14th IFSDAA International Conferenceon

Sustainable Agriculture for Food Security under Climate Change

September 27-29, 2023

Celebration for Excellence of AASF for 64 yearsand IFSDAA for 16 years

Book of Abstracts

Editors

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in

African-Asian Studies Promotion Association
Mahatma Gandhi House, Theodor Heuss Str-11
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in collaboration with

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Von-Ossietzky-Str. 99
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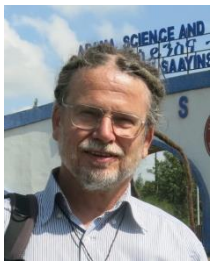

Prof. (Dr) Achim Ibenthal
HAWK University of Applied Sciences and Arts
Göttingen, Germany
Chair, 14th IFSDAA International Conference

Foreword

Dear fellow participants,

It is my honour to welcome youto the 14th*IFSDAA International Conference on Sustainable Agriculture for Food, Security under Climate Change* from September 27-29, 2023 at Mahatma Gandhi House, Göttingen. It is organized by the International Foundation for Sustainable Development in Africa and Asia (IFSDAA) and theAfro - Asian Studies Promotion Association (AASF) in collaboration with the HAWK University of Applied Sciences and Arts, Göttingen, Germany and the Society for Sustainable Agriculture and Resource Management (SSARM), India.

Since commencing the recording of temperatures in 1880, the average global temperature has increased by at least 1.1° Celsius. Throughout history climate variations have been causing the rise and fall of empires but since the beginning of industrialization the anthropogenic influence is statistically predominant, with an increasing rate of 0.15 to 0.20° Celsius per decade from 1975 up to today. It correlates to the atmospheric carbon dioxide levels. Never exceeding 300 ppm for millennia before 1911, according to NASA they reached 422 ppm as of July 2023.

The Russian astronomer Nicolai Kardashev catalogued civilizations according to their harnessing of power. A Type I civilization as per today's definition could make use of all the power radiated from its star to its planet, making the use of fossil energy obsolete. Humanity - according to physicists estimates - is supposed to be 1 or 2 centuries away from this technical capability. In not even half of this time the population of the African continent is expected to grow to 4 billion by the year of 2100.

While this gives rise to a plethora of challenges in technological advance, growth economy, natural resources management, social security and peaceful coexistence, this conference is targeted at the latest advances in sustainable agriculture and food security under the manifold implications of climate change. As we see from many historic examples, scientific advance often comes by two faces: its ostensible benefit to humanity and a hidden cost that may leave generations to come depleted. Hence I am encouraging this gathering of international experts to critically assess opportunities and threats of scientific developments in a holistic context.

It was Mahatma Gandhi who gave this house its name and inspires this assembly by the words "True agriculture is not about exploiting the land, but about nurturing and sustaining it." Today's inauguration of his statue on the conference premises pays tribute to an exceptional world leader who successfully applied the idea of sustainable farming to the politics of one of the largest nations of the world.

In his spiritI wish the conference a great success..

Date: September 27, 2023 **Prof. Achim Ibenthal**

Dr. K. W-Giorgis
President, AASF
Mahatma Gandhi House, Göttingen, Germany

About AASF and IFSDAA

Dear fellow participants,

I am happy welcome you to the august gathering of 14th IFSDAA International Conference on Sustainable Agriculture for Food Security under Climate Change being held at Mahatma Gandhi House, Gottingen, Germany. I take this opportunity to briefly introduce to you about African-Asian Studies Promotion Association (AASF) under whose umbrella the sub-organization International Foundation for Sustainable development in Africa and Asia (IFSDAA) is engaged since 2007, to organize a series of International conferences and webinars.

The AASF was founded in 1959 with some unique features, which enabled this association to embark on different activities at the local and global stage. In the beginning the main aim of the association was to overcome continental divide, among students from Africa, Asia and Europe in Göttingen followed by overcoming ideological divide and to promote understanding among its members. In 1969, with the help of the University of Göttingen and funds coming from the Volkswagen Foundation, our association (AASF) was able to build a student's hostel, previously called as Afro Asian hostel and since 1998 Mahatma Gandhi House, in which 130 students from Africa and Asia reside.

The African Asian studies promotion had a great opportunity to consolidate its foundation when it was able to convince the German Government of the importance of reintegration of academics from Africa and Asia upon their return to their respective home country after years of stay in Germany. Funded by the German Government we were able to conduct 258 seminars in total from 1974 until 2009 in the AASF, at which 4700 students from African and Asian countries participated, 2400 from Africa and 2300 from Asia.

We were also able to invite 125 returnees from various African and Asian countries to share their experiences with the participants. The results of the seminars during those years were publicized every 3 months in a magazine. On top of that, AASF had an annual publication from 2001 until 2009, the authors were African and Asian Academics. We also initiated the formation of returnee offices in some countries like Ghana, Iran and Ethiopia.

When the reintegration seminar program phased out, it was time for AASF to stand on its own. In 2007, we established the IFSDAA (International Forum for Sustainable Development in Africa and Asia).

The members of the IFSDAA named as the Global Scouts that is "enthusiasts to shape changes for a better future" are committed to Humanism, Rationality, and the development of global ethics and achieve peace and socio-economic progress without endangering the living conditions of all of us on our "blue planet".

Global Scouts need a generation-pact to stimulate the fruitful co-operation of those who are knowledgeable and wise and all those having a vision of a better future for mankind. The Global Scouts Movement for Food Security and Sustainable Development is understood as a forum, not only for discussion, but for tangible results through pragmatic planning and responsible actions.

Since then we have organized International Conference/Seminars in Germany, Hungary, Turkey, India and Poland in cooperation with other institutions. We are now aiming at international research and development projects. It technologies have enabled us to continue our mission with dedication, devotion, conviction and sincerity of the principles of sustainable development in developing countries through international webinars. Our motto is to serve the unserved people with knowledge, expertise and mobilization of resources from the developed world. In 2019 we launched a skills-development-project with the aim to establish a training centre in the area of agriculture. This may find a multiplication effect in the future in other countries of Africa and Asia to fill the knowledge gaps by knowledge flow for mutual learning and serve as global scouts for peace and social progress. Professor (Dr.) Brigitta Benzing memorial gardens in different countries is our new initiative.

I understand that during next three days you will have intensive deliberations on various themes of the conference which will enrich your knowledge and experience. I wish the 14th IFSDAA International Conference a great success.

Date: September 27, 2023 **Dr. K. W-Girogis**

INTRODUCTION

World food security depends on food production, access to food and its availability at affordable costs. Food production in turn is determined by the genetic potential of crop varieties, their agronomic management, growing environment and genotype x environmental interactions. Often, crop plants witness environmental stresses, which could be either short or long term, intermittent or persistent. These stressors like drought, heat, salinity and flooding may occur singly or in combination. Both genetic and management solutions are needed to cope up with such stresses to infuse tolerance/resilience for sustainable agriculture and food security.

Climate changes are witnessed globally which are marked by erratic changes in diurnal regimes, rainfall patterns, frequent droughts, floods and high and low temperatures. The average global temperature has risen by 0.9 ℃ since the nineteenth century, mainly due to greenhouse gas (GHG) emissions. This rise is expected to be 1.5 ℃ by 2050 or may be even more. Due to deforestation, GHG emission is increasing and as a result soil, water bodies and air are being polluted. The resultant land degradation, deforestation and desertification may pose serious threat on crop productivity hence food security. World population is ever increasing and is expected to be about 8 billion in 2025 and stabilizing at about 10 billion people by 2050. Currently around 1 billion people suffer from hunger and 2 billion children are malnourished due to deficiency of minerals and vitamins. Food production needs to be doubled by 2050 from less land area and shrinking water and other natural resources to meet the needs of growing world population.

