11th International Conference

Harnessing Scientific, Technological Innovations and Entrepreneurship for Sustainable Development in Africa and Asia

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INTRODUCTION

Dear Colleagues,

Innovations coupled with entrepreneurships in Science and Technology are essentially needed for realizing the UN goals of the 2030 Agenda for Sustainable Development. For that matter, appropriate, affordable, simple and easy to use technologies should be generated and potential entrepreneurs should be motivated and supported through skill development and financial assistance by national governments and international agencies for economic transformation and sustainable development in Africa and Asia. Science Technology Innovations and Entrepreneurships can increase the efficiency, effectiveness, impact and complement the efforts of government and institutions for socio-economic and environmental benefits under climate change. Several innovations and green technologies, bio-technologies, agri-technologies developed and spread around the world over the last few decades, have helped improving crop growth and health, establishing enterprises in agriculture, food and feed processing, health/hygiene, infrastructure and civic amenities in rural and urban settings. Digital technologies support almost free and fast flow of ideas, knowledge and data offering opportunities for collaborative and open approaches to innovation in Science, Technology and entrepreneurship for inclusive growth.

In that context, it is important to have visionary leadership, a pragmatic action plan integrating social, economic and environmental imperatives, and commensurate science and technology innovations and entrepreneurships for holistic development. A strong regulatory environment, including corporate law and intellectual property, will also encourage the risk-taking required to innovate.

Keeping above facts and pious goals in view, the HAWK University of Applied Sciences and Arts, the International Foundation for Sustainable Development in Africa and Asia (IFSDAA) are jointly organizing this international conference in cooperation with the AfAro - Asian Studies Promotion Association (AASF) and the Society for Sustainable Agriculture and Resource Management (SSARM). This year's conference also marks the 60th anniversary of AASF founded in 1959 and since then building up academic networks for sustainable development and delivering services to students.

Policy planners, researchers, scholars and NGOs in science & technology, agriculture, bio-technology, health care, economics, environment, skill development and entrepreneurship streams are welcome to participate. The organizers will be happy to welcome the participants to the conference venue HAWK University of Applied Sciences and Arts and and to the AASF center at Mahatma Gandhi House, both in Goettingen, 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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Mulu Worku Yimer
Deputy Head of Mission
Embassy of the Federal Republic of Ethiopia
in Berlin, Germany

MESSAGE

I am delighted to know that the IFSDAA located at the Afro-Asian Studies Promotion in the Mahatma Ghandi House and HAWK-University of Applied Sciences and Arts in Göttingen are jointly organizing an international conference on

„ Harnessing Scientific, Technological Innovations and Entrepreneurship for Sustainable Development in Africa and Asia“

from September 2 to 4 at HAWK University Campus.

Developing human resources through capacity building is one of the foremost priorities for realizing the UN-millenium goals for sustainable development. In developing countries, the application of science and technology is of utmost need for development of infrastructure, trained man-power and establishment of enterprises and institutions for socio-economic transformation.

I am happy that this international conference is intended to cover topics ranging from physiological counceling of the working force for skills development and training for capacity building using emerging science and technology for sustainable development in areas like agriculture, biotechnolgy, engineering, plant breeding, health and automation engineering.

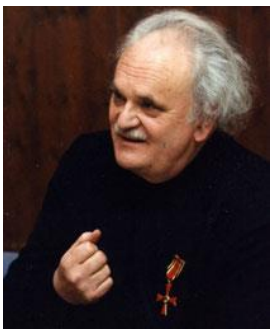
I trust that the deliberations at the conference will be valueable for the participants and all stakeholders.

I congratulate the organizers and wish the conference great success.

Regards,

Mulu Worku Yimer
Deputy Head of Mission
Embassy of the FDRE in Berlin, Germany

4th 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

Protein of Animal Origin: Are there Alternatives to Animal Products?

Gerhard Flachowsky, Ulrich Meyer and Martin Waehner,
Braunschweig, Bernburg; Germany

ABSTRACT

Considering limited natural resources, such as land, water, fuel, some minerals and increased emissions as well as rapid population growth (appr. to more than 10 Bill. people in 2100), food security is one of the largest challenges of the current century. Apart from sufficient food in an adequate quality, the supply with essential nutrients, such as amino acids, minerals and vitamins have top priority in human nutrition. In consequence of the high need of limited resources and some emissions, farm animal husbandry is questionable from various views and many people ask for alternatives.

Based on a stocktaking of the traditional production of edible protein of animal origin, the paper analyses potentials for improvement of traditional ways of plant and animal production and new possibilities to avoid food competition between humans and animals.

The following topics will be covered by the paper:

- Protein yield of food producing animals, the expenditures and emissions
- What are feedstuffs and which fractions can be directly consumed by humans (**h**uman **e**dible **f**raction; **hef**)
- Potentials to stabilize and to increase production of food of animal origin (plant breeding, plant cultivation and plant protection; animal breeding, animal health, animal nutrition)
- Reduction of losses of land area, feeds and food
- Changing of human consumption behavior; avoiding of over consumption and overweight
- Dogs, cats and further meat consumer as food competitors
- Aquaculture
- Imitated food on the base of plants
- Single Cell Protein
- Algae
- Insects
- In vitro meat (or lab grown meat).

The Pro`s and Con`s of various ways of food alternatives will be discussed. More food for more people with lower resource input and lower emissions can be considered as the largest challenge for all those, working along the food chain. Further research needs are outlined and future potentials are commented.

Further details are described by: G. Flachowsky, K.-H. Suedekum, U. Meyer (2019): Protein tierischer Herkunft: Gibt es Alternativen? (in German) Zuechtungskunde 91, (3), 178-213

Foto-Quelle:
#Momentesammler

Quantum Thinking - How do Entrepreneurs Think? "The word 'impossible' only exists in the dictionary of fools." - Napoleon

Akuma Saningong

Keynote Speaker & Life Scientist, PhD, Personal Development – You are stronger than you think!

Email: info@drsaningong.com

ABSTRACT

During this keynote speech, I convey how an entrepreneur thinks. Entrepreneurs are quantum thinkers, i.e. they think in terms of possibilities and solutions.

As an entrepreneur you profit from your attitude, which is open to everything and bound to nothing. I underline the contents of this lecture with the knowledge from quantum physics, a physics of possibilities. Everything is possible.

As an entrepreneur you are unique. You think about what things you can do better than others. You are a visionary and you have a holistic approach that helps you master challenges. And above all, you're an *action taker* and you're ready to go the extra mile. You are willing to pay the price and you know that to be successful you need patience.

Successful entrepreneurs are innovators, networkers and bridge builders as well as accelerators. They know their potential, their abilities and gifts, and share them with the world. Their goal is to improve this world and leave a legacy through their actions.

Experience a moment of pure self-reflection and a firework of inspiration among likeminded people!

Keynote Lecture

Meat Alternatives ("*Plant-Based Meat*", "*Cell-Cultured Meat*") Will Plow up Agriculture in Future by 2025/2050!?

Dr. Manfred J. Kern, Director, agriExcellence e.K., Germany

Email: info@agriexcellence.de

Symbol for "Alternative Meats" (UC Berkeley, 2018)

ABSTRACT

After 125 years, the visions/dreams of the famous chemist **Professor Marcellin Berthelot** about "**Foods in the Year 2000**", that synthesized food will displace agriculture published in 1894 seems to be on the way to be realized. However, options are not coming exclusively from chemistry, but more and more from biology and biotechnology.

"**Cellular agriculture**", "**labriculture**", and "**integriculture**" are new word creations based on new production technologies named: "**in vitro meat**", "**cellular meat**", "**cell-based meat**", "**cell-cultured meat**", "**cultured meat**", "**fermented meat**", "**animal-free meat**", "**slaughter-free meat**", "**cruelty-free meat**", "**resource-efficient meat**", "**ethical meat**", "**artificial meat**", "**synthetic meat**", "**lab grown meat**", "**home cultured meat**", "**zombie meat**", "**blood-free meat**", "**imitated meat**", "**simulated meat**", "**faux-meat**", "**non-meat**", "**methane-based meat**", "**processed meat**", "**reinvented meat**", "**beyond meat**", "**fake meat**", "**Frankenburger 'Shmeat'**" or "**clean meat**" etc.

"**Go green. Go clean. Go plant-based. Do it for your health. Do it to save the planet. Do it to save the animals.**" are key credos of the new spectacles in agriculture and food production (Radke, A., 3/2019). Key words such as: "**Fourth Industrial Revolution**", "**Second Domestication**" or "**2nd Red Revolution**" are intensively propagated in various media to promote "**Meat Alternatives**" and alternative meat production methods.

Meanwhile, ~$16 billion were invested in plant-based ($15.3 billion) and cell-cultured ($73.3 million) meat since 2009 and a broad spectrum of start-up companies were founded in the field of alternative meat production (The Good Food Institute, 6/2019).

In a new report published in 5/2019 by the consulting company **ATKearney** titled: "**How Will Cultured Meat and Meat Alternatives Disrupt the Agricultural and Food Industry?**" it is concluded, that "**Meat Alternatives**" are going to disrupt the $1,000 billion conventional meat industry with all its supplier companies. The report claims, that by 2040, 35% of global meat consumption will be come from cultured meat, and 25% from vegan meat replacements. Individual enthusiasts believe, that "**plant-based meat**" and "**clean meat**" will be very close to 100% of the global meat market, maybe by 2100.

Fair regulations and an appropriate labelling of "**Meat Alternatives**" will be fundamental for the growth of the new industry.

Key parameters for the future market of "**Meat Alternatives**" among other are the following ones: Quality, taste, flavor, texture, convenience, price, profitability, target groups in markets, affordability, availability, nature based vs science based, GMO-debate, natural vs artificial, nutritional profile, long-lasting impact on human health, food safety, fair regulations, appropriate labelling, progress in personalized nutrition (Kern, M., 1/2007), general benefits (health, environment, animal welfare), CO_2 footprint, use of non-fossil energy, bio-based product manufacturing, sustainable utilization of resources, transparency, consumer acceptance, consumer preferences, consumer demand, changing eating habits, respecting religions and cultural levels, social consensus, reactions of the livestock industry, improvements in animal production, innovations in agriculture (Grieve, B.D. et al. 5/2019), education, information, media and social media reflections, fake news, image creation, visibility, etc.

Pro and cons of "**Meat Alternatives**" and their impacts on agriculture, livestock and food industry will be reflected and discussed.

Coming back to **Prof. Marcellin Berthelot** who has said in 1894: "If one chooses to base dreams, prophetic fancies, upon the facts of the present, one may dream of alternations in the present conditions of human life so great as to be beyond our contemporary conception. One can foresee the disappearance of the beasts from our fields, because horses will no longer be used for traction or cattle for food. The countless acres now given over to growing grain and producing vines will be agricultural antiquities, which will have passed out of the memory of men." – "These are dreams, of course, but science may surely be permitted to dream sometimes. If it were not for our dreams, where would be our impulse to progress?" (Dam, H.J.W., 9/1894).

Keynote Lecture

Fruits and Vegetables Alternatives ("*Lab-grown*", "*Fruit & Veg-cell Based"*) Will Increase Horticulture in Future by 2025/2050!?

Dr. Manfred J. Kern, Director, agriExcellence e.K., Germany

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Symbol for "Alternative Fruits & Vegetables" (eco icon, 2019)

ABSTRACT

Today in 2019, there are not enough fruits and vegetables in the world for everyone to have a healthy diet at an affordable price, and neither the nutritional nor economic power of fruits and vegetables is sufficiently realized. Furthermore, it is essential to consider, that 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 9.7 billion people living on earth (*Kern, M., 2016*).

