhancement in phytotoxic potential of rice genotypes upon MeSA application. Germination potential, root and shoot length of weed *Echinochloa colona* was found to be reduced upon application of extracts of rice plants treated with different concentrations of MeSA. MeSA was found to improve the competitive ability of the genotypes by suppressing weed biomass through enhancements in phenolic acid content (viz. caffeic, o-coumaric and syringic acid) and also in plant growth without any detrimental effect on the host plant, Moreover, HPLC analysis demonstrated an increase in different phenolic acids in rice plants in response to MeSA application. The results obtained suggest that treatment of rice plants with elicitor compounds like MeSA can be used for increasing the competitiveness of the cultivars in commercial agriculture.

Key words: Competitiveness, MeSA, Phytotoxicity.

Development of rancidity in stored pearl millet flour contributed by interaction of fat acidity and lipase acidity

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ABSTRACT

Pearl millet is a popular crop in Africa and in some part of India due to its nutrition-rich profile and farmer friendly properties, as it required less input of water, fertilizers, resistance to drought with high-energy yield. However, its utilization is quite limited and hence sometimes called a lost crop because of poor storability and development of rancidity along with unappealing grey colour among consumers. Major factors like fat, fat acidity, free fatty acids, peroxides, phenol, lipoxygenase, peroxidise and lipase were identified for causing rancidity in stored flour and off-odour. A total of thirty-flour genotypes of pearl millet were investigated for fat content, total phenols content, activities of peroxidase, lipoxygenase and lipase in different time period (8 and 30 days) and temperature conditions (summer and winter) to identifify the main factor for this rancidity generation in stored flour. Significant variation was observed in all the parameters during both the seasons. These genotypes also showed wide variation in development of FA in flour (prepared from grains of each inbred harvested during these seasons) stored for 30 days under ambient conditions. Five contrasting genotypes for each parameter were identified based on mean performance recorded during two seasons. However, these genotypes were statistically at par in respect of off odour developed and were not distinguishable from each other. Positive correlation was found between fat content and phenol content (r = 0.401 for summer and 0.383 for winter). Built up of fat acidity was also related to fat content (r = 0.960 for summer and 0.867 for winter), phenol content (r= 0.409 for summer as well as winter) and lipase (r = 0.706 for summer and 0.732 for winter). Development of off odour was not related to either the contents (fat % and total phenols) or enzyme activities. The interaction between temperature and storage duration was found significantly correlated with each other only for fat acidity and lipase activity. We concluded that high temperature along with increased storage time contributes to deterioration of pearl millet flour as by increasing the fat acidity, free fatty acids and lipase activity. From the study it was observed that activity of lipase and fat acidity were more responsive to storage time period and temperature as well.

Community Embeddedness Driven Skill Development for Sustainable Economic Growth

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ABSTRACT

With the growth of Indian population many concerns have emerged for the government, of which the primary area of concern is skill-based education. The growing demographic dividend of India has the potential to attract foreign investments and subsequently drive economic growth. Education in India being more supply driven, also poses problems in terms of availability of the right skills and proficiency required to work in private sector industries. The role of private sector enterprises therefore, is vital in bridging the ever-widening gap between skilled youth and right job opportunities, but the business environment today has become more dynamic than ever. Thus, unique perspectives and skills are required to work in VUCA (volatile, uncertain, complex, ambiguous) companies. Businesses are trying to create competitive advantages by creating niche in areas which were traditionally handled by local communities. Skills required in these traditional crafts like handloom, silk weaving, unani medicine etc are passed on through family traditions which make these individuals traditionally skilled but formally untrained. So if the communities are trained for modern technology the community embeddedness is likely to reflect itself into higher efficiencies and better trained manpower which will substantially and positively impact the production environment and production itself. It is the need of the hour for firms to integrate their business definition with local communities to formalise the traditional skill sets of local and indigenous communities for creating a profitable and sustainable business model. Moreover, it has been established by research that committed employees contribute more effectively to a firm's success. A quantitative research conducted on 264 employees of companies in Delhi NCR found a strong and positive relationship of community embeddedness with organisational commitment. Community embeddedness also showed significant variance among demographic groups of gender and non-standard hours work among employees, emphasising the role that community plays in the skill and employment opportunities of an individual as well as in creating a sustainable business model.

Key words: community embeddedness, skill development, VUCA, organisational commitment.

Genetic Engineering for development of salt tolerant pigeon pea plants

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ABSTRACT

Stress which arises due to environmental conditions such as salinity, drought and extreme temperature disrupts the normal metabolism of plants. Salinity is one such major stress which causes considerable loss in crop productivity. Development of transgenics has been used to deal with increasing salinity problem. In this study, Os*RuvB*, a DNA helicase, working under the control of CaMV35S promoter has been used to develop salinity tolerant transgenic pigeon pea plants. The transgenic lines have been developed using an efficient *Agrobacterium*-mediated transformation protocol and the transformation efficiency was found to be 35%. Southern hybridization and real- time PCR confirmed the stable transgene integration and the copy number in the transgenic lines. To assess the efficacy of transgene the transgenic and wild type plants were exposed to 75mM NaCl stress. Observations for various physiological parameters clearly indicated that transgenic pigeon pea plants have enhanced tolerance to salt stress. The underlying mechanism still needs to be elucidated for the functioning of the gene in a strikingly different manner under salt stress conditions as was evident from the results.

Evaluating the differentials in root dynamics and manganese efficiency of rice genotypes under different growing conditions.

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ABSTRACT

The increasing scenario of manganese (Mn) deficiency in soils emphasize the need of better crop management and evaluating strategies for breeding genotypes with increased Mn efficiency in taking up and utilizing Mn. The present investigation was planned to evaluate differential Mn efficiency of eleven diverse rice genotypes in response to applied Mn (basal, B and basal & foliar, B+F) and understand its mechanism w.r.t. root dynamics. All the genotypes respond better in terms of grain yield (4%), grain Mn concentration (21%) and Mn uptake (14%) with B+F application of Mn in comparison to B application. The rice genotypes with higher Mn efficiency index (Yield at low Mn /yield at high Mn × 100) in field had higher index in greenhouse also as Mn efficiency index of a genotype grown in pot and field was at par. The genotypes (PAU 201, PR120) with higher Mn efficiency had higher leaf area (LA), SPAD index and superior root characteristics viz. root length (RL), root surface area (RSA) and mean half distance between roots (MHDR). The results of correlation analysis depicted strong positive relation between grain yield and LA (0.60) and SPAD index (0.53). The root characteristics viz., RL, RSA and MHDR could respectively explain 76, 77 and 83% of variation in grain yield emphasizing the importance of superior root geometry in regulating the mechanism pertaining to differential Mn efficiency. Thus, the breeders could select the traits for better root geometry along with high yield in breeding programs to develop Mn efficient genotypes.

Key words: Manganese, rice, grain yield, Mn efficiency, root geometry

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