Consequently, the ever increasing demand for food has led to pressure on land and water resources, intensive cropping and livestock generation, extensive use of agro chemicals, mechanization, secondary salinization and nutrient deficiency due to over mining and hence to grey patches. All these factors cumulatively have aggravated the increased release of GHG which needs to be tackled to mitigate adverse effects of climate change on agricultural production. There are two major strategies to combat climate change effect on agricultural production that includes a) mitigation through agronomic and environment management and b) adaptation through genetic resilience against climate change for stress tolerance and higher crop yield.

Prudent technologies including plant breeding, biotechnology, agri-technologies for crop production and plant protection can pay dividends. Resource optimization, conservation, increased input use efficiency and development of crop varieties with enhanced resilience and tolerance to biotic and abiotic stresses are key deterministic factors for higher crop production and productivity. Application of bio fertilizers, bio stimulants and organic farming to improve soil agro ecosystem would be worthwhile. Use of artificial intelligence, GIS, GPS technology will pay dividends towards climate smart precision agriculture.

In view of the above facts and the urgent need to develop climate change resilient agriculture, the International Foundation for Sustainable Development in Africa and Asia (IFSDAA) and Afro - Asian Studies Promotion Association (AASF) are jointly organizing this international conference in collaboration with the HAWK University of Applied Sciences and Arts, Goettingen, Germany and the Society for Sustainable Agriculture and Resource Management (SSARM), India. This conference shall also embark on innovation ignition through idea competition for young scientists to develop useful products and processes that can contribute positively to the welfare of human society.

Policy planners, researchers, scholars and NGOs in science & technology, agriculture, bio-technology, healthcare, economics, environment, skill development and entrepreneur-ship, social research streams are welcome to participate. The organizers will be happy to welcome the participants to the conference venue at AASF center at Mahatma Gandhi House, in Goettingen, Germany.

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Keynote

Optimizing water use under climate variability and climate change in particular in the Sahel and Mediterranean regions

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Abstract

Long periods without rainfall and water scarcity have been experienced and documented since 1500, in particular in the Bassin Parisien, and also in the Sahel. Due to population growth, climate change, and El Niño events, such difficult periods are likely to be exacerbated, due to higher evapo-transpiration rates, more erratic rainfall and sea level rise (in coastal zone and delta, associated with underground water salinization).

It is therefore important to better use water by different methods that we assess here below:

1. With banks, or hill reservoirs as in the past and still today in Mediterranean regions
2. With rain water harvesting and Zaïs, or reservoirs and complementary irrigation, combined, as in the Sahel or in Ethiopia. We show that yields and water use efficiency of maize are much lower in Africa than in the rest of the world, and how this could be improved.
3. By enhancing rain water infiltration in forest regions to better supply the underground reserves such as experienced in the Veneto region in Northern Italy
4. With "megabassines" as planned today in the centre of France, but largely criticized for leading to unfair water use by a limited number of farmers
5. By waste water treatment and optimizing water sharing between domestic use, and water use by agricultural (for livestock and irrigations, by optimizing use for annual and perennial crops, by earmarking water use, for instance for olive tree survival in Spain), and by industry.
6. By large and small scale water desalinization plants, with fossil or solar energy, as shown in another presentation at this Conference by Mélanie Ducros from Mascara

Keywords: **W**ater use, climate variability, climate change, salinization, evapo-transpiration

Climate change impact on agriculture

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Abstract

Climate change may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions (*i.e.,* more or fewer extreme weather events). In recent years, climate change has seemed to be a taboo subject in several countries around the world. The agricultural sector and many other sectors mainly dependent on climate did not give to fear. Current demographic data as well as United Nations studies in 2009 which predicted that the world population would be 9.1 billion in 2050 have accentuated the debates on climate change and precisely its impact on agriculture. However, the climate change has important consequences for agricultural production and trade in developing countries, as well as an increased risk of hunger. Data have shown that chronic hunger disasters have increased from 800 million in 1996 to over a billion in recent years. To overcome the impact of climate change on agriculture, many techniques have been developed around the world to provide more food. Among these techniques, the greenhouse farming, the development of specific fertilizers for certain plants and high mechanization help to further relieve agricultural policies in many countries.

***Keywords*:** Climate change, agricultural sector, demographic data, greenhouse farming fertilizers, agricultural policies

Keynote

Micro- and Nanoplastics, 2025/2050: The Invisible and Neglected Epidemic Pollution That Threatens Food Security and Safety, the Environment and Human Health

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Abstract

Plastics, microplastics and nanoplastics are potentially everywhere in the world.

Plastic pollution is inextricably linked to food safety, human health and climate change. They are an invisible and neglected threat to humans and the environment.

Plastics, microplastics and nanoplastics: microplastics (MPs), (1 µm to 5 mm); nanoplastics (NPs); (1 nm to 1 µm); exist in various forms and are based on fossil fuels (14% of global oil production); over 367 million tons were produced worldwide in 2020; total global production of plastics has reached 8.3 billion tons to date; 6.3 billion tons is plastic waste; by 2050, an additional 34 billion tons are projected; 12 billion tons of which will be plastic waste; 1 kg of plastic generates 4.2 kg of CO_2 over its lifetime (Ashworth, J., 7/2022); most plastic pollution comes from packaging materials, construction materials, household waste, medical waste, sports equipment, fishing gear, auto parts, electronic equipment, and agribusiness components (Ekner-Grzyb *et al*., 10/2022); are degraded by thermal, photo- and oxidative processes, by hydrolysis and by microorganisms,; are persistent and are estimated to take 250-1000 years to fully degrade; 6% are recycled; 19% are incinerated, and further contribute to global CO_2 emissions; most plastics end up in landfills or in the environment - in oceans, rivers, at both Earth's poles, on mountaintops, in snow, in soils, gardens, and farmland.

Important topics from literature review, 3/2023:

Plants/Crops: A hidden and unknown biohazard (9/2020); impact (12/2022); response to (10/2022; 11/2022); crop yield impairment (5/2022; 11/2022); impact on seed production and quality (11/2022); reduce seed germination, seed vigour, and relative root elongation (10/2022); decline in crop gene expression (11/2022); threats to plants (10/2022); toxicity to plants (10/2022); risks to biota (2/2023); imminent concerns (10/2022).

Agriculture: Changing agricultural crops (5/2019); emerging environmental contaminants in agriculture (3/2022); "*White Revolution*" becomes "*White Pollution*"; emerging environmental

pollutant in agriculture (3/2022); ravaging our agro-system (2/2023); matter of concerns in farmlands (7/2022); risk for organic farming products (3/2022); found their way into our fruits and veggies (1/2023); environmental concerns (2022); environmental challenge in agriculture (2/2023); emerging threat to food security (5/2022); undermine food security (10/2022); emerging food contaminants challenge for food safety (1/2022); a call for action, FAO (2021; 2022).

Animals/Humans: Too early to say they pose a food safety risk (2016); daily intake by humans unknown (6/2019); evidence (9/2022); effects (3/2022; 9/2022; 10/2022); interactions (2/2022); entry into the human body (2/2023); found in human blood (3/2022; 5/2022); bio-effects (1/2021; 11/2021; 6/2022); absorption (10/2022); contamination (4/2020; 10/2021); accumulation (6/2020; 11/2021; 5/2022); increased nutritional risk (6/2020), "damages" human organs (9/2022), impairs vital functions (9/2022), causes metabolic disorders (2/2023); migrates to placenta and fetal tissues in rats (6/2022); jeopardizes male fertility (3/2021); 0.016 mg/kg/d of MPs leading to abnormal male semen quality (4/2022); may significantly impair male fertility (5/2022). - Can affect your dogs and cats (6/2022).

Call to Action: Climate change and plastic pollution are directly linked; rethinking the future of plastics; reduce to the minimum necessary; need for new plastics strategies; need for waste management plans; replacement with bio-based and bio-degradable plastics.

Appeal: Bring epidemic plastic, micro and nano plastic pollution under control as soon as possible!

The focus of the presentation is on impacts of MPs and NPs on plants/crops, agriculture, and food security/safety.