Actually, after 125 years, the visions/dreams of the famous chemist **Professor Marcellin Berthelot** about "***Foods in the Year 2000***", that synthesized food will displace agriculture/horticulture published in 1894 seems to be on the way to be realized. He claimed: *"That at some time in the future artificial meat will infringe upon the domain of natural meat, as artificial butter has upon that of natural butter, is only to be reasonably expected. So with the vegetables." ... "And what is to prevent us, once we gained the mastery, from making better milk, better meat, and better potatoes, at any season of the year, than those which nature gives us, more or less afflicted, as these are, with impurities and additions, and produced only at the periods in which her laboratories are kept open for the public good?"* (*Dam, H.J.W., 9/1894*).

However, options are not coming exclusively from chemistry, but more and more from biology/biotechnology.

"***Cellular agriculture***", "***labriculture***", and "***integriculture***" are new word creations based on new production technologies named: "***in vitro fruits/vegs***", "***cellular fruits/vegs***", "**cell-*based fruits/vegs***", "***cell-cultured fruits/vegs***", "***cultured fruits/vegs***", "***fermented fruits/vegs***", "***resource-efficient fruits/vegs***", "***ethical fruits/vegs***", "***artificial fruits/vegs***", "***synthetic fruits/vegs***", "***lab grown fruits/vegs***", "***home cultured fruits/vegs***", "***imitated fruits/vegs***", "***processed fruits/vegs***, "***reinvented fruits/vegs***", "***fake fruits/vegs***", "'***Frankenstein' fruits/vegs***", "***clean fruits/vegs***" or "***super fruits/vegs"*** etc.

"***Go green. Go clean. Go plant-based. Do it for your health. Do it to save the planet. Do it to save the animals.***" are key credos of the new spectacles in agriculture and food production (*Radke, A., 3/2019*).

Key words such as: "***Fourth Industrial Revolution***", or "***4th Green Revolution***" are intensively propagated in various media to promote "***Fruits and Vegetables Alternatives***" and alternative fruits and vegetables production methods.

Plant cell cultures are more and more developed to produce healthy fruits and vegetables during the whole year by using minimal land resources. Food vending machines, home "***Bioreactors***" personal "***Food Computers***" or so called "***Food Servers***" are on their way to provide people at home, restaurants or supermarkets with fresh fruits and vegetables. Furthermore, plant cell cultures are key prerequisites for vertical agriculture, especially established in or close by urban area.

Fair regulations and appropriate labelling of "***Fruits and Vegetables Alternatives***" will be fundamental for the growth of the new industry.

Key parameters for the future market of "***Fruits and Vegetables Alternatives***" among other are the following ones: Quality, taste, flavor, texture, convenience, price, profitability, target groups in markets, affordability, availability, nature based vs science based, GMO-debate, natural vs artificial, nutritional profile, long-lasting impact on human health, food safety, fair regulations, appropriate labelling, progress in personalized nutrition (*Kern, M., 1/2007*), general benefits (health, environment), CO_2 footprint, use of non-fossil energy, bio-based product manufacturing, sustainable utilization of resources, transparency, consumer acceptance, consumer preferences, consumer demand, changing eating habits, social consensus, reactions of the horticulture industry, improvements in fruits and vegetables production, information, media/social media reflections, fake news, image creation, visibility, etc.

Pro and cons of "***Fruits and Vegetables Alternatives***" and their impacts on horticulture and food industry will be reflected and discussed.

Keynote Lecture

Ethiopia in the context of national and world land use and global sustainable development

Arthur Riedacker

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ABSTRACT

Governmental delegates and IPCC scientists have approved at the beginning of August the Summary for Policymakers of the Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. (https://www.ipcc.ch/site/assets/uploads/2019/08/4.-SPM_Approved_Microsite_FINAL.pdf).

It should however be underlined that IPCC reports, although policy oriented, are not policy prescriptive. Moreover the underlying report, -7 chapters, about 1000 pages- does give specific indications, neither for national, nor for global sustainable development to meet the goals of the Paris Agreement on climate change.

We present here a preliminary approach to assess what should be considered to put Ethiopia, the second most populated country in Africa, as well as developed countries considering the international cooperation with Ethiopia, on the right track to stabilize the climate at +1.5/2°C by 2050. For this we are to consider the evolution of the population, of land use, of land use efficiency, of agricultural production and the respective impact on the balance of trade and on net GHG emissions: In particular of food which has a direct impact on land use in Ethiopia and elsewhere in the world, in particular in countries exporting food to Ethiopia or getting food from that country. Imports and exports of fossil and renewable energy are also to be considered, as well as constraints for water use of the River Nile.

Keynote Lecture

Sustainable, Competitive, Reliable, Secure

What Kind of Energy Do Africa, Asia and South America Need?

Prof. Dr. N. El Bassam

Scientific Director: International Research Centre for Renewable Energy
Chairperson, WCRE, World Council for Renewable Energy
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ABSTRACT

It is no secret that we have reached our limits as a result of the excessive use of fossil fuels and related technologies that benefit a few financially, but leave the rest to cope with the consequences. Among these unfortunate outcomes are health hazards, security issues, dwindling public services and restricted access to education and job opportunities.

Developing the energy supply would automatically improve the major issues of sustainable development: poverty, job creation, income levels, and 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 will be to provide energy for a further 5-7 billion people, while cutting our emissions by half.

By 2050, humanity will need two earths to supply enough resources to meet the growing demands for energy. We cannot continue to manage our resources in such a negligent manner. This option doesn´t even exist. We have to consider the needs of future generations.

Serving the needs of unserved people should be our main priority. We have no other choice, but to tackle the issues of energy shortage and the resulting poverty, which affects one-third of the world's population.

We have the knowledge and the technologies available to do so. What is needed is for us all to be honest, faithful and sincere – to ourselves as well as to others – and pursue a life of peace and dignity. This should not only be for our own personal benefit, but should remain our deepest desire for the whole of mankind.

We have realized that an insufficient supply of energy automatically leads to underdevelopment.

The populations which suffer the most are found in countries and regions with a shortage of energy. Since the era of fossil fuel is coming to an end, future sources of energy need to be based on renewable energy.

However, this transition will require clear and reliable political and financial commitment if it is to succeed.

Resource Management for Sustainable Wheat Production

Palvindar Singh* and J. K. Behl

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24 BB Padampur District Sri Ganganagar- 335041 Rajasthan, India

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ABSTRACT

Wheat is major crop District Sri Ganga Nagar , Rajsthan India. It is grown under diverse agro-ecological conditions from rainfed low nutrient to high input regimes. Wheat yield under limited irrigation conditions is generally low and hence calls for sustainable intensification of wheat yield through improved management and varietal selection. SKM Agriculture College is situated in agriculture belt with poor natural resource base like low organic carbon, low nutrient profile, limited water availability for canal irrigation. An experiment was conducted with the aim to identify wheat varieties suitable for limited water supply and medium input conditions in organic and normal whaet cultivation. The experiment was sown on 24 November, 2016 when the day and night temperatures were optimal. Three fourth doses of recommended N,P,K for wheat were applied in split doses so as to ensure nutrient supply at all cruitical stages. Likewise irrigations were scheduled in such manner that tillering , boot and grain filling stages are not deprived of water supply. One variety WH1080 was also grown under organic regime where 15 Tons of organic compost and two tons of Vermicompost were applied. Our results revealed that WH1080 recorded highest yield in normal and organic regime followed by bold seeded variety WH283 and WH1142. Variety WH 1105 and WH1124 also recorded good yield with smaller grains.Out of these five wheat varieties WH 1080 and WH 283 were selected on the basis of their performance grain yield, maturity and other ancillary traits like that plant height, plant biomass, grain characteristics and yellow rust resistance. Wheat variety WH 1142 exhibited long spike, higher grain number and higher gentic plasticity. The grain yield recorded at SKM Agriculture College Research Farm were much higher than the neighbourhood farms due to better management.

Key Words: bread wheat, rainfed and salinity, high grain yield and production management.

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

Mesay Barekew[1] and Joseph Antony Vedanayagam (PhD)[2]

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

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Evaluating the association of rs731236 polymorphism with predisposition of Poly Cystic Ovary Syndrome

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ABSTRACT

Vitamin D, a secosteroid plays important regulatory roles in metabolic pathways affected by poly cystic ovary syndrome, including insulin synthesis and secretion pathway, calcium homeostasis and sex hormone biosynthesis. The aim of this study was to investigate the association of VDR SNP with increased risk of developing PCOS. Three hundred women of reproductive age were enrolled in this retrospective case-control study. Patients had their PCOS diagnosis made on the

basis of Rotterdam Criteria. Genotyping of VDR Taq-I (rs731236 T/C) SNP between groups was determined by PCR-RFLP. Taq1 CC genotype was found to be more prevalent in PCOS pateints (10.6%) than controls (0%) (OR: 0.9995; 95% CI: 0.528 to 1.8921; p = 0.9987). The mutated genotype was also significantly associated with BMI (p = 0.000), LH/FSH (0.03), HOMA-IR (p=0.05) and VDD (p=0.05). The genotypic (p=<0.05) and allelic (p=0.0001) frequency distributions showed significant difference between the PCOS cases and control women. Significant association was found between vitamin D receptor genetic polymorphisms (rs731236T/C), indicating the increased susceptibility towards PCOS with CC genotype. In the light of extra skeletal functions of vitamin D, VDR Taq1 polymorphism act as a significant risk factor for PCOS, suggesting that VDR might involve in the pathogenesis of PCOS. The genotype of an individual could potentially fulfill the role for targeted therapeutic decision making. This necessitates further research in different populations in future possibly helping to guide personalized care.

Key words: vitamin D receptor, polymorphisms, vitamin D, polycystic ovary syndrome,

Technology for a building and maintaining civil engineering systems

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ABSTRACT

Public health and hygiene is important aspect for infrastructure development in such a way that the human waste is disposed off safely without affecting the water supply chain and water quality. For that matter the civil engineering system should be optimized in such a way that the sewage disposal system is entirely and differently placed away from the water supply system for drinking purposes. Another safeguard is that the sewage disposal system remains unblocked, continuous with consistent flow of the waste water and the solid waste in it, so that it can be taken away to the safe storage places, where from it can be taken out to take the human solids on one side and water on the other side. The water again can be recycled for purposes like irrigation and the solid waste can be converted to compost and apply in agriculture. However in developing countries due to construction failures or faults in assembly lines the sewage systems are often blocked due to excessive deposition of sludge on account of non-maintenance of flows and all the problems off levels and dimensions of pipe lines used in sewage disposal systems. Therefore the sewage system engineering has to be optimized for regulating the flow of water getting sewage sludge through optimization of levels of pipe lines as well as dimensions of pipe line connections. Also the Sewage systems should have the treatment plant in assembly line so that the inorganic pollutants like the soaps heavy metals are precipitated differently than the water so that such toxic materials do not reach and enter Food or public water supply chains.

Also the excessive flow from sewaerage should not be deposited in Street near civic amenities to ward off nuisance On account of foul smell and spread off diseases due to insect pests bacteria, fungi and viruses. In this presentation, a model system for Management of waste water and Sewage sludge is exemplified for waste management while keeping the environment healthy and sustainable.

Management of whitefly *Trialeurodes vaporariorum* (Westwood) (Homoptera: Aleyrodidae) on cotton using endophytic strains of the entomopathogenic fungi (*Beauveria bassiana* EABb04/01-Tip) and *Metarhizium brunneum* (ART 2825)

Elhadi Morzog and Prof. Dr. Stefan Vidal

Georg-August-University of Gottingen,
Faculty of Agricultural Science Department of Entomology

ABSTRACT

The greenhouse *Trialeurodes vaporariorum*(Westwood) (Homopetra:Aleyrodidae) is one of the most pests of ornamental and crops. Because of the cryptic nature of immature underside leaves and raid development of very dense populations, and reveal a group of insects with ability to develop population are highly resistance to pesticides and this pest become difficult to achieve comprehensive control. However, the present study seek to explore the virulent of *Beauveria bassiana* (EABb04/01-Tip) (4×10^6spore per ml^{-1}) and *Metarhizium brunneum* (Mb-ART 2825) (0.5×10^7 spore per ml^{-1}) by means of seed and root inoculation in cotton plant on the management population of greenhouse whitefly *Trialeurodes vaporariorum* (Westwood). In controlling this pest in quarantine cabinet, the endophytic colonization of *B. bassiana* and *M. brunneum* were effective in reducing number of nymphs. The results of this study showed that the two strains fungus was pathogenic to adults greenhouse whiteflies, rapidly reduce the number of nymphs and meanwhile Mb-ART 2825 increased the dry matter of cotton plant act as plant growth regulation, moreover the studies sought after the potential use of Mb-ART 2825 and Bb-Q as biological control agents against greenhouse whiteflies.

Biodiversity for the Conservation of Environment

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ABSTRACT

Persisted ecological imbalance makes the environment unfavourable for initiating any kind of development plan. That's why biodiversity conservation stands at epicentre of the sustainability of the global developmental goals and targets.Biodiversity is the *"living foundation"* for sustainable development.Without biological diversity, there is no other life on Earth, including our own. This diversity of life provides clean water, oxygen, and all other things that end up being part of our diet, as well as clothing and shelter. It provides a lot of psychological benefits too, which are not much appreciated. India's biologically rich areas (*e.g.* protected forest, hot spots) are facing severe conservation threats due to anthropogenic activities. The degradation of remaining forest habitats due to deforestation, land use change is one of the major threats of biodiversity. Therefore, it is imperative that conservation science should put in place for effective conservation and protection of biodiversity.**Biodiversity has a great impact on sustainabledevelopment.**Sustainable use of biodiversity is measured under the headings -- 'Direct-use value', 'Indirect-use value' and 'Non-use value'. Direct-use value includes food, medicine, biological control, industrial materials, recreational harvesting and ecotourism. Indirect-use value deals with biodiversity and ecosystem functions for maintenance of soundness of environment as a whole. Non-use value provides options value, bequest value, existence value and intrinsic value. All use-values of biodiversity are possible to be sustainable when conservation of biodiversity is made sustainable. Introduction of exotic species is another major challenge to biodiversity conservation and its use in development. In India, some plant and animal species have been introduced from different countries.

These exotic species have hampered endemic species both in their population dynamics and in the position of their trophic levels. In typical aquatic ecosystem of our country (like pond ecosystem), fishes like singhi feed on the chironomid larvae keeping them in the status of fourth trophic level (3rd consumer). The carnivorous fishes of our endemic nature like Chital and Boal feed on the fishes of fourth trophic level and attain the status of fifth trophic level (fourth consumer). In our typical aquatic ecosystem (pond ecosystem) the energy-flow and ecological pyramids are arranged in this pattern. On the other hand, when African magur and Red Piranha are introduced to the ecosystem they drastically consume without maintaining the chronology of the ecological pyramid-pattern in an ecosystem. These introduced species drastically reduce the population of animals of all trophic levels and create ecological hazard for the population of all other aquatic animals and many aquatic plants also. Consequently aquatic ecosystem gets altered. Biodiversity conservation has got a great role in maintenance of species richness and proper functioning of an ecosystem.

Conservation of biodiversity means the conservation of biotic and abiotic factors together and their interaction to provide the sustainable situation for living organisms in an ecosystem. If the normal proliferation and reproduction of all living organisms and their interaction with abiotic factors fail in an ecosystem, then ecological imbalance remains in its persistence. Persisted ecological imbalance makes the environment unfavourable for initiating any kind of development plan. And this is why the biodiversity conservation stands at epicentre of the sustainability of the global developmental goals and

targets. To us important is that, we shall have to understand the process of making biodiversity sustainable, and the technique to be adopted for its use at the same time. Biodiversity & Environmental Sustainability (BEST) is an initiative from the hearts of those who have experienced the beauty of nature very closely. Solving the problem of environmental threats and a dwindling biodiversity has been on the international agenda for some decades now.

Value addition of Safflower oil seeds by alleviating antinutritional effects of tannin and phytic acid.

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ABSTRACT

Safflower, an important oilseed crop has been used extensively for its medicinal and pharmaceutical applications since ancient times. Besides its useful applications and high nutritional value, this crop also possesses some anti-nutritional factors (ANFs) that restricted their uses as an animal feed. Pretreatment processing of this oilseed can reduce ANFs and nutritrients became available for the animal feed. Among these ANFs, tannin and phytic acid have been considered as a major anti-nutrient which binds with the cationic nutrients including Zn, Fe and made them unavailable for the human intestinal absorption.

In our study, effect of heat pretreatment has been employed to reduce the level of tannin and phytic acid in safflower seeds. The heat pretreatment was done with two sets of seed samples i.e. corticated and decorticated seeds. Each set was divided into four portions i.e. B10, B20, B30 and C. Samples B10, B20 and B30 were heated for 10 min, 20 min and 30 min respectively at 80^0C, while sample C served as the control for the experiment. The results showed significant reduction in tannin and phytic acid content in treated seeds than control. In conclusion, heat pretreatment proved to be a good processing method for significant reduction of the tannin and phytic acid in safflower seeds.

Key words: Safflower seeds, Heat pretreatment, ANFs, Tannin, Phytic acid

Dissecting Genetic Diversity in Forage Sorghum using Cluster Analysis

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ABSTRACHT

Genetic diversity in a set of 49 forage sorghum genotypes were estimated using D^2 cluster analysis. The experiment was carried out in randomized block design with three replications during *Kahrif*-2018. The D^2 cluster analysis classifies the genotypes into different clusters with little diversity within cluster while diversity between two clusters is usually high. In present study, D^2 analysis grouped the 49 genotypes in ten different clusters which supports the existence of substantial genetic diversity among them. Cluster-I was the largest cluster with a total of 28 genotypes followed by cluster-II (12) and cluster-VII (2) while rest had only one genotype each in it. The maximum inter-cluster distance between Cluster-VII and Cluster-VIII make their genotypes most diverse and suitable for hybridization programme. Further, Cluster-II was characterised with maximum intra-cluster distance followed by Cluster-I which indicates that certain genotypes can be used for hybridization with the other members of that cluster. Cluster I had highest mean for plant height upto flag-leaf base, total plant height, leaf length and breadth, green fodder yield and low HCN content. Cluster II had highest mean value for time of panicle emergence, stem diameter, crude protein percentage. While, cluster X had highest mean fordry fodder yield and crude protein yield. A dendrogram was developed with the help of Tocher method which revealed that genotype, PGN 66 from Cluster-I (26) and genotype, IS 40921 from Cluster-X (34) were most diverse and suitable to for a hybridization programme. Furthermore, with in clusters, genotype PGN 66 and GP-298 in Cluster-I and genotype GP-318 and PGN 9 were in cluster-II were most diverse. These genotypes are suggested to be most suitable for exploiting hybrid vigour and heterosis for forage sorghum improvement.

Forage sorghum germplasm screening and evaluation of identified perennial sorghum genotype for fodder yield and quality traits in Western Haryana

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ABSTRACT

Sorghum being a C_4 plant is major crop in semi arid regions of the world. It has diverse uses like food, feed, fodder, fuel and medicinal uses. In India, sorghum is grown for grain and fodder purpose. For agriculture based economy a crop like sorghum can provide multiple benefits with low input resources. It is preferred over corn because of its climate resilience nature. So keeping these points in view a experiment was planned in *kharif* 2017 to screen forage sorghum germplasm lines for high biomass related traits. These lines were cut at 60 days after sowing to check their multicut potential and observations for green fodder yield, dry fodder yield, tillering and regeneration potential were recorded. Out of 300 lines only 41 lines had high tillering and good regeneration potential. But one germplasm line is having high number of tillers and fast regeneration. This is evaluated for all fodder yield related traits like plant height, leaf length, leaf breadth, tillering, regeneration, green and dry fodder yield (upto 3 cuts)in *kharif* 2018. IC 581853 (GFY: 1091.0 q/ha & DFY: 268.3 q/ha) has shown 10.5% increase over the best check SSG 59-3 (GFY: 987.7 q/ha & DFY: 237.2 q/ha). But as far as quality is concerned crude protein and IVDMD measured for IC 581853 was 6.56% and 46.2 %, respectively. In the mean time, we have propagated it by root/stem cuttings and are under evaluation for fodder yield related traits in *kharif* 2019. Due to its high dry fodder yield it can be used for silage making and can be explored for production of green fodder during lean period with stem/root cutting which will be a source for quality fodder for livestock. This can be used to overcome major constraint in fodder production i.e. non availability of quality seed to farmers. Further studies at genetic and molecular level should be required to study its high biomass production potential and improve its fodder quality.

Key words: Fodder, sorghum, tillering and regeneration

Promotion of Organic culture in the Agriculture system

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ABSTRACT

SGT University is committed to promote sustainable development initiatives particularly amongst the poor small scale farmers in adjacent areas through participatory and innovative practices. The strategic plan of the organization is to empower the local people with knowledge to harness their potential in order to raise their living standards and to make them healthy and environmentally conscious. The faculty members as trainer spreaded the knowledge about organic culture system among students. In this strategic plan of organic vegetable production including cucumber, French bean, Okra, Sponge guard, Round melon, Bitter gourd and muskmelon were grown at the farm area of FAS, SGT University. This project primarily targeted population residing inside SGT Campus for marketing the produce by students through digital marketing and small scale farmers of nearby villages to get awareness regarding importance of organic farming and its adoption. We adopt integrated and intensive farming system in one acre area to avoid wastage of resources. The group of ten students of BSc (Hons.) agriculture were prepared to look after all practices starting from land preparation to marketing. The insect and pest incidence were treated by using organic product such as neem oil and vermin wash. Vermi wash were not very popular in Haryana state we used it in the field and got major difference in growth and development which figured in better yield. SGT Agriculturists were committed to promote organic farming as means of empowering the communities towards better living. The project aims at training ten students in one year which will generate awareness on organic farming among small scale rural farmers of nearby villages. The farmers are then followed up to assist in adoption of the ideas and their implementation. The previous result shows that food security improves as a result of improved and maintained soil fertility as well as diversification of crops leads to improved nutritional status of the communities. As organic farming methods are less costly and utilize locally available materials thereby raising the standard of farm family.

Key words: Organic culture, Vegetables, Health benefits, Vermi wash and bio-fertilizers.