***Keywords*:** Micro- and Nanoplastics, Epidemic Pollution, Environment and Human Health

Keynote: Online

Utilizing biodiversity in underutilized native grains can contribute to agricultural sustainability, food and nutritional security for improved human health

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Abstract

Agricultural production system that stabilizes local environments and contributes to human health and wellbeing is a major challenge of our time. Modern agriculture during the latter part of twentieth century made significant progress towards achieving food security. The increased production was mainly due to reliance on extensive use of inputs and mechanization of agriculture practices. This resulted in dense and monoculture cropping systems. Another consequence of intensive agriculture has been the homogenization of foods around the world, resulting in the loss of ethnic and regional flavors of food. Homogenization and industrialization of food production and delivery has some unanticipated consequences such as increase in the incidence of chronic diseases severely impacting human health and wellbeing. Diet diversification is one of the strategies to overcome the challenges of chronic diseases while providing environmental and economic stability to diverse regions around the globe. An estimated 300,000 edible plant species are available to humans, however, only 7,000 are cultivated for food, with 30 species contributing to ninety percent of world dietary energy. Thousands of species and there ecotypes are defined as underutilized or neglected crops. Several of the underutilized crops are part of traditional diets providing energy and nutrients to achieve food and nutritional security. Genotype, environmental conditions, agricultural practices and growth stages affect the grain composition, which in turn affects food quality and end-use by consumers. Several examples of region-specific grains that have been used by ethnically diverse populations in their native food products will be discussed. The utilization of grains native to the regions can be very beneficial to the local economy, contribute to diet diversity with human health benefits and above all can be very beneficial to the environmental sustainability.

Keywords: Biodiversity, underutilized native grains, agricultural sustainability, food and nutritional security, human health.

Development and Quality Evaluation of Ready to Eat Products from Elephant Foot Yam Tuber (*Amorphophallus Spp.*)

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Abstract

Osmotic dehydration process for development of ready to eat elephant foot yam product was optimized using response surface methodology and quality of raw and optimized samples was compared. Optimal conditions were 64°Brix osmotic solution concentration, 59°C temperature and 180min processing time. The moisture content of osmo-dried samples was reduced to 18±0.75 (wet basis) by hot air drying. Under optimum conditions, the values of water loss, solute gain, water activity, L-value, and overall acceptability of optimized sample were 51.7 g/100 g, 16.32 g/100 g, 0.69, 15.12 and 8.82, respectively. Comparative study revealed that protein content was significantly altered and no significant changes were observed in fat, ash, and, phenolic contents of optimized or raw samples. Also, when compared to raw samples, the increase in crude fiber content, decrease in hardness (N), water activity, and, oxalate content was observed in optimized sample. Furthermore, optimized osmo-dried samples showed fewer micro-structural changes as compared to samples dried without osmotic dehydration. We conclude that optimized EFY product is highly palatable and nutritionally comparable to raw EFY samples thus making it possible to use this medicinal and nutritional crop in regular diet.

Keywords: Optimization, osmotic dehydration, total phenol, antioxidant activity, oxalate

Food Security and Climate Change

Maryam Azish
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Abstract

Climate change could hamper progress towards a world without hunger. Today, a clear and consistent global pattern is observable in the different impacts of climate change on crop productivity that could have impacts on food security. Accordingly, the stability of the whole food system may be in jeopardy under climate change as of its unpredictable variations. Indeed, agricultural production is highly vulnerable even to a 2°C estimated increase in global mean temperatures in 2100, with major implications for poverty and for food security. The climate change impacts seem to be clear in areas currently affected by hunger and under nutrition, which will intensify food insecurity in these parts of the world. Therefore, adapting food systems both to increase food security and to prevent future negative impacts from climate change will necessitate attention to more than just agricultural production. The evidence sustains the need for considerate investment in adaptation and mitigation actions toward efficient management of climate change influences on food security.

Keywords: Food security, climate change, hunger, agriculture

Keynote

Sustainable agriculture system to sustain food production

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Abstract

The current global population has reached over eight billion adding two billion people just in the last 24 years and it is expected to be 10 billion by 2050. The food production needs to be doubled by 2050 to avoid starvation. There is no arable land to expand for more food production and this must be achieved by increasing land efficiency. With the increase in awareness and improvement in economic status, people are demanding not only more quantity of food, but also for better quality and nutritious food, such as meat which requires more water than crop production. Besides increase in food production, there is also need of clean drinking water, pollution free environment, soil security, biodiversity, minimal impact on climate change, forest and so on. This may be achieved by a sustainable agriculture farming system. This involves farming in sustainable ways for meeting society's present food, water and textile needs, without compromising the ability for current or future generations to meet their needs. This requires good understanding of ecosystem services, protection and enhancement of the environment and natural resources. It relies on natural, renewable and on-farm inputs to replenish the soil nutrients removed by the crop. This is a shift from the large-scale production involving large equipment, pesticides, irrigation and monoculture to producing a diverse range of foods, fibers, and fuels adapted to local conditions and regional markets. It is based on 'no harm' principle to the environment. However, a big question arises whether this can be achieved to fulfill the needs of growing population. Several measures, such as crop diversification, mixed farming and integrating crops, livestock and forestry, rainwater harvesting, minimum or no tillage, mulching, precision agriculture, vertical farming have been suggested as the means of sustainable agriculture production. There is also a thought that 'no harm agriculture' is not enough to improve the soil, water resources, forestry and environment because the soil is already degraded and cannot provide nutritional food. Soil salinity, acidity and alkalinity are increasing due to overuse of farm chemicals, fertilizers and ground water. A third of the world's arable topsoil has been lost in just the past 40 years due to erosion and pollution. There is ever increasing threats from new diseases and pests, herbicide resistant weeds and depletion of ground water and contamination of rivers. The biodiversity is has decreased threatening the ecosystem. The earth's temperature has risen by an average of 0.08°C per decade since 1880, but since 1981 this rate has increased by 0.18°C per decade threatening to limit the temperature rise below 1.5°C above

the pre-industrial level. Regenerative agriculture may provide solution to the above problems. To improve food security, we need to diversify food sector and emphasis should be given to highly nutritious traditional and indigenous crops that are well adapted to specific regions in the world. It is time to foster research on these neglected and orphan crops. The number of malnourished people is increasing reaching over 700 million in 2022. The grain legumes are one of those crops that may provide an avenue for sustainable crop production. They can fix atmospheric N and decrease the use of mineral N fertilizers thereby preserving soil and fossil fuel use, break disease cycle in cropping system, emit less greenhouse gases – 5-7 times less per unit area compared with other crops, increase organic matter and enrich soil properties for nutrient absorption and water retention, increase the food nutrition in human as well as animal because of protein and fibre rich grain, leave more water in the soil after harvest because of shallower root system than cereals. Legumes have 2-3 times higher water use efficiency than non-legumes.

Keywords: Sustainable agriculture, food production, soil security, biodiversity, legumes, protein and fibre rich grain

Keynote

Plant Genetic Resources for Research and Future Breeding

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Abstract

Plant genetic resources for food and agriculture (PGRFA) play a major role for global food security. The most significant and widespread mean of conserving PGRFA is *ex situ* conservation. World-wide 7.4 million accessions are stored in about 1,750 *ex situ* gene banks. Plant *ex situ* gene bank collections comprises seed gene banks, field gene banks as well as *in vitro* and cryo collections. Species whose seed can be dried, without damage, down to low moisture contents can be conserved in specially designed cold stores. Such "orthodox" seeds can be expected to maintain a high level of vigour and viability for decades. Field gene banks, *in vitro* and cryo storage are used primarily for species which are either vegetative propagated or which have non-orthodox seeds that cannot be dried and stored for long periods. With a total inventory of 150,000 accessions from 3, 212 plant species and 776 genera, the 'Federal *ex situ* gene bank of Germany' in Gatersleben holds one of the most comprehensive collections worldwide. It comprises wild and primitive forms, landraces as well as old and more recent cultivars of mainly cereals but also other crops. Starting in the 1920's material was accumulated systematically. Seed storage is managed in large cold chambers at -18°C. Seeds are kept in glass jars, covered with bags containing silica gel (active collection) and in aluminum bags under vacuum (base collection). The maintenance of the collection requires regeneration. Each year between 8 and 10 Thousand accessions are grown either in the field or in glasshouses. The collection has been widely characterized and evaluated. In the cereals, mainly wheat and barley, a number of bi-parental mapping populations and association mapping panels have been established to allow for the genetic analysis of various traits. The current focus covers resistance/tolerance to a number of biotic and abiotic stresses, in particular drought and cold.