Evaluation of Wheat Genotypes for Early Heat Stress Environment

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ABSTRACT

Earth temperature is increasing continuously since the last two decades due to greenhouse gases. This increasing temperature is not congenial for wheat crop. Wheat crop is affected by rising temperature at various crop stages. As the weather modules are expecting a continuous rise in temperature in near future, there is need to screen wheat genotypes which can perform better under early heat stress environment. Keeping this in view an experiment was planned and sowing of bread wheat genotypes was done under early heat stress environment (October sown) under German funded project *i.e* BMZ project. Sixteen genotypes including four checks were evaluated in simple lattice design with two replications under early sowing *i.e* 25th October, 2017. The results revealed that two genotypes from CCS HAU, Hisar namely, WH 1253 (70.42 q/ha) at 1st rank and WH 1252 (69.00 q/ha) at 3rd rank in pooled data at zonal level to the best check DBW 88 (68.70 q/ha). During 2018-19, 49 genotypes were sown on 23rd October as early and 10th November as timely including four checks in simple lattice design with two replications. All the genotypes were coded. The yield range was 32.2 q/ha (BMZ 140) to 73.4 q/ha (BMZ 145) with mean yield 60.1 q/ha under early sown environment. The low yielding (BMZ 140) in early sown environment was due to late maturing of genotypes (169 days). The high yield was due to 1000 grain weight, high biomass and lodging resistance. Under timely sown environment, the yield range was 24.8 q/ha to 65.7 q/ha with mean yield 47.12 q/ha. By these two years experiment we can assume that wheat genotypes with good germination, early vigour, high biomass, lodging resistance and more 1000 grain weight give high yield under early heat stress environment.

Key words: biomass, early heat stress and 1000 grain weight

Recent Innovation in use of Fly Ash as a Construction Material

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ABSTRACT

Intensive effort have been made in last three to four decades to identified construction materials which gives adequate strength to building structures and are cost effective and environmentally benign while conserving natural resources.

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 (SiO2) and calcium oxide (CaO).

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.Fly ash has shifted from “Waste Material” category to “Resource Material” category.

Fly ash properties are unusual among engineering materials. Unlike soils typically used for embankment construction, fly ash has a large uniformity coefficient and it consists of clay-sized particles. Engineering properties that affect the use of fly ash in embankments include grain size distribution, compaction characteristics, shear strength, compressibility, permeability, and frost susceptibility.]

Use of fly ash as a partial replacement for Portland cement is particularly suitable but not limited to Class C fly ashes. Class "F" fly ashes can have volatile effects on the entrained air content of concrete, causing reduced resistance to freeze/thaw damage. Fly ash often replaces up to 30% by mass of Portland cement, but can be used in higher dosages in certain applications. In some cases, fly ash can add to the concrete's final strength and increase its chemical resistance and durability.

More recently, fly ash has been used as a component in geopolymers, where the reactivity of the fly ash glasses can be used to create a binder similar to a hydrated Portland cement in appearance, but with potentially superior properties, including reduced CO2 emissions, depending on the formulation.

Fly ash is also used as a component in the production of flowable fill, Flowable fill includes mixtures of Portland cement and filler material, and can contain mineral admixtures.

Another application of using fly ash is in roller compacted concrete dams. Many dams in the US have been constructed with high fly ash contents. Fly ash lowers the heat of hydration allowing thicker placements to occur. This has also been demonstrated in the Ghatghar Dam Project in India.

Fly ash bricks can be made in different way.One type of fly ash brick is manufactured by mixing fly ash with an equal amount of clay, then firing in a kiln at about 1000 °C. which allows reducing the amount of clay required. Another type of fly ash brick is made by mixing soil, plaster of paris, fly ash and water, and allowing the mixture to dry. Because no heat is required, this technique reduces air pollution. Which accures environmental benefits.

Rural Migration: Emerging Challenges for Sustainable Development

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ABSTRACT

Migration is the movement of people, either within a country or across international borders. It includes all kinds of movements, irrespective of the drivers, duration and voluntary/involuntary nature. It encompasses economic migrants, distress migrants, internally displaced persons (IDPs) refugees and asylum seekers, returnees and people moving for other purposes, including for education and family reunification.Migration is often a deliberate decision and an important component of household livelihood strategies. More than 75% of the world's poor and food insecure live in rural areas, mostly depending on agricultural production for their subsistence. The rural poor, and especially smallholder family farmers, face considerable difficulties in accessing credit, services, technologies and markets that would allow them to improve the productivity of their natural resources and labour. Migration becomes an important part of the strategies of rural households for improving their livelihoods. Most available jobs in agriculture are associated with low and unstable incomes, poor safety and health conditions, gender inequality in pay and opportunities, and limited social protection. Due to restricted access to training, financial and extension services and processing facilities, more attractive prospects may be limited in rural areas. Rural people are drawn to urban areas where they expect to have better employment opportunities and improved access to health, education, and basic services. About 73% of the world population have no adequate access to social protection. The majority live in the rural areas of developing countries, where they face difficulties in managing social, economic and environmental risks. Smallholder family farmers, small-scale fishers, forest-dependent communities and pastoralists are hardest hit by weather related disasters, which are increasing in frequency and intensity. Droughts and related food price volatility increase poverty and hunger, and the need to find viable options elsewhere. Land degradation and desertification affect around one-third of the land used for agriculture and about 1.5 billion people worldwide, undermining farmers' productivity and resilience. Climate change and the use of inappropriate farming techniques further exacerbate these challenges.

Key words: Agriculture, Farmer, Migration

Arbuscular Mycorrhizal fungi as potential intervention for bioenergy crop species under climate change

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ABSTRACT

About one percent of the total water reservoir of the world is potable, of this only 4.2 % water is available for 16% of world population in India. Water is thus a scared commodity. Only one third arable area is irrigated while the rest are rainfed. Under climate change rainfall pattern has been erratic with net decline in annual precipitation in most area. Plants growing under such area are experiencing water stress and its associated stresses like high temperature, salinity and nutrient use efficiency. In such a situation, a potential biological agent which helps in water conservation and nutrient mobilization is utmost needed. AM fungi are one such biological entity which can perform various biological functions. Numerous researches recommended that Arbuscular Mycorrhizal Fungi (AMF) can recover the acclimatization of micro-propagated plantlets, improving their growth and survival. Dual symbiosis showed that during C acclimatization, mycorrhizal inoculated plants (AM) existent greater number of leaves with height of plants as compared to non-mycorrhizal plants. Furthermore, highest biomass accumulation directly based on shoot/root length at the end of the hardening process in mycorrhizal plants results in renewable biomass. The biomass accumulation in mycorrhizal fungi related with increasing the absorption capacity of water for utilization in various process in host plants which increase in dual symbiosis. It also affects the opening and closure of stomata, especially in water stress. Mycorrhizal fungi are recognized to act as central roles in land-dwelling ecologies playing as drivers of nutrient including solubilization of P and Carbon cycles. The energy crops are the best replacement of fossil fuels and vital contribution in reducing anthropogenic CO_2 emissions. The symbiotic property of AMF fungi with host plant is important for increasing biomass production. Because it modified the host plant water balance in drought condition too and increased root biomass through plant mass and height. Also, solubilization and mobilization of nutrients especially phosphorus is often increased in roots to shoot which related to an increase in plant size that directly related to biomass. The aim of the current study was to explore the natural resources for C assimilation into biomass from those areas which are facing the tremendous pressure of carbon dioxide emission into the atmosphere. The study highlighted that the mycorrhiza- induced alteration in the metabolic pathway of plants, construct more biomass under water stress and CO2 pressure. The AM fungi accelerated the plant growth system which accumulates 9 to 17% more biomass. It is recommended that inoculation of plants with AMF fungi for rapid biomass production can provide sustainable raw material that may be probable solution for abundant and low-cost renewable cellulosic biomass through fungal engineering.

Keynote Lecture

Potato: a crop contributing to sustainable world food security

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ABSTRACT

But rice and wheat potato is the third of key crops providing sustainable world food security and livelihoods especially in South America, Africa, Central Asia and other developing countries. According to reports available in literature potato crop is grown in more than 100 countries around the world. It is estimated that close to 50% of potato grown worldwide have been used for fresh consumption. Until the early 1990s, most potatoes were grown and consumed in Europe, North America and countries of the former Soviet Union. FAO data show that in 2005, for the first time, the developing world's potato production exceeded that of the developed world. China is now the biggest potato producer, and almost a third of all potatoes is harvested in China and India (Table 1).

The total world potato production in 2017 was estimated at 388,191,000 tonnes. In EU-28 52 million tonnes of potatoes were harvested in 2018. This is about one-third (37.3 %) less than in 2000. Such amount of potatoes was produced in Poland in 1960 and 1970s, when potato acreages were reaching almost three millions ha. At that decades Poland showed to be one of the giants of potato growing and production. Over the next 50 years potato acreages and production volumes have been dropping substantially. In 2018 the production of potato in Poland reached 7,1 mln tonnes. Nevertheless, potatoes still remain at the heart of Polish agriculture, grown on 300 000 ha. Poland is ranked 8 among potato producing countries worldwide (Table 1).

Table 1. The top 25 potato producing countries in 2017 [Source: FAOSTAT, (retrieval date: January 5, 2019)].

Rank	Country	Tonnes
1	China	99,205,600
2	India	48,605,000
3	Russian Federation	29,590,000
4	Ukraine	22,208,200
5	United States	20,017,400
6	Germany	11,720,000
7	Bangladesh	10,216,000
8	Poland	9,171,730
9	Netherlands	7,391,880
10	France	7,342,200
11	Belarus	6,414,760
12	United Kingdom	6,218,000

Rank	Country	Tonnes
13	Iran	5,102,340
14	Turkey	4,800,000
15	Peru	4,776,290
16	Algeria	4,606,400
17	Belgium	4,416,660
18	Canada	4,410,830
19	Egypt	4,325,480
20	Pakistan	4,142,400
21	Brazil	3,656,850
22	Kazakhstan	3,551,110
23	Romania	3,116,910
24	Colombia	2,819,030
25	Uzbekistan	2,793,690

Continued on next page

It is also to indicate, that all potato varieties are clones. Their propagation is done vegetatively. Potato as all other crops is susceptible to a wide range of pathogenic organisms – fungi, bacteria, viruses, viroids, nematodes and other pests, which will be discussed during the presentation.

Keynote Lecture

Course of the soil reaction and the plant-available nutrient contents in the 140 year-old Eternal Rye Trial in Halle (Saale), Germany

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ABSTRACT

The topic of this paper is the course of pH and the levels of plant-available macro- and micronutrients in the soil of five fertilizer variants of the Eternal Rye Trial in Halle (Saale), Germany. The pH decreased in the course of the trial in all test variants. The base saturation degree was closely related to the pH. Lime applications that were made, increased the pH temporarily or slowed down the decrease. The lowest pH was found in mineral N-fertilization and the highest in PK fertilization. The plant-available P, K, and Mg contents have decreased in all fertilizer variants in the last decades, with the exception of the K contents after manure fertilization. With application of mineral fertilizers in combination with manure, the P and K contents and the pH are increased in the subsoil. In the case of micro-nutrients, regular manure fertilization led to a significant increase of Mn, Fe, and Si contents.

Novel High-Accuracy Emotion Recognition Technology Using 3D Electromagnetic Articulography

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ABSTRACT

In low economy countries mental disorders are still exempted from treatment to a large extent due to insufficient capacity of experts. On the way towards computer aided psychological analysis this project investigates emotion recognition using a dataset consisting of movements of facial muscle groups responsible for the 7 universal human expressions, namely anger, disgust, fear, happiness, sadness, surprise, and a neutral expression. In this case, only 3 expressions, happiness, anger and neutral, are recorded, using a commercial AG501 electromagnetic articulograph from Carstens Medizinelektronik GmBH, Germany. An articulograph uses 3D electromagnetic sensors attached to facial vertices to measure their location at sub-millimeter precision. Data have been recorded at the Affective Neuroscience and Psychophysiology Lab. in Goettingen, Germany.

Relevant recorded information is fed into an RNN (Recurrent Neural Network) in order to consider temporal patterns of data. Due to the uniqueness of the dataset, various preprocessing techniques are applied to improve the quality of data for neural network training. Once a suitable architecture is found the distilled data are used for RNN training and a grid search is performed to find optimal hyperparameters. Furthermore the effects of data reduction are examined on the predictive qualities of the best prior-determined network, to gain further understanding of the available dataset.

The accuracy of this novel method using articulography reaches 94%, significantly exceeding results obtained from using pure video data. It is concluded that the method has the potential to be extended to automized or semi-automized clinical analysis of mental conditions, which is especially beneficial for regions lacking of psychological experts.

Optimum Deep Learning Hyperparameters for Computer Aided Malaria Diagnosis

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ABSTRACT

Malaria is one of the most infectious diseases, specifically in tropical areas where it affects millions of lives each year. The subject of this project is the binary patch-based detection of plasmodia in thick blood smear images for computer-aided diagnosis of malaria. This is achieved via deep learning on datasets of images with bounding boxes annotating the presence of plasmodia. Optimum deep learning hyperparameters are determined empirically. Training data are provided by the Automated Laboratory Diagnostics project of John A. Quinn et al. at Makerere University, Uganda. A further independent test dataset is provided through the cooperation with Mekelle Institute of Technology and Tigray Health Research Institute, both located in Tigray, Ethiopia. The plasmodia in this dataset feature multiple species and development stages, enabling a thorough testing procedure.

By means of grid search, the network architectures are trained with different training hyperparameters. Specifically, the batch size, learning rate and decay of the learning rate are examined. In order to evaluate the best hyperparameters for each model and to find the best architecture overall, a test protocol is developed. This yields a set of hyperparameters that achieves an accuracy of up to 99.3% using a network with two consecutive convolutional layers with a smaller kernel size and 337,450 trainable parameters.

Effect of Biochar Application on Nutrients Dynamics and Improvement of Soil Fertility

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ABSTRACT

Biochar has been used in agriculture as a safe and sustainable soil amendment. It has ability to attract and retain water and nutrients as well as hold agrochemicals. It reduces the total fertilizer requirements of the crops. Biochar application has been reported to decrease nitrogen losses from soils. The increased adsorption of NO_3^- on sugarcane bagasse biocahr produced at five pyrolysis temperatures, and degree of adsorption depended on temperature. The increased adsorption of NO_3^- was because of functional groups rather than physical adsorpation. The biochar produced from wood of *Eucalyptus* species at 600^0c substantially removed NH_4^+ in solution. It has been reported that biochar application reduced N leaching by holding nitrate and thus increased its crop use efficiency. Adsorption, immobilization and ionic exchange of NO_3^- and NH_4^+ onto biochar are the mechanisms for reduction of N leaching and retention in soils treated with biochar. The mechanical disturbance from biochar application increases soil aeration and promotes nitrification, causing rapid transformation of NH_4^+ to NO_3^-. Higher concentration of NO_3^- in vicinity of wheat seedlings and rhizosphere after application of biochar produced from mixed deciduous hardwood, has been reported. Biochar may reduce the formation of phosphate precipitates and therefore increase availability of phosphorus to plants. A field study carried out in Lombok, Indonesia showed that the application of biochar significantly increased soil available P, which subsequently increased maize yield. Synergistic and positive effects of biochar on available P have been observed through increasing water retention capacity of a sandy soil.

Biochar application has been proven to increase soil fertility since it increase macro and micro elements status in soil. Moreover, introduction of biochar ash components can significantly improve soil fertility. Biochar as such contains micro nutrients such as Mn, Zn, Cu, Co and Mo. Biochar has been revealed to enhance the growth of micro-organisms by decomposition of the labile compounds in soil. The porous nature of biochar provides a favourable habitat for micro-organisms where they can easily thrive and get shelter against predators in soil.

Field efficacy of cypermethrin with combination of different botanicals against shoot and fruit borer, (*Leucinodesorbonalis* Guenee) of brinjal (*Solanum melongena* L.)

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ABSTRACT

The present investigation was conducted during July to December 2018 at Central Research Farm, SHUATS, Naini, Prayagraj. Eight treatments were evaluated against *Leucinodesorbonalis* i.e., Neem oil 2ml/lit, Garlic bulb extract 50ml/lit, Pongamia oil 5 ml/lit, Neem oil 2 ml/lit+ Cypermethrin 10EC 1ml/lit, Garlic bulb extract 50ml/lit + Cypermethrin 10EC 1ml/lit, Pongamia oil 5 ml/lit + Cypermethrin 10EC 1 ml/lit, Cypermethrin 10EC 2 ml/lit and Untreated control. Minimum per cent of shoot infestation, fruit infestation and B:C ratio were recorded in Neem oil + Cypermethrin with (15.04%, 10.62% and 1:8.10) followed by Pongamia oil + Cypermethrin (15.56%, 11.26% and 1:7.42) < Garlic bulb Extract + Cypermethrin (16.04%, 12.33% and 1:6.86) < Cypermethrin (16.70%, 12.82% and 1:6.69) < Neem oil (17.99%, 13.00% and 1:6.37) < Pongamia oil (18.62%, 13.66% and 1:6.13) < Garlic bulb extract (19.65%, 14.66% and 1:5.20) < untreated control (25.67%, 20.70%,1:3.10) respectively.

Keywords: *Leucinodesorbonalis***,** Benefit cost ratio, Brinjal, efficacy

Current taxonomy of rhizobia infecting legumes to develop better inoculants for sustainable agriculture

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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.

Application of mobile phone technology to enhance agricultural production for rural development

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ABSTRACT

In India, where nearly 65 per cent of the total Indian population lives in rural areas and dependent on Agriculture, still faces several challenges, such as low literacy, low income, high poverty and poor infrastructure. The mobile phones can facilitate to get out of these constraints by providing need-based and user-centric information and services to the farming community at an affordable cost. In this context, this paper explores the impact of mobile phone usage on livelihood of rural people through a primary survey in the State of Haryana. Rural services are at the heart of successful agricultural and rural development in developing countries. The usages of mobile phone in agricultural activity in India are growing very fast with deep penetration of mobile service at very affordable price in rural sector of country during the recent years. Hence a study was conducted in the Hisar district of Haryana State of India during the year 2018 to investigate the extent of use of mobile phone by the respondents for agricultural entrepreneurial activities with 60 numbers of randomly selected respondents from farming community. The respondents were interviewed with the help of pre-structured schedule. Regarding usage pattern of Mobile phones by the farmers for the area of information was concerned, the data presented in revealed that maximum number of farmers were using it for preparation of land and sowing, harvesting and processing technology and marketing of agricultural product, followed by, manure and fertilizers management, preparation of seedling, plant protection measures, schedule of water supply.

As far as usage pattern of Mobile phones by farmers for animal husbandry activities, it was found that maximum number of respondents used mobile phone for the purpose of purchase of feed for animal followed by availability of male animal for mating, sale and purchase of animal, sale of animal, veterinary doctor's availability, availability of feed for animal and routine check-up of animal during pregnancy. The results pertaining to the constraints faced by farmers while using mobile phones were revealed that 'high cost of best featured mobile phone' was found as major constraint followed by 'fear of hacking, illicit material and misuse', 'lack of information in local language', 'low durability of Hand Set', 'low battery backup' and 'frequent technological changes in Mobile Phone'.

With the huge number of potential users in rural areas and the low cost of usage lead to growth of large number of mobile based information delivery system for the farmers. This is the need of the hour for effective communication and timely transfer of technology for adoption among farmers for efficient and effective agricultural decision-making to change the economy of livestock, agriculture and rural masses in India.

Effect of pulsed electro-magnetic field on germination and seed vigour in Tomato

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ABSTRACT

Tomato is one of the important crops where seed longevity is a big problem. This experiment was planned with the objective to prolong seed longevity by electromagnetic field treatments. The fresh and aged seeds of tomato variety Arka kalyan were treated with 1, 10, 50 and 100 Hz of electromagnetic frequency at Madras Institute of Magnetobiology, Chennai. Seeds without treatment served as control. The treated as well as control seeds were sown in laboratory conditions. Results showed that the seed germination, seedling length, seedling dry weight and vigour indexes were higher in fresh seeds as compared to aged seeds. Electromagnetic treatment enhanced the seed germination, seedling length and seedling dry weight which is reflected in seedling vigour index I and II. The impact of different electromagnetic frequencies was statistically variable. The best results were obtained with 50 Hz followed by 100 Hz. The same set of experiment was also conducted in field conditions under standard practices recommended for cultivationof tomato in this region. It was noticed that germination and seedling vigour were, in general, higher in electromagnetic treated seeds as compared to control. Again 50 Hz frequency was found best which was closely followed by 100 Hz. The yield parameters were also recorded and it was found that 50 Hz electromagnetic frequency followed by 100 Hz were most effective compared to other treatments and control. It is suggested that electromagnetic frequency may be a suitable way to enhance seed longevity in small seeded high value crops. However, more research is needed in this area.

Keynote Lecture

Directions and perspectives of Triticale breeding in Ukraine

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ABSTRACT

Triticale, as a relatively young crop, is still looking for an optimal niche. It is known that triticale is competitive in comparison with wheat on poor, acidified soils with sufficient moisture. The most common use of triticale is using grain as a feed. Currently, there are 39 triticale varieties in the State Register of Plant Varieties Suitable for Distribution in Ukraine (the Register). 37 of them are for grain production, and 2 – for green feed. Small farmers, growing triticale, bake bread from it, mainly mixing triticale flour and wheat, but industrial use of baking triticale is still lacking.

At the Institute of Agriculture, triticale breeding is conducted in the following main areas: bread baking, feed grain, production of bioethanol and for the production of starch.

The material with high protein and gluten content, with reduced secalin content is selected to create varieties for bread baking. In 2019, the Register has entered 2 varieties of triticale for bread baking of the NSC “Institute of Agriculture of NAAS”, and 2 more are undergoing qualification.

For grain forage direction we create varieties with increased yields and adaptability, with the optimal biochemical composition, which is typical for triticale. One variety of our breeding for this use (Poliskyi 7) is listed in the Register, and 2 are undergoing qualification.

Another area of application of triticale is the production of ethanol. For this purpose we select breeding material with high starch content, small starch granules and high level of fermentability. Samples are analyzed by infrared spectroscopy, granulometric analysis, and alcohol yield analysis at the final stages. Triticale variety Petrol with optimal characteristics for this line of use has been created and entered in the Register, 2 more are undergoing qualification.

A specialized variety of triticale for starch production is a relatively new trend. The project is based on the idea of the possibility of creating new varieties of triticale with programmed size of starch granules. The size of the granules and their variability, according to our hypothesis, is genetically determined, however, like each quantitative trait, depends on the growing conditions. Cereal starch can have different purposes: for the manufacture of foodstuffs, the production of ethanol, for technical purposes. For technical purposes it is better to use starch with large uniform granules, for bioethanol and baby nutrition it is important to have small-granulated starch that reacts quickly and simultaneously to enzymes. The sample should have a high starch content, aligned starch granules, in some cases important low amylose content. For this purpose, we perform biochemical and granulometric analyzes, as well as PCR analysis for alleles of *Wx* genes of the wheat-triticale hybrids. Currently, heterozygous and for some *Wx* alleles homozygous samples of F4 triticale have been obtained.