Keywords: Plant Genetic Resources, gene banks, *in vitro*, cryo storage, biotic and abiotic stresses

Keynote

New Developments in Plant Breeding with Genetical Modification and Genome Editions

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Abstract

Presently, more than 8 billion people are living on our earth. In 2050 (or later), about 10 billions of people will be expected globally. In consequence, the further growing of human population reduces the available land area and further limiting resources for people. Plant breeding is one of the most important starting point for the human and animals food/feed chains. Plant breeding as a scientific discipline started about 100 years ago at various European Research Stations and later in the United States and other regions globally. At the end of the last century plant breeders introduced genetical modification as a new scientific method of plant breeding. Some years later (about 2015) Genome Editing (genetic sissor) followed as a new technique. This technique is able to influence the location and the type of the genome. E.g. CRISPR Cas9 (*Clustered Regularly Inter spaced Short Palindromic Repeats and CRISPR associated protein*) and further techniques have the potential as new molecular biological techniques to improve plants. Most important improvements of plants are for example:

- More resistance against diseases
- Higher yields and/or improved composition of plants and/or plant products
- Better adaptation to weather and climate changes (such as heat, coldness, dryness *etc*.)
- Lower application of chemicals for plant protection
- Positive effects on sustainability of food and feed systems.

Presently, more than 500 new treatments with genome edited plants were tested. A further increase of applications may be expected in the near future.

Some more information can be found in the text book by Flachowsky and Jany (2023) „Contributions of Gene Technology for Global Food Security“(in German), Behr`s Verlag, Hamburg, Germany, 212 p.

Keywords: Global developments, growth of human population, plant breeding, genetically modified plants, genome editing, composition, food, feed, and nutrition

Keynote

The Role of Local Genotypes in Wheat Breeding Programs Compatible with Climate Change

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Abstract

Global climate change is one of the biggest threats to world food supply security. The changing climate triggered by global warming has negatively affected the adaptation conditions of plants grown in different ecologies, making the sustainable agricultural system fragile. Urgent measures need to be taken to make sustainable again the agricultural production, which is very sensitive to changes in climate factors. Wheat, which has the largest cultivation area in the world, is one of the strategic products in ensuring global food supply security. Global climate change and related environmental stress factors cause significant yield losses in wheat, which is mostly grown in rain-fed areas, as in other products. Crop breeding programs are of great importance for re-optimizing plant production systems in the context of a changing global climate. In this context, the greatest need in wheat breeding programs compatible with changing climatic conditions is to find genetic resources and genotypic diversity suitable for the goals of the program. Local varieties offer an important gene source potential in terms of resistance to marginal climatic conditions. Since the 1960s, local varieties have been widely used in breeding programs in Turkey. Developed by taking advantage of the stress-tolerant properties of local varieties and being the varieties most resistant to arid conditions, Gerek 79 (BW), Dağdaş-94 (BW) and Kızıltan-91 (DW) are widely grown in facultative regions during the winter months. In the pedigrees of these cultivars, there are local genotypes such as Yayla-305, Ankara-093/44 and Uveyik, respectively.

***Keywords*:** Breeding, climate change, landraces, stress, wheat

Epigenetic Determinants of Plant Lifespan: A Systematic Review of DNA Methylation Across Plant and Tree Species"

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Abstract

Epigenetic modifications, particularly DNA methylation, constitute pivotal regulatory mechanisms governing plant development and adaptability. While extensive studies have elucidated the role of DNA methylation in gene regulation and stress responses, a comprehensive understanding of its implications for plant and tree longevity is still nascent. This systematic review amalgamates the existing literature concerning the impact of DNA methylation on the lifespan of diverse plant and tree species, including *Arabidopsis thaliana*, *Oryza sativa*, *Populus trichocarpa*, and *Musa spp*. We critically assess the influence of DNA methylation on integral biological processes such as regulation of gene expression, epigenetic inheritance, and responses to biotic and abiotic stressors, onset of senescence, disease resistance, and telomere stability. We extrapolate the potential consequences of these interactions on plant and tree longevity. Our appraisal reveals that DNA methylation significantly influences plant phenotypic manifestations and environmental resilience, which may subsequently affect longevity. However, substantial gaps persist in directly linking DNA methylation with plant lifespan. Accordingly, we identify key areas for future research, emphasizing the need for direct, comprehensive explorations into the effect of DNA methylation on plant longevity. This review serves as a roadmap for future investigations, potentially facilitating the development of strategies to enhance plant resilience and longevity in the face of climatic shifts.

***Keywords*:** Epigenetics, DNA methylation, longevity of plant and tree species, lifespan

Keynote

Selection of wheat varieties tolerant to combined heat and drought stress using morpho-physiological and molecular markers: An overview

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Abstract

Wheat is the second most important cereal crops in the world to meet the caloric needs of global population as main element of food security. Both heat and drought stress individually as well as their combined effects adversely influence wheat yield and therefore wheat production globally. Heat, drought and their combined stress effects are witnessed globally in major wheat producing regions. In general, 5.5 and 12 % yield losses due to heat and drought stress, respectively have been estimated globally. As per the IPCC projections, global temperatures may upsurge by 0.6–2.5^{0}C by the year 2050 and 1.4–5.8^{0}C by year 2100 along with increased severity of drought condition that may lead to new challenges for wheat production. Average temperature in India has risen by 0.7^{0}C from 1901 to 2018, while the world's average warming rate is recorded as 1.1^{0}C in a decade. The effect of heat stress includes increased reproductive rate with decreased plants' photosynthetic rate. Wheat requires 15^{0}C as daytime optimal temperature in its reproductive phase and wheat yield is reduced by 3-4% on 1^{0}C rise in temperature. Only a small number of studies have documented the impact of combined heat and drought stress on wheat productivity and biological processes. Both heat and drought stress negatively affect the growth by impairing the photosynthetic system, reduce stomatal conductance, disrupt water relations leading to shortened grain filling duration, reduced grain size, weight and ultimately yield. The effects of these stresses may be mutually exclusive or antagonistic, however, their interactive effects are more apparent. Although, heat and drought stress effects on grain yield are known, however, tolerance mechanism underline combined stress effects are less understood mainly due to complex interaction effects on biological processes. Breeding for combined heat and drought stress tolerance is the best option in wheat, though it is cumbersome as the tolerance traits may be polygenic traits. The strategy to breed for high temperature or drought tolerant genotypes includes identification of potential parents using conventional, physiological, molecular markers, various quantitative trait loci, association mapping, gene expression profiling studies, cDNA, transcript profiling, proteomics and their applications to develop stress tolerance variety, which can withstand individual or combined stressors. Integration of plant breeding and molecular approaches may pay dividend to attain sustainable wheat yield in stress environment.