Breeding in such directions allows to create specialized varieties and maximal utilize the potential of such valuable crop as triticale.

Keynote Lecture

Developments of Seed Sector in Turkey

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ABSTRACT

The seed is the most important technological input in increasing the yield and production in agricultural system. The ability of seed to be used in agriculture, which is extremely important in agricultural production and food supply, depends on the structural and legal arrangements and investments required for the development of the seed sector in the public sector and the private sector. In 1925, seed breeding stations were established in different ecological regions. In 1950, State Production Farms were commissioned with seed production. In 1961, the first private seed company was established. With the enactment of the Seed Law No. 308 in 1963, a public-oriented system of production and procurement was introduced and continued until 1980. Since 1983, seed policies have been adopted aiming to integrate with the world in the free market economic conditions, where the private sector also takes place. The Turkish seed sector has gained significant momentum and has begun to be restructured with the adoption of the *"Protection of breeder's rights of new plant varieties"* in 2004 and the adoption of *"Seed"* laws in 2006. Depending on these developments, seed production capacity, R & D activities, certified seed production and use in our country have increased over the years. Certified seed production was 110 thousand tons in 1996, 369 thousand tons in 2006 and 1059 thousand tons in 2018. The seed trades also dramatically have changed in time. The seed export rose from 47 million dollars in 2006 to 152 million dollars in 2018, and seed imports increased from USD 106 million in 2006 to USD 179 million in 2018. The ratio of export coverage imports increased from 44% in 2006 to 85% in 2018. With the law, important developments have been experienced in the private seed sector. The private sector seed production in self-fertilized plants such as wheat, barley and forage crops were 20, 22 and 52% in 2006 respectively. Now, in 2018, the share of private sector increased to 60% in wheat, 85% in barley and 79% in forage crops. Private sector has shown remarkable increase on cotton seed production, its share in cotton seed production increased from 2% in 1996 and in 87% in 2006 to 100% in 2018. Besides that, private sector has dominated as 100% percent of the seed production of soybean, corn, sunflower and potatoes since 1996 to 2018. However, certified seed use rates in self-pollinated crops are not adequate yet. The use of certified seed should be further expanded and new support methods for certified seed should be developed. R & D work should be supported especially via cooperation of public-university-private sector and the competitiveness of the sector should be increased both domestically and abroad.

Key words: Turkey, seed production, seed sector.

Keynote Lecture

Technologies' for Rural Industrialization

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ABSTRACT

The main objective is to develop innovated products, improved the design of exiting rural machines to improve its efficiency and the transfer of developed products / process for the benefit of rural masses in the surrounding villages. Several such innovated technologies have been developed and transferred not only in surrounding areas but in the several parts NER for improving the economy of rural people. Technologies such as Puff Rice (muri) making machines which has increased the productivity by 10-12 times compared to traditional method. Mechanized Dhenki for paddy processing increases the productivity by 5 times and reduces the drudgery and labour requirement to one person. Motorized Sabai grass roping making machine increased the rope making by 5 times compared to by hand. Pedal as well as motor driven potter wheels raised the production by 7 times and enhance the income of potter by Rs 20000 pm. Simple innovation in the exiting hand driven Amber Charkha to foot operated Charkha had improved the production of spindle by two times and thus reduced the drudgery of working women. There is great demand of all these technologies but unable to supply due to non-availability of trusted manufacturers in the local areas. Introduction of such technologies have helped the rural people to increase their daily income while reducing drudgery. These machines are at affordable price with negligible maintenance cost and can be repaired locally. Several training programs and workshops are organized to disseminate these tested technologies with the help of a large number of NGOs interested to leverage on S&T to improve the livelihood among the rural peoples. These technologies have helped villagers not only to improve their income but also to generate employment opportunities at village level to reduce migration of villagers to cities in search of job. Work on rural technologies has led to creation of Design Innovation Centre that aims to engage undergraduate and postgraduate students for bringing innovations in machine design to meet the need of rural India. We will discuss all these successful story of impact of Rural technologies on improving the livelihood of Rural people during my presentation.

Keynote Lecture

Science and Technology Innovations for Agripreneurship in Northern India

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ABSTRACT

Indian agriculture have been evolving since ages, from farmer subsistence agriculture to exploitive agriculture and to sustainable agriculture right from iron age to modern era. Each phase has been marked by innovations of technologies for adoptions by agripreneurs mostly in rural areas. Such technology covered field operations for cultivating land to sowing, intercultural operations, harvesting and processing of the harvested produce for marketing in rural hatts or grain mandis. With the advent of green revolution, quest of agripreneurs focused on enhancing production by enhancing per day productivity through maximization of input use efficiency. Also the crop rotations, cropping intensity changed with increasing possibilities for irrigation and fertigation. This phase necessitated technologies which are far precise and mostly energy driven, accordingly science and technological innovations help to create new technologies for all these operations covering production and processing phases. Large section of agricultural labour is women. To minimize their drudgery and empower them, simple technologies have been developed by our National Institute for Agricultural Engineering, Bhopal.

In India, the farmer groups represent small holders, medium holders and large holders. The technologies have also been evolved for each category of agripreneurs for production and processing operations. Natural resource conservation through all these years attracted the attention of agricultural scientists to convert agricultural based into potential resources for plant nutrition and bio-energy. During last two decades, agriculture is evolving as agribusiness and coming out of the shackles of traditional thinking, technologies, processing and marketing produce both nationally and globally. To support agricultural growth which constituted the backbone of Indian economy, the government has taken several initiatives like subsidies, agricultural credit facilities, transportation of farm produce to markets and processing centres so as to ensure establishment of food supply chain from field to forke for socio-economic upliftment of farmers by enhancing their income. The popular vision with Government of India is to double the income of agricultural farmers by providing appropriate agricultural technologies, inputs, access to marketing, access to credit and by fixing minimum support price (MSP) for each crop. Indian agripreneurs defied the Malthus theory. Due to policy planning and agricultural technologies the country has been able to record significant agricultural growth and usher into an era of self sufficiency.

Key words: Agripreneurs, socio-economic, technologies

Development of value added product from Ber (Zizyphus mauritiana Lamk) and Mahua (Madhuca longifolia) for prosperity and livelihood of tribal and farming community

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ABSTRACT

Nature has gifted a variety of fruits in abundance to the mankind which contains important phyto-constituents but due to seasonal and perishable nature most of the fruits remain underutilized and considerable amount of post-harvest losses occur. By means of value addition, innovative nutritionally rich products can be developed from them to bring prosperity in the life of tribal and farmer's community could provide livelihood opportunity also. Present study deals with development, quality control and dissemination of value added products based on dried fruits of Ber (*Zizyphus mauritiana* Lamk) and Mahua (Madhuca longifolia). Both are distributed in most of the states of India and are being sold in throw away price in season. In the present study, value added food products namely, ladoo, barfi, kheer, sweet puri and biscuits from Mahua and jam, candy, preserve, powder, Murabba, beverages, wine and pickle from Ber have been developed. Similarly, value added products like "**Sattu, digestive powder and fruit leather**" were also developed by blending both the fruits powder and adding spices. The products were analyzed for their nutritional value and phyto-chemical parameters such as protein, fat, carbohydrate, etc. The developed Sattu is a complete food containing carbohydrate, protein, minerals, vitamins and antioxidants etc., digesting powder is highly appetizing and fruit leather is soft, tasty and nutritious. These products have potential for developing a food enterprise which will create an opportunity for livelihood and uplift of the life of tribal and farmer community as well as women self help group at large. This will further help rural trade to develop.

Key words: Ber, Mahua, Value addition, antioxidant, livelihood

Identification of PEG induced water stress tolerance mechanism in pearl millet hybrids recommended for semi arid conditions

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ABSTRACT

Pearl millet is an important crop of semi arid regions of India. It is generally grown under rainfed conditions and therefore, identification of water stress tolerance mechanism in this hardy crop is important to develop tolerant varieties in future. Seven hybrids of pearl millet namely RHB-30, RHB-90, RHB-58, RHB-121, RHB-154, RHB-173, and RHB-177 were taken for the study. The seeds of these hybrids were grown in small plastic pots under controlled conditions. The water stress conditions were created by supplying these pots with PEG 6000 solution (5 and 10 %). The non stress plants were irrigated with distilled water.

Observations on growth, physiological attributes, osmolytes and antioxidants were measured at 10 and 20 days after sowing. Results showed that there was a significant reduction in shoot length, root length, seedling dry weight, seedling vigor index I and II, relative water content, chlorophyll content, membrane stability index under PEG induced water stress conditions at 10 and 20 DAS (days after sowing). The total soluble sugar, proline and MDA increased whereas CAT activity decreased under PEG induced water stress conditions. The detrimental effects of PEG 10% were more pronounced than PEG 5% at both the stages of observations. Significant variations were observed in these hybrids for many parameters taken in study. It is concluded that the drought tolerant mechanism exists in pearl millet hybrids which can be measured in term of seedling vigour indexes, membrane stability, osmolytes and antioxidants (catalase and superoxide dismutase). Overall, hybrid RHB-177 was found most tolerant followed by RHB-173.

Key words: Membrane stability, physiology, PEG 6000, drought tolerance, antioxidants

Major theme: Food processing for value addition

On-farm production of brown rice for nutritional security

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ABSTRRACT

Rice is one of the main staple food of the world, and people prefer to consume white rice, in spite of the fact that brown rice is rich in nutrition. One of the main reasons, for non-adoption of brown rice, is its higher cost. To produce cheaper brown rice, a tractor operated paddy thresher –infrared dryer–dehusker was designed and developed. The machine consists of co-axial split-rotor thresher for threshing of high moisture paddy, ceramic infrared heaters for drying the paddy grains and rubber roll dehusker for removing the husk and producing brown rice. Conical abrasive polisher was also installed as an optional feature for producing white rice. By using the tractor operated paddy thresher-cum-dryer-cum-dehusker, the reduction in the cost of basmati brown rice and polished rice has been found to be 31 and 29 percent, respectively, as compared to the rice mill. Similarly, the reduction in the cost of non-basmati brown rice and polished rice has been found to be 25 and 24 percent, respectively. The machinery owner can earn a profit of Rs.1,35,000 per annum, if the machine is operated for 450 hours in a year. The Break Even Point (B.E.P.), Pay back period and Return on Investment (ROI) were found to be 284 hours, 4.44 years and 9.64 %, respectively. The study of quality characteristics (fat, carbohydrates, protein, ash, crude fiber and micronutrients) of brown rice and single polished rice revealed that there was no difference in the quality produced by the developed machine and the rice mill. However, in case of polished rice, the percentage reduction in protein, fat, ash and crude fibre was found to be 13.4, 48.4, 41.6 and 73.8 as compared to brown rice. The vitamins like thiamine (B_1), riboflavin (B_2), niacin (B_3), pantothenic acid (B_5), pyridoxine (B_6) and biotin (B_7) in the polished rice were lesser by 91.6, 18.7, 47.9, 9.8, 68.7 and 55.6 %, respectively as compared to brown rice. Thus, it can also be concluded that consuming brown rice is more beneficial as most of the nutrients gets eliminated in polished rice.