Keywords: Heat, drought, interaction, wheat, stress tolerance, breeding strategy

Evaluation and morphological characterization of new germplasm lines of giloi (*Tinospora cordifolia*)

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Abstract

The medicinal advantages of giloi (*Tinospora cordifolia*) have been identified in Indian medicinal system as an important constituent in several of medicinal formulations. The plant parts i.e. leaves, stem, bark, and fruits have been used for the treatment of different uses such as to cure acute fever, improve immunity power and increase platelets. It was found quite effective against COVID. Genetic improvement in any crop, breeding programme mainly relay on the proper utilization of available variability. Sixteen promising new collections were evaluated and characterized at MAP Section, Department of Genetics and Plant Breeding, CCSHAU, Hisar during 2022-23 cropping seasons and highly significant effects have been mentioned by analysis of variance. The range of vine length varied from 6.35 to 32.00m, vine girth from 0.81to 1.81cm, number of branches from 6.00 to 57.33, number of leaves 222.67 to 4375, leaf length from 9.90to 22.12, leaf width from 8.31to 19.07 and fresh vine yield from 0.25to 3.44 kg/plant. The longest vine length was recorded in HTC-12 (32.00m) followed by HTC-11 (31.82m), HTC-10 (28.33m) HTC-14 (28.14m), and HTC-8 (25.04m). Maximum vine girth was observed in HTC-15 (1.77cm) followed by HTC-11 (1.81cm), HTC-15 (1.80cm). HTC-5 (1.70cm), HTC-14 (1.70cm) and HTC-12 (1.62cm) and Maximum number of branches were found in HTC-14 (57.33) followed by HTC-12 (50.67), HTC-11 (48.00), HTC-15 (42.11) and HTC-2 (40.67).Maximum number of leaves were found in HTC-2 (4375) followed by HTC-12 (4158), HTC-15 (3735), HTC-14 (3624) and HTC-11 (3228). Maximum leaf length was noticed in HTC-11 (22.12cm) followed by HTC-12 (20.41cm), HTC-14 (19.10cm), HTC-9 (17.03cm) and HTC-8 (16.48). Likewise, maximum leaf width was noticed in HTC-11 (19.07cm) followed by HTC-12 (17.19cm), HTC-14 (16.90cm), HTC-16 (14.94cm) and HTC-8 (14.91). The highest fresh vine yield was reported in HTC-12(3.44 kg/plant) followed by HTC-11 (3.35 kg/plant), HTC-14 (2.74 kg/plant), HTC-8 (1.88 kg/plant) and HTC-15 (1.55 kg/plant).

***Keywords*:** Giloi, *Tinospora cordifolia* , vine yield, morphological characters

Development of onion hybrids and fixation of heterotic effects in double haploids

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Abstract

Onion (*Allium cepa*) is one of the most important vegetable spices worldwide and used in vegetarian and non-vegetarian dishes and shanks. Onion is rich in fibre, Vitamin E, mineral matter, bioactive compounds and antioxidant properties. Bulb yield in onion is contributed by various component traits like bulb size and bulb shape. It is cross pollinated crop due to protandry and therefore some degree of heterozygosity in base population has to be maintained for hybrid vigour. The hybrid vigour is greatly influenced by diversity among parents and their combining ability, both GCA and SCA. It is generally believe that greater the heterozygosity among parents heterosis in F_1 is high. Likewise high SCA and heterosis in F_1 are usually associated as function of dominance gene effect. However, this may not always be true. To validate this hypothesis the experiment was conducted at CCSHAU, Hisar from 2015-18. Eight lines and three testers were grown in randomized block design and bulb yield and its component traits were studied in 24 crosses. Correlation between sum total diversity for 10 characters, general combing ability in lines and testers and their 24 crosses for SCA and heterobeltiosis were computed. It was observed that high heterosis is function of compatibility among parents entering crosses than the genetic diversity which determine the heterosis. In some cases average diversity among parents and good general combing ability of parents resulted in high heterosis which may be due to complimentary gene action in F_1 crosses. In some other cases high diversity among parents and average combing ability of parents and high SCA in crosses led to high heterosis mainly due to dominance gene effects. In that context, hybrids MS 35 x Hisar- 3, MS 37 x Hisar-3, MS 22 x Agrifound Dark Red, MS 20 x Pusa Red followed by MS 37 x Pusa Red, MS 34 x Pusa Red and MS 20 x Hisar 3 showed high heterosis as well as high SCA which emanated from average to high general combing ability parents and varying levels of diversity. Therefore it is concluded that high heterosis is the function of genetic complementation among parents and their crosses than the genetic diversity *per se* among parents and their crosses. This could be postulated to balanced metabolism in crosses involving low diversity among parents and dominance of superior parents in crosses with wider parental diversity.

Keyword: *Allium cepa,* GCA, SCA, heterobeltiosis, heterosis, diversity

Advancing Wheat yield and micronutrients stability through the application of AMMI, BLUPs and WAASB

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Abstract

The importance of wheat as a staple food crop is well known, as it is among the top three cereals globally due to its high yield potential, nutritional value, and adaptability. However, changing climatic conditions have raised concerns about the yield stability while maintaining the quality of wheat. Also, the high performance and stability are pre-requisite among wheat genotypes for varietal development ensuring food & nutritional security, and climate resilience. To achieve this, a comprehensive evaluation of genotype-by-environment interactions (GEI) is necessary in genotype selection decisions. A multi-environment testing approach was undertaken to test a total of 100 bread wheat genotypes under four different environments comprising two sowing times (Normal and Late) in Hisar Haryana for two consecutive main crop seasons of (2019-20) and (2020-21).For quality and micronutrient analysis automatic kjeldahl protein analyser and ICP-MS were used. Weighted Average Absolute Scores of BLUPs (WAASB) stability index, employing use of Best Linear Unbiased Prediction (BLUPs) in additive main effects and multiplicative interaction (AMMI) was employed for this purpose. Results showed that timely sown genotypes in Hisar produced the highest yield while for quality traits late sown environments were stable. Meanwhile, combined analysis of variance exhibited highly significant genotype-by-environment interaction and indicated the involvement of crossover interaction. The first two principal components (PCs) accounted for more than 60% of the total variance in the environment-centered yield results. Few genotypes were found to be most stable based on WASSB score.

***Keywords*:** Wheat, GEI, stability, WAASB, BLUPs, AMMI, diversity

Genomic Exploration and Molecular Profiling of *Melia dubia*

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Abstract

Melia dubia, Malabar neem, is a fast-growing, deciduous tree native to the Indian subcontinent. Biotechnological research on *Melia dubia* has expanded our understanding of its genetic makeup and provided insights into its diverse applications. This study provides a technical overview of the DNA-related aspects of *Melia dubia* biotechnology. The present study was carried out to explore the genetic diversity and population structure of *Melia dubia*, for conservation and breeding programs. The various molecular markers were tested to assess the genetic variability i.e., microsatellites and single nucleotide polymorphisms (SNPs).Molecular analysis at the DNA level has revealed the genetic diversity of *Melia dubia* populations, with an average of 12.5 alleles per microsatellite locus, indicating significant genetic variability. Additionally, analysis of genetic differentiation has revealed moderate to high levels of genetic diversity among different geographic regions, suggesting the existence of distinct population clusters. Advancements in DNA sequencing technologies have enabled the analysis of tree genomes. Moreover, DNA sequencing of micro-propagated plants has shown a high degree of genetic similarity, with over 99% sequence identity, confirming the clonal nature of the propagated individuals. Whole genome sequencing efforts have provided valuable information about the tree's gene content, organization, and functional elements. Successful transformation efficiencies of up to 20%, enabling the development of transgenic lines with enhanced characteristics, such as improved insect resistance. Transcriptomic studies have focused on understanding gene expression patterns in *Melia dubia*. RNA sequencing (RNA-seq) techniques have been used to analyze the transcriptome of different tissues and developmental stages, providing insights into the molecular processes underlying growth, development, and responses to environmental stimuli. These Genome-wide association studies (GWAS) studies have identified genes associated with key traits, such as wood formation, stress tolerance, and secondary metabolite production.Functional genomics approaches, such as gene expression manipulation and gene knockout strategies, have been employed to elucidate gene functions and explore their roles in specific pathways or traits. Techniques like CRISPR-Cas9 gene editing have the potential to precisely modify the *Melia dubia* genome, facilitating the development of improved varieties with desired characteristics. Overall, the application of DNA-related techniques in *Melia dubia* biotechnology has provided a deeper understanding of its genetic diversity, functional genomics, and applications in breeding and conservation efforts. The integration of molecular markers, genomics, transcriptomics, and gene editing technologies has opened new avenues for harnessing the potential of this tree in various fields, including forestry, medicine, and agriculture.