Key words: brown rice, paddy thresher, infrared dryer, dehusker, polisher

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Processing and Value Addition of Pearl Millet: Journey of Super Grain to Smart Foods

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ABSTRACT

Pearl millet (*Pennisetum glaucum*) is an important food grain crop which is nutritionally comparable to rice and wheat. It can be grown with least maintenance cost, and is staple food crop for population below poverty line specially in rural areas. It can grow under hardy condition and is a crop of arid and semi arid regions. It possesses unique nutritional characteristics, is gluten-free and is a good source of carbohydrates, rich in dietary fibre, phytochemicals, minerals, protein, energy and some vitamins also. Carbohydrates are the major component of pearl millet grains varying from 71.82 to 81.02 per cent and its protein content is not only high but the protein is also of good quality except for lysine deficiency. Different varieties of pearl millet contain 12.25 to 13.09 per cent protein, 4.32 to 5.11 per cent fat, 4.31-5.30 per cent crude fibre, 1.53-2.00 per cent ash, 450 -990 mg/100g phosphorus, 10-80 mg/100g calcium, 7-18.0 mg/100g iron, 5.3-7.0 mg/100g zinc, 1.0-1.8 mg/100g copper and 1.8-2.3 mg/100g manganese. It possesses more iron and almost similar phosphorus and calcium contents compared to cereals. It is rightly termed as 'Nutri-cereal' because besides being nutritious it is a rich source of phytochemicals and antioxidants which offer several potential health benefits i.e. preventing obesity, diabetes, cancer, cardio vascular diseases, reducing tumor incidences, lowering blood pressure, risk of heart diseases, cholesterol and rate of fat absorption, delaying gastric empting and supplying gastro intestinal bulk. However the utilization of pearl millet in human system is limited due to the presence of appreciable amount of various antinutrients leading to poor digestibility of protein and carbohydrates and also presence of lipase enzyme which is basically responsible for development of off flavours and bitterness in flour within 5-8 day after milling. Another constraint that obstacles its diversified utilization is the typical grey colour of pearl millet flour which in turn gives undesirable grey colour to the developed products. Though pearl millet is having high nutritional quality yet it holds a secondary place in the dietary system which may be due to the grittiness or difficulty in its cooking, shorter shelf-life of flour and developed products and lack of ergonomic processing technologies at household level. Pearl millet can be subjected to suitable processing techniques like blanching, malting, soaking, germination, popping, roasting, decortication, etc. to improve the nutritional quality, *in vitro* starch and protein digestibility, *in vitro* iron and calcium bioavailability, availability of vitamin B and ascorbic acid and improve shelf-life of pearl millet and its products. Processed pearl millet can be used in combination with other grains and nutritious ingredients like seasame seeds, quinoa, chia seeds, flaxseeds, soy flour etc. for development of nutritious and phytochemical rich health promoting Smart foods of various categories i.e traditional products (*ladoo, matar, sev, dalia, khichri, bakli*), baked products (variants of cake, biscuits, muffins, sweet bun, bun, pizza base, bread, *kulcha* and *nan-khatai*, Gluten free biscuits and sugar free biscuits), extruded products like pasta, macroni, noodles, macroni, Ready to Eat products like nutritious crispies and puffs, convenience foods (*laddoo, halwa, kheer, upma, idli, dhokla* and *khichri* mixes), popped mixtures, instant noodles and *paushtik atta* containing 60:20:20 of pearl millet, bengal gram and barley. Pearl millet Smart foods were found to be nutritionally superior, organoleptically acceptable and possessed good shelf life compared to traditional products. Shelf stable flour and grits can also be developed from pearl millet, for commercialisation. The

utilization of pearl millet for product development will help in diversifying its use for achieving food and nutritional security. Biofortified pearl millet varieties have been developed for providing higher level of micronutrients specially iron and zinc and this approach is being identified as a cost effective and sustainable one to ameliorate the problem of malnutrition and micronutrient deficiencies. Bio-fortification could prove to be an essential strategy for controlling hidden hunger in developing countries like India. Keeping in view the importance of pearl millet to alleviate malnutrition Indian Government has declared 2018-19 as National Year of Millets and UN will declare "International Year of Millets" - 2023. There is tremendous scope to link value chains and pearl millet growing farmers to markets and enhanced consumer awareness about health benefits that would in turn would result in exponential increase in area under pearl millet cultivation. This is also a step towards ensuring water conservation, climate protection and sustainable agriculture to solve the problem of food and nutrition security and reducing incidences of malnutrition.

Key words:- Pearl millet, nutrition, value added products, food, climate, processing

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Mulethi cultivation and entrepreneurship development in arid and semi-arid regions

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ABSTRACT

Mulethi /Liquorice (Glycyrrhiza glabra L.) a perennial under shrub belongs to family Fabaceae, having maximum height upto 1.2 m in nature. The root crown gives out a number of long woody stems which bear compound pinnate leaves. Flowers pale-blue in colour and are borne at the age of 2/3 years and onwards. The pods are 2 to 2.5 cm long containing 2 to 5 seeds. It is native to the Middle East, southern Europe, and parts of Asia, such as India Sandy loam fertile soils having pH of 6 to 8.2 have been found suitable for better root development. The plant thrives in aried and semi-arid regions receiving 50-100 cm of rainfall annually and cultivation supported with irrigation; irrigation beneficial for higher root yield. It inhabits dry cold temperature to Mediterranean region. Organic manures like, FYM, Vermi-Compost, Green Manure etc. may be used as per requirement. To prevent diseases, bio-pesticides could be prepared (either single or mixture) from Neem (kernel, seeds & leaves), Chitrakmool, Dhatura, Cow's urine etc. The crop requires irrigation at an interval of 30-45 days in dry summer season. The plant sheds leaves in November and no irrigation is given throughout winter season. It is found that high yields are obtained from 2-½-3 year old crop manual digging is performed for harvesting roots. The digging of roots by using disc harrow has proved successful and is highly economical. The roots are harvested in November or December months to obtain roots of high glycyrrhizic acid. Harvest roots at 50-60 percent moisture, and dry in sun for 2-3 days and then in shade for next 10-12 days. The dry roots should possess less than 10% moisture before storage in polythene lined bags. The roots are cut into pieces of convenient size and shorted into grades, based on thickness. The yield of dry root at Hisar (Haryana) is recorded between 70 to 80 q/ha. At Anand 10 to 20 months crop has given an average yield of 20 to 25 q/ha. Return Rs. 3,50,000/- to 4,00,000/-per hectare

Liquorice flavour is found in a wide variety of candies/sweets. These are primarily purchased in Europe, and also popular in Australia and New Zealand. In Netherlands, liquorice confectionery (*drop*) is one of the most popular forms of sweets. It is sold in many forms. Mixing it with mint, menthol, aniseed, or laurel is quite popular. Strong, salty sweets are also popular in Nordic countries. Dried sticks of the liquorice root are also a traditional confectionery in their own right in the Netherlands, and sold simply as sticks of *zoethout* ('sweet wood') to chew on as a candy. Through chewing and suckling, the intensely sweet flavour is released. The sweetness is 30 to 50 times as strong as sucrose, without causing damage to teeth. Pontefract in Yorkshire, England, was the first place where liquorice mixed with sugar began to be used as a sweet in the same way it is today. Pontefract cakes were originally made there. In County Durham, Yorkshire and Lancashire, it is colloquially known as 'Spanish'. In Italy, Spain and France, liquorice is popular in its natural form. Throughout Italy, unsweetened liquorice is consumed in the form of small black pieces made only from 100% pure liquorice extract. In Calabria a popular liqueur is made from pure liquorice extract. Liquorice is used in Syria and Egypt, where it is sold as a drink, in shops as well as street vendors. Thus, mulethi cultivation provides a good opportunity to the farmers to become an entrepreneur.

Key words: Mulethi / liquorice, cultivation, entrepreneurship, root yield, glycyrrhizic acid

Formulation and Effectivity of Consortia of Potential Plant Growth Promoting Endophytic Bacteria from Chickpea

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ABSTRACT

Different bacterial genera coexist in nature; help each other in development and survival via gene transfer and metabolic cross-feeding. Syntrophic relationships between different organisms have been demonstrated in several microbial ecosystems. Recently, there has been lot of interest in illuminating the metabolic cooperation between different microbial genera for breakdown of organic compounds. The present study was done to devise the effective microbial consortia of potential multi plant growth promoting endophytic bacteria isolated from nodules and roots of Chickpea. In the present study, five isolates, CPJN13, CPSN8, CPHN4, CPHN2 and CPReR11 were used to develop consortia. Compatibility of all the isolates was checked. The growth profile study of the isolates revealed that they were fast growers. Consortia produced high amount of IAA, siderophore and solubilized inorganic phosphate as compared to monocultures. Upon inoculation of Chickpea plants, consortia resulted in significant increase in plant growth parameters viz. shoot and root length, fresh and dry weight of root and shoot in comparison to monocultures.

Forage breeding for improvement in economic traits for livestock

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ABSTRACT

The importance of livestock in agriculture is well recognized in the world, but their productivity is low due to poor nourishment, has been concern for forage researchers and livestock managers. A severe shortage of nutritious green fodder is main cause of low productivity as well as the escalated cost of production of livestock products. The fodder production is not sufficient to meet the requirements of ever-increasing livestock population and also the forages so produced, are low in nutritional quality. There is vast gap between the demand and supply of forage. Therefore, adequate efforts are made to develop high yielding varieties and transfer the quality forage production technology to farmers to enhance the productivity and production which ultimately boost up the milk and meat production. The livestock production can be effectively done by breeding superior forage varieties which have high green forage productivity along with good nutritional quality, palatability, digestibility and fee from anti-nutritional factors. Forages are classified into two major groups i.e. cultivated and rangeland forage crops with different breeding objectives. Breeding in forage crops primarily deals with basic methods like introduction, pure line selection, mass selection, recurrent selection, clonal selection, hybridization, pedigree method, bulk method etc. In addition to the above breeding methods, some special techniques are also being utilized in forage crops improvement. These are polyploidy, wide hybridization, double haploids, diallel selective mating and induced mutations. Moreover, the marker assisted breeding and plant genetic engineering techniques are able to design and produce crop varieties which could successfully withstand in biotic and abiotic stresses and could harness solar energy more efficiently alongwith proper utilization of available land, fertilizer and water resources.

Key words: Forage breeding, yield improvement, economic traits, livestock

Metabolomics of fatty acid content of rapeseed collection samples of various origin

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ABSTRACT

Rape long time has been used as a valuable oilseed crop that is in high demand in many industries. The area under rapeseed in Ukraine in 2019 has increased significantly by 40% compared to 2018, which indicates a steady demand from producers. It is an export-oriented product that enables the products to be sold to foreign markets. On the other hand, this crop is in the group at risk for cultivation in Ukraine, as it can freeze in some years.

The biochemical profile of rapeseed oil has essentially been the main object of improvement for breeders of this relatively young crop in evolutionary terms. With the advancement of chemical analysis methods, the selection of genotypes with a healthy fatty acid composition has emerged. Hence, in Canada, low erucic acid (less than 2%) and glycosinolate (less than 30 mc-mol / g) rapeseed varieties have been created, named CANOLA (Canadian Oil, Low Acid) and have become quality standards.

Researches of winter rape varieties by fatty acid composition were conducted to identify the genotypes that most meet production requirements and can be used in the breeding process. The study included 33 varieties and rapeseed hybrids of Ukrainian and other countries breeding. The analysis was performed on an Agilent 7820A GS System chromatograph with a flame-ionization detector (PID) equipped with a DB-FFAP 30m column, 0.32mm × 0.25μm. The component composition of the fatty acid methyl esters of the oil was determined by internal normalization using Agilent (USA) Open Lab CDS software.