Keywords: *Melia dubia,* DNA sequencing, transcriptome, GWAS, genomics

Agronomic-management-targeted breeding for sustainable wheat cropping systems: prioritizing traits for pre-breeding

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Abstract

Wheat (Triticum spp.) is a staple food crop with annual production of ~777 Mt and ~50% of its growing area in low-income countries (LIC). Wheat farm yields (FY) must increase by 2-3% annually to fulfill the expected global demand in 2050. The challenge is exacerbated by estimates that every one-degree temperature increase results in 6% yield reduction under optimal conditions, and larger reductions under water-limited conditions. Although wheat grain yield potential (YP) is growing (currently 16.8 Mg/ha), this may not directly benefit resource-poor farmers if it mainly results in increased yield gap (YG) between YP and FY. Environmental stresses (abiotic and biotic) and sub-optimal agronomic management practices cause YG, and sustainable agronomic practices must therefore contribute to shrinking YG while minimizing agricultural footprints on the environment. Synergies occur between crop genotypes (G), environments (E) and management (M), and while GxE has been well studied and is addressed by modern breeding programs, GxM interaction effects have received much less attention. I will first present few sample of GxExM in wheat from recent studies. In addition I will summarize the global survey of wheat experts (n=214, spanning a wide set of disciplines and working in 49 countries) we have conducted. The survey prioritized, drivers and technologies for future wheat agronomy and 18 potential breeding target traits. Trait ranking is based on relevance, potential impact, feasibility (heritability and selection methods for breeders) and innovativeness to contribute to meeting future varietal needs in the nine main Mega-Environments (MEs) of LICs. Breeders and agronomists (the main two representative disciplines), generally agreed that N-uptake, N-utilization, early vigor, root architecture and stem water-soluble carbohydrates are potentially impactful traits to prioritize. Breeding wheat genotypes for maximizing production at an agricultural system level was also prioritized as both innovative and likely impactful. Optimizing the root microbiome and decreasing nighttime respiration, however, despite being very innovative were considered of low potential impact due to low feasibility of breeding for their improvement. As trait-based approach tend to over simplify the actual complexity of FY we will also illustrate the importance of trait x trait interactions with few examples. Modern breeding proved the success of wide adaptation approach in wheat breeding repeatedly in last decades. I would argue that investments in pre-breeding for novel, sustainability-enhancing traits is warranted, relying on global genetic resources collections and using high throughput phenotyping approaches. Such effort might be led eventually by a multi-disciplinary breeders-agronomist teams that will screen G x M early in the breeding pipeline with a clear effort to minimize complexity of pre-breeding operation as possible.

Keywords: wheat, sustainable, cropping system, prebreeding

Genotypic and environmental (GxE) variation in grain and biomass yields of advanced bread wheat lines

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Abstract

Wheatin Mediterranean agro-systemsis grown as dual-purpose cropfor production of both grain and forage (50% < of wheat acreage in Israel) with continuous effort to enhance biomass productivity and forage quality. Wehypothesized that plant investment in stem traits (increasingsolidness) in genetic background of hollow-stemmed wheat varieties might contribute to forage productivity. Pairs of homozygous wheat lines (n=7)contrasting in their stem characteristics (solid vs hollow) were assessed in the field along two growing seasons [2021-22 and 2022-23, randomized complete block design (n=4) at ARO central farm,Zafaria]to evaluate the relationship between stem characteristics, and various agronomic and forage quality traits:crop phenology, stem morphology [stem wall width (WW) and diameter (SD)], forage yield, and quality traits [e.g., neutral detergent fiber digestibility (NDF)] were characterized.Substantial genetic variation was recorded among wheat genotypes, particularly in terms of crop phenology, WW and SD, grain yield (GY), and biomass productivity.Gx E was notably significant for days to heading [P(F)<.0001], days to maturity [P(F)<.0001], grain yield [P(F)<.0103], but not for biomass productivity[P(F)=.1103]. Interestingly the two experimental seasons differed in rainfall, 761 mm in 2021-22 and only 414 mm in2022-23. However, grand mean biomass (1282 and 1311g m-2 respectively) and GY(574 and 551g m-2 respectively) did not differ significantly between the two seasons. The current breeding materialsmight provide the genetic base for dual-purpose breeding programs due to their suitability for hay and silage production and consistent high biomass yield.

Keywords: RILs, G x E, phenology, biomass, solidness

Bread wheat stem characteristics and their association with water soluble carbohydrates, grain size, and yield

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Abstract

Under terminal stress when wheat canopy scenes, assimilate supply for grain filling depends on stem water-soluble carbohydrates (SWSC) (Blum 1998). Following previous hints on congruence between stem traits, WSC content, and grain yield (GY) under drought (Saint Pierre et al., 2010), here we investigate in bread wheat stem structural biomass investment and its association with grain filling under drought and heat stress.A set of 25 spring wheat genotypes was evaluated under four environments: drought (140 mm), heat (late sowing, in early March instead of November, 500mm), optimum conditions (Obregon, Mexico), and Mediterranean-rain-fed conditions (Israel). The phenotypic evaluation concentrated on stem morphology traits such as internode diameter (ID), stem solidness (%), peduncle length (PL) and SWSC (via NIR analysis), biomass (BM), thousand-grain weight (TGW), and GY. First, acrossall environments except heat, SWSC accumulation reached the peak 25 days after heading (DAH) with the highest values recorded under drought and Mediterranean environments. Under heat and drought increased investment in stem ID resulted in a higher SWSC accumulation. Drought and heat stress negatively affected crop productivity [from mean GY of 626 (irrigated) to 311, 287, and 213 g/m2 for Mediterranean, drought, and heat respectively] but also structural stem biomass as expressed in lower ID and PL. However, PL, SWSC content, and remobilization were positively correlatedwith grain filling (TGW and GY) under drought and heat stress. Interestingly, across environments, there was no trade-off between increase crop investment in both ID and PL and GY [r=0.42, (P(r)<.0001) and r=0.44, (P(r)<.0001) respectively]. In summary, these results indicate that selecting breadgenotypes with high ID, PL, SWSC content, and remobilization, is a useful strategy to offset TGW reduction under water deficit and high-temperature conditions during grain filling.

Keywords: Bread wheat, stem characteristics, water-soluble carbohydrates, grain size, yield

Leaf trait responses to drought and management practices in pasture species

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Abstract

Grasslands, including rangelands and pastures, cover ~40% of Earth's terrestrial surface area and more than 70% of the total agricultural area, serve as a key repository of biodiversity, and contribute significantly to global food security by providing a feedbase for livestock production. However, climate models project increasing mean atmospheric temperatures and an increase in associated intense and frequent droughts, expected to affect forage production due to their negative effects on plant physiological functions. It is crucial to understand plant responses to these predicted environmental conditions to sustain forage production in future extreme climatic conditions. Plant traits and trait syndromes describe various aspects of plant species' fitness, survival, and reproductive success, including species' responses to environmental variability and disturbance. For instance, plasticity in leaf traits helps plants adapt to severe drought by minimizing water loss via transpiration (lower SLA or higher LDMC) and optimizing photosynthetic carbon assimilation associated with increasing leaf tissue nitrogen concentrations.

Here, we investigate leaf trait responses to predicted extreme rainfall scenarios (wet and dry conditions) in seven pasture species (grasses and legumes) using a well-replicated field experiment at the Hawkesbury campus. We hypothesize that during future extreme drought conditions, pasture species reduce transpirational water loss by shifting their leaf traits towards avoidance (by reducing leaf area per unit leaf mass) and acquisition (higher carbon assimilation per unit leaf area associated with higher tissue nitrogen concentrations). We will test our hypothesis that drought-induced trait responses in plants will be higher during plant non-growing season relative to growing seasons. Our initial data during summer partly support our predictions that there was a reduction in specific leaf area and an increase in leaf dry matter content across species, which is critical for reducing transpirational water loss during extreme soil water reductions. We foresee understanding whether leaf trait responses to predicted drier climates vary across multiple seasons for different species in the coming months.

***Keywords*:** Climate models, leaf traits and trait syndromes, plant species' fitness, leaf dry matter content, tissue nitrogen concentrations, altered rainfall.

Keynote

Influence of Elevated Atmospheric CO_2 Concentrations on Global Vegetation Development and on Yields as well as on Product Quality of Agricultural Plants

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Abstract

The relationships between increased CO2 supply on the one hand and vegetation development, plant growth, yield and quality of different crop species on the other hand were examined on the basis of observations and experiments (meta studies) available worldwide. Special attention was paid to FACE experiments (Free-air CO2 enrichment method), but satellite surveys and chamber fumigation systems were also included.

The results are:

1. The increase of the atmospheric CO2 concentration by about 100 ppm during the last 100 years led to increased plant growth worldwide. The global vegetation cover increased by 11–14%, which is attributed by 70% to the increased atmospheric CO2 content. Since 1982 the global tree population has increased by 7.1%.
2. The increase of the CO2 content in the air (typically from 350 to 550 ppm) resulted in the yield increases of selected crops from 10 to more than 30%.
3. In Germany, from 1990 to 2015 the yields of wheat, barley, maize and potatoes increased by more than 30% which was partly due to the increased CO2 content in the air. Across all crop species, the annual net CO2 fixation in Germany is 96.3 million tons.
4. The CO2-related yield increases are based on an increase in photosynthesis performance. They were subject to large fluctuations depending on plant species, water supply and nutrient supply (especially N and P).
5. In the case of poor nutrient availability in the soil and insufficient fertilization, the CO2 induced yield increase can be associated with a reduction in plant nutrient and protein concentrations (mainly due to "dilution effects") and thus with a reduction in quality. N (to a lesser extent also P) obviously plays a key role in this process. This can be compensated by adapted fertilization management and by breeding of drought-tolerant "low input" varieties with high nutrient utilization efficiency.
6. The CO2 induced yield increases should be used to secure the world's food supply and improve the income situation in poorer countries.

***Keywords*:** CO_2 concentrations, global vegetation, yields, product quality, agricultural plants

Keynote

Drought Identification at Diyala Region, Iraq Using Selected Drought Indices

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Abstract

Iraq is an arid country and severely affected by the climatic changes. As a result, prolonged periods of drought were occurred in Iraq and Diyala region is the most affect one. Beside the economical effect, the drought also affected ecological processes at Diyala region; therefore and based on available hydrologic data, the drought as a natural climatic phenomena should be studied. In this study, two indicators were used to categorize the drought for various time periods at Diyala region and these indicators were the Standard Precipitation Index (SPI) and the Standardized Stream flow Index (SDI). The values of SPI were determined using rainfall data at 8 selected stations while value of SDI was calculated using the stream flow data at station locate on Diyala river. Both indicators produced the same results which show that the region was severely affected by drought in 1999, 2002, from 2007 to 2012 and in 2017.

***Keywords*:** Drought, SPI, SDI, GIS, Diyala region

Keynote

Potential of Agroforestry in Sustaining Wood Based Industries and Securing Farmer's Livelihood in India

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Abstract

Agroforestry imparts ameliorating and mitigating effects of harsh and erratic climatic conditions and poor soils, raising soil fertility build-up and enhance symbiotic activities that help crop growth, sustainable production of food and feed, fuel, timber, fibre, tools, draught power, medicines, and several other products of day-today utilization on farms. In addition, it permits higher security and sustainability during droughts and famines that are not infrequent in dry regions. Despite the many promises and benefits that agroforestry holds under appropriate conditions, there are also limitations arising from biophysical, socio-economic and socio-political conditions such as land ownership and control, usage rights and the like. In India, natural forest contributes just 6.4% of timber demand (3.17 million m3) and about 44.34 million m3 is harvested from Trees outside Forests (TOF). Demand for furniture has been raising 12 to 15% annually. Similarly, demand of paper has been raising 8% annually. Annual demand of wood-based panel products is 8 million cum against production of 3.4 million m3. India is meeting its wood demand through import of timber and allied products which is roughly 18.01 million m3. Thus, there is significant gap between demand and supply of wood in the country and import is bound to increase in coming years if concrete action is not taken to address the issue. As a report, 50% of timber demand, 65% fuelwood demand, 70-80% demand for plywood, 60% of raw material for paper pulp and 9-11% of fodder demand is met from AF. AF practices have demonstrated that production could be safely enhanced to more than 30 m3/ha/year by selecting suitable tree-crop combination. Thus, agroforestry is a viable option for meeting the raw material demand of wood-based industries and to sustain them in long run. AF needs to be given boost and more markets need to be established in close proximity of AF regions. Forestry policies need to be farmer friendly to enable them to produce hassle free wood by doing away with archaic taxation systems and wood transit rules. The key lesson from AF is that tree cover needs to be understood and managed as part of landscape, harmonising agriculture and forestry policies.

Keywords: Agroforestry, wood based industries, livelihood, fuel wood, policy

Sueada nudiflora based Silvipastoral Systems on Highly Degraded Arid Salty Soil in Rajasthan, India

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Abstract

Due to large gap in demand and supply, there is increasing pressure on the available land resources and continuous shrinkage of grazing lands due to over exploitation is necessitating search for additional land resources in arid regions of Rajasthan of India. In Rajasthan, large area (0.38 mha) suffers from salinity and alkalinity problems and utilization of these lands for silvipastoral system could provide an alternative to improve pastoralism in the arid region. Against this background, a research trial was established in Gangani village (Latitude 26.50 Longitude 73.21) of Jodhpur district of arid Rajasthan. The soil pH of to area ranged from 8.2 to 8.8 and EC from 4.2 to 16 d Sm^{-1}. Salt encrustations were observed at many places with EC values as high as 48 d Sm^{-1}. After initial field trials with *Atriplex lentiformis*, an excretory halophyte, for six years the EC was reduced to 1.3 to 14 dsm^{-1}. Thereafter another field trial with *Suaeda nudiflora* in combination to agriculture crop was laid on improved salty soil in 2013. The results of four years of study are presented here. *S. nudiflora,* (Chenopodiaceae), is an evergreen shrub with numerous slender, erect branches, endemic to coastal regions around the world. In India the foliage has been used traditionally as a vegetable and forage/fodder especially for camels. It is found on mud flats along sea coast or in saline soils in Bharoach, Cambay, north Gujarat, Saurashtra and Kutchh region of Gujarat state of India. *S. nudiflora* seedlings, planted in August 2013 at a spacing of 4mx5m on double ridge mounds were established well. The mean percent survival was (64.5%) in October 2017. Shrubs attained appreciable growth and the mean height was 2.01 m, crown diameter 1.73mand collar diameter 7.52cm. In the year 2016, Bajra variety HHB-67 (IMP) was sown in the inter row spaces of *S. nudiflora* and it showed good survival and growth but succumbed to water logging and hence it was again sown in July 2017. About 80% germination was observed after 10 days having 4-5 cm height length. There was rain in the first week of August. The crop height ranged from 60cm to 30cm from lesser to more saline soil after one month of crop sowing. The crop attained height~ 90cm with flowering initiation from the normal soil to 60cm in saline soil. However, after that there were no rains and no flowering and fruit setting took place. The crop dried in the first week of September and harvested. The calculated green straw mass ranged from 561.2g/sqm to 256.7 g /sqm. This indicated that the salty area was improved substantially and agriculture crop could be grown on the site. Therefore, the improved silvipastoral systems could provide an alternative to improve pastoralism in the arid region, giving a greater buffer capacity and allowing for sustainable production even in critical years.

Keywords: Sueada nudiflora, silvipastoral systems, degraded arid salty soil, pastoralism

Combinatorial approach for improving nutritional properties of compost prepared from rice straw

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Abstract

Rice straw burning in fields is a serious issue in India during winter season, that is responsible for increased environmental pollution and health hazards. Recovering of nutrients from crop residues in agriculture by composting helps in restoring the soil health. The aim of the present study was to prepare compost of paddy straw by combinatorial effects of *Trichoderma harzianum, Eisenia fetida* and cow dung. The composting was studied for the NPK nutrients recovery in five different treatment groups for 90 days. At the end of composting C : N ratio of paddy straw decreased from 81.5 to 33.1 in treatment group having combination of *T. harzianum, E. fetida* and cow dung. While the increase in N, P and K was from 0.57 to 0.87%, 0.21 to 0.47 and 2.36 to 2.66% respectively. Results suggested that combinatorial composting by *T. harzianum, E. fetida* and cow dung is quite effective in decomposition of paddy straw resulting in compost having recommended levels of high-quality products in a short time. This finding is useful to farmers in recycling and management of huge amount of paddy straw residue and also helps in its sustainable management. The produced compost not only replaces the synthetic fertilizers but also solves the problem of environmental pollution which arises due to open burning of paddy straw waste in India.

Keywords: Paddy straw, composting, *Eisenia fetida, Trichoderma harzianum.*

Impact of Climate Change on Soil Health

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Abstract

Soil health has been described as integral to the concept of sustainable agriculture. Climate change has a potential impact on the soil health through physical, chemical and biological properties of soil. The change in the statistical properties of the climate system when considered over long periods of time, regardless of the cause is called as climate change. It is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climatic variability observed over comparable time periods. Soil health is a composite set of measurable physical, chemical and biological attributes related to functional soil processes, which can be used to evaluate soil health status as affected by management practices and climate change. Defining soil health in relation to climate change should consider the impact of range of predicted global change drives such as rising atmospheric carbon dioxide levels, elevated temperature, altered precipitation and atmospheric nitrogen deposition on physical, chemical and biological functions of soil. Soil health is the continued capacity of a soil to function as a vital system, within ecosystem and land use boundaries, to sustain biological productivity, maintain the quality of air and water, environment, and promote plant, animal and human health. Indian agricultural soils are low in organic carbon content and for achieving higher agricultural production; we have to depend on the fertilizers. . Farmers often achieve far less than 50% of the climatic and genetic yield potential for a given sowing date, cultivar choice and site. The potential yield or maximum yield is limited by climate and crop cultivar only, all other factors being optimal. Therefore, climate plays a major role while attaining potential yield or maximum yield. Climate change has an impact on the soil, a vital element in agricultural ecosystem. Higher air temperatures cause higher soil temperatures, which generally increases solutions chemical reaction rate and diffusion controlled reactions.

***Keywords*:** Climate change, soil health, soil properties, crop yield

Effect of enhanced doses of Phosphorous, Potassium and Magnesium on grain yield of Durum wheat *(Triticum durum*)

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Abstract

Durum wheat (*Triticum durum*) is the 10th most important and commonly cultivated cereal worldwide with a yearly production average of 40 million tonnes (MT). Typically, durum wheat production represents 5% of total wheat production with a planting area of 16 M hectares globally. Durum is produced primarily for making pasta semolina, vermicelli, noodles etc. The production of pasta requires grain with high protein content, gluten strength, and high yellow pigment content (resulting largely from lutein), which provides the characteristic yellowness that is expected from the pasta. Only a few regions in the world are capable of producing durum that meets the high standards for end-use suitability. It is influenced by genotype of variety and agronomic management which include plant nutrition, irrigation and plant protection. In order to increase yield and ensure healthy produce by supplying the right balance of nutrients to the soil, recommended dose of fertilizer for wheat crop vary from region to region. Therefore, in order to optimise fertilizer doses, an experiment was conducted to determine effect of varying levels of phosphatic and potassic fertilizers over recommended dose of fertilizers(RDF) on morpho-physiological attributes of grain yield, to assess effect of varying levels of magnesium on grain growth, quality and yield of grains, to work out N,P,K use efficiency , to work out the economics of higher doses of Mg, P and K fertilizers along with treatments Nitrogen- 150kg/ha through Urea(50% basal dose + urea 25% at after 25 days of sowing + 25% pre flowering, Phosphorus- 60kg/ha through SSP (100% basal dose)+25%more, Potassium- 60kg/ha through Muriate of Potash (100% as basal dose)+25%more, ZnSo4-25kg/ha, Mg-1.6g(60days).The comparative evaluation of various treatments revealed that 25% enhanced doses of Phosphatic, Potassic, Magnesium fertilizers gave good response and maximum yield as compared to RDF. Therefore, recommended dose of fertilizer should be revised in view of our experimental results for North-eastern districts of Haryana where the soils are saline-alkaline and underground water is rich in carbonates and bicarbonates.

***Keywords*:** Wheat, *Triticum durum*, phosphatic, potassic, magnesium *etc*.

Effect of enhanced doses of Phosphorous, Potassium and Zinc on grain yield and its components in Wheat (*Triticum aestivum L.*)

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Abstract

Wheat (*Triticum aestivum* L.), a member of *Poaceae* family, is India's prime most staple food and the second most important food crop in the country after rice both in area and production. About 14% of the total cropped area in the country is under wheat cultivation. Mainly three species of wheat are grown, with *Triticum aestivum* or bread wheat being the most commonly grown one. Wheat is a major source of natural and bio-fortified nutrient supplementation, including dietary fiber, protein and minerals. It is influenced by genotype of variety and agronomic management which include plant nutrition, irrigation and plant protection. In order to increase yield and ensure healthy produce by supplying the right balance of nutrients to the soil, recommended dose of fertilizer for wheat crop vary from region to region. Therefore, in order to optimise fertilizer doses, an experiment was conducted to determine the effect of enhanced doses of Phosphatic, Potassic and Zinc fertilizers over recommended doses of fertilizers (RDF) on morpho-physiological attributes of grain yield, assess the effect of varying levels of zinc on grain growth, quality and yield of grains, efficiency of N, P, K, economics of higher doses of Zn,P, and K fertilizers along with treatments: Nitrogen- 150kg/ha through Urea (50% basal dose + urea 25% at after 25 days of sowing + 25% pre flowering), Phosphorus- 60kg/ha through SSP(100% basal dose)+25%more, Potassium- 60kg/ha through Muriate of Potash (100% as basal dose)+25% more and ZnSo4- 25kg/ha. The comparative evaluation of various treatments revealed that 25% enhanced doses of Phosphatic, Potassic, Zinc fertilizers gave good response and maximum yield as compared to RDF. Therefore, recommended dose of fertilizer should be revised in view of our experimental results for North-eastern districts of Haryana where the soils are saline-alkaline and underground water is rich in carbonates and bicarbonates.

***Keywords*:** Wheat, *Triticum aestivum*, phosphatic, potassic, zinc *etc*.

Plant – Microbiome Interaction, Era of Future Plants

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Abstract

In arid and semi-arid regions, vast reservoirs of plant species and associated organisms thrive. These plants possess an inherent ability to endure harsh conditions, drawing researchers worldwide due to their unique survival strategies and the microflora they attract in the rhizosphere. Interactions between plants and microorganisms occur in both the phyllosphere and rhizosphere. Notably, certain plants like tomatoes release a range of compounds such as PSMs (Plant Secondary Metabolites), SGAs (Sesquiterpene Glycosides), SLs (Strigolactones), and VOCs (Volatile Organic Compounds) into the rhizosphere, thereby influencing the soil microbiome. Remarkably positive outcomes have been observed with plants like tomatoes, potatoes, and eggplants. The impact of root exudates has been particularly significant in the case of tomatoes. For instance, PSMs