The palmitic acid content of the samples averaged 4.60% and ranged from 3.80% to 5.50%. Stearic acid was detected in one third of the varieties in which it was at the level of 1.64% - in the rest it was contained in the amount of less than 0.5%, which is probably a genetic feature of these varieties. Oleic acid ranged from 51.70 to 64.70% among the varieties. The content of linoleic acid in most samples was at the level of 16.43 - 22.32% with an average content of 19.19%. The average content of linolenic acid in the samples was 8.88% and in different genotypes ranged from 6.33 to 12.61%. In all samples, the content of erucic acid was less than 1%, which corresponds to the "00" type of rapeseed.

Therefore, most varieties contain oleic acid in an amount of 52 to 65%. The study identified genotypes that have a high content of oleic acid – Synthetics (UKR), Fines (DEU) and Hayak, and low content of linolenic acid - a hybrid Synthetic (UKR) and variety Emerald (UKR). The results of the study of the fatty acid composition of rapeseed oil are an important element in the breeding of initial material, verification of quality indicators of breeding lines at the final links of the breeding process and in seed production.

Development of plant growth promoter based on globally and abundantly available waste Banana pseudo stem and hair

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ABSTRACT

Banana is cultivated in more than 120 countries, over an area of 4.8 million hectares, with an annual production of 99.99 million tons in the year 2011 whereas in India alone in about 1.0 million hectares generating approximately 51.18 million tons of pseudo stem as waste annually (Indian Horticulture Database, 2011). Similarly millions tones of small hair (approximately 2500-3000MT) are being generated annually in India as waste. Both the waste material is abundantly, economically and easily available at throw away price. These waste materials contain all types of nutrients, vitamins, nitrogen, phosphorus and trace elements useful for microbial growth. With a view to develop wealth from these waste namely banana pseudo stem and hair, the study was carried out to develop plant growth promoter utilizing these waste. Banana pseudo stem juice (BPSJ) was extracted from the leaf sheath and tender core with the help of a juicing machine by squeezing twice. Plant growth promoter was prepared in laboratory using waste hair and banana pseudo stem juice under acidic condition which contains dissolved solid (40%), amino nitrogen (4%), total nitrogen (7%), organic carbon (8%), total amino acids mixture (13%) and trace elements. The efficacy study of this product was carried out @ 5 L diluted to 200 L of water per acre on banana plantation. Drenching of this product was done four times at an interval of 1 month. During efficacy trials, parameters such as chlorophyll content, total biomass, root and shoot biomass and harvested fruit yield were studied. The efficacy reveals in the increase of chlorophyll content (50%), total biomass (35%), root and shoot (50%) and fruit yield (15%) as compare to control. Based on efficacy study it is concluded that plant growth promoter has shown encouraging fruit growth and can be promoted among banana cultivators to enhance the productivity of crop.

Key words: Banana, Hair, Hydrolysate, Bio efficacy, Bio-mass

IPR: Effects on growth, welfare and Indian acts

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ABSTRACT

Intellectual property is the product or creation of the mind. It is different from other properties in term that it is "intangible". Hence it needs some different way for its protection. INTELLECTUAL PROPERTY RIGHTS i.e. IPR is the body of law developed to protect the creative people who have disclosed their invention for the benefit of mankind. This protects their invention from being copied or imitated without their consent. The agriculture sector employs more than half of the workforce in the country. However, its contribution was 20% of the GDP (at current prices) in 2017-18. Over the past six decades, the agriculture sector's contribution has decreased from more than 50% of GDP in the 1950s to 15.4% in 2017-18 (at constant prices). India's production of food grains has been increasing every year, and India is among the top producers of several crops such as wheat, rice, pulses, sugarcane and cotton. All such efforts need heavy financial investment not only by govt. sector but by private sector as well. In India, the concept of commercialization of technology from R&D is relatively new in most sectors; especially in agriculture. The Government of India has recently announced the "National Intellectual Property Rights (IPR) policy (GOI, 2016a). The policy advocates promotion of a holistic and conducive ecosystem for catalysing the intellectual property for economic, socio-cultural development and protecting public interest. The policy document put forth seven objectives namely i) IPR awareness: outreach and promotion, ii) generation of IPRs, iii) legal and legislative framework, iv) administrative management, v) commercialization of IPR, vi) enforcement and adjudication and vii) human capital development. The WTO-TRIPS agreement of 1995 provided for minimum norms and standards in respect of protection of IPR in several categories: patents, copyrights, trademarks, plant varieties, geographical indications, industrial designs, layout designs of integrated circuits, and trade secrets. This agreement led India to put in place a set of appropriate and compliant mechanisms and instruments. Some of the legal instruments on IPR passed by the Indian Parliament, include The Patents Act, 1970 (39 of 1970), The Patents (Amendment) Act, 1999 (17 of 1999), The Patents (Amendment) Act 2002 (38 of 2002), The Patents (Amendment) Act 2005 (15 of 2005), The Geographical Indications of Goods (Registration & Protection) Act, 1999 and The Protection of Plant Varieties and Farmers Rights Act, 2001 (PPV FR Act) (53 of 2001) Apart from these, the Government of India also enacted an umbrella legislation called the Biological Diversity Act, 2002 (No.18 of 2003).

Key words: IPR, Plant variety protection, Patents Act, Agriculture

TO ASSESS THE COWPEA (*Vigna Unguiculata)* BASED FORTIFIED FOOD PRODUCTS

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ABSTRACT

The Cowpea (*Vigna Unguiculata)* is an annual herbaceous legume from the genus *Vigna.* Cowpeas are grown mostly for their edible beans, although the leaves, green peas and green pea pods can also be consumed, meaning the cowpea can be used as a food source before the dried peas are harvested. Cowpeas seeds provide a rich source of proteins and calories, as well as minerals and vitamins. The present investigation was carried out evaluate the sensory evaluation of the value-added product prepared using various combinations of cowpea and moth bean seed. The investigation was carried out in the Food Science and Nutrition Department, College of Home Science, CSAU&T, Kanpur. The products developed were traditional products *viz.; murukku,* baked products *viz.;* biscuits and extruded products *viz.;* pasta. The product, thus prepared were evaluated for organoleptic characteristics and nutritional composition. Blends were prepared by mixing cowpea flour, moth bean flour and rice flour in different ratios such as T1, T2 and T3. The products were analyzed for its nutritional value and organoleptic acceptability. Nutritional analysis of Cowpea fortified products revealed that it had high amount protein and iron and moderate amount of ash and moisture. Nutritional analysis of these products showed that Pasta T3 had significantly lower iron (2.09 mg/100g) and protein (7.63%), while Murukku T3 had higher iron (3.40 mg/100 g) and protein (13.44%) content. Protein in pasta ranged from (7.63-11.41%), Biscuits (9.42-9.74%) and Murukku (11.33-13.44%), while iron in Pasta (2.09-3.18 mg/100g), Biscuits (2.80-3.06 mg/100 g) and in Murukku (2.88-4.23 mg/100g). Organoleptic evaluation revealed that T3 incorporated sample of pasta, T3 incorporated sample of biscuit and T2 incorporated sample of murukku had better quality in terms of appearance, colour, texture and overall acceptability and were "liked moderately". T2 incorporated sample of pasta, T3 sample of murukku and T3 sample of biscuits had better flavor among the all other treatment. Results also depicted that T1 sample of pasta, T1 sample of biscuits and T2 sample of murukku were "liked slightly". Hence, the study suggests that cowpea and moth bean can be used for the development fortified food products because of its exotic flavor, high iron and protein content and high acceptability.

Key words: Iron, Fortified products, cowpea flour, Organoleptic evaluation.

Theme: GIS and Computer Applications for Natural Resource Management and Sustainable Agriculture

A GIS based municipal solid Waste Management Study of Rohtak City, India

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ABSTRACT

Municipal solid waste management (MSW) is a major problem faced by city planners all over the world. The problem is especially severe in most developing country cities where increased urbanization, poor planning and lack of adequate resources contribute to the poor state of municipal solid waste management system.The study examines the solid waste management system of Rohtak city and deals with recommending the number and spatial placement and distribution of secondary storage bins in the study area using GIS tools. The Rohtak city municipality spans 139.4 Km^2 with a population of 0.48 million. Total waste generation of the city is 189 MT/day. The city waste is not segregated at source, however the traditional kabariwalas and rag pickers perform segregation of waste at various levels. The city waste dumpsite covers 35.4 acres and has a waste management plant which involve manual and mechanical segregation, shredding, screening of inert and biodegradable matter, ballistic separation etc to finally separate the waste into recyclable, biodegradable and non-biodegradable waste. Waste collection is from house in cycle rickshaws and from secondary storage waste bins. The secondary storage is a very important component of any solid waste management system. Secondary storage of waste is the link between the waste generators and those responsible for its collection and transport. Adequate bin numbers and their proper spatial placement ensure higher waste collection efficiency. The capacity of bins should be proportional to the waste generation in the catchment area, easily accessible for the waste generators in terms of distance, and easy accessibility by the collection vehicles for loading of waste or loading of bin on to the waste collection vehicles. The bins are place haphazardly and service area covered is <50 % hence illegal open dumping is rampant. Many bins placements violate the recommendations of Central Pubic Health and Environmental Engineering Organization (CPHEEO). Solid waste generation was estimated taking population and socioeconomic conditions. The area serviced by the proposed number of bins and their placement is 73% of the residential area and ensures availability of community bin within a reasonable distance to all residents and ease loading and transport to waste dumpsite.

Theme: Agri-waste and Bioresource Management

Potential of Earthworms in Bioconversion of organic solid Waste

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ABSTRACT

Millions of tonnes of solid waste,generated from the modern society and solid waste management has shifted from conventional disposal strategies such as incineration; landfill etc to conversion of waste into value added products during recent years. In – situ management of earthworms for culture using an indigenous earthworms *Metaphire posthuma* for converting organic solid waste into valuable compost, and in waste management was thought and experiment was carried out for proper management of solid waste through the action of earthworm, *Metaphire posthuma* of mixtures containing various solid wastes and cow dung. Analysis of soil bed and waste from experimental container after 15 days interval for physical and biochemical activities revealed that worm is capable of recycling of solid waste into useful nutrients. During this process organic carbon, organic matter, pH and C:N ratio revealed negative trend, however total nitrogen, available phosphorous and exchangeable potassium content expressed positive trend of increment with vermicomposting up to 60 days. Vermi-composting & vermi-agroproduction technologies can together maintain the 'global human sustainability. Earthworm participation enhances natural biodegradation and decomposition of solid waste from 60 to 80% thus significantly reducing the composting time by several weeks. Consumption of organic waste earthworm culture is an ecologically safe and economically viable process to get beneficial products. While they devour our organic waste, thus decreasing our disposal problems, they are also and concurrently manufacturing two new products- earthworm biomass and vermicompost. Further, the suitability of earthworms as bio-indicator in soil toxicity is largely due to the fact that they ingest large quantity of the decomposed litter, manure, and other organic matter deposited on soil, helping to convert it into rich topsoil. Earthworm skin is a significant route of contaminant uptake and thus investigation of earthworm biomarkers in the ecological risk assessment (ERA) can be helpful. Exposed organisms have to expand their energy to metabolism, detoxification or sequestration, and excretion of the contaminants. Reproduction rate and various selected parameters in earthworm were shown to be a sensitive endpoint in toxicity tests of various metals and organic compounds under study in laboratory, using metals and pesticides and observations will be discussed during presentation at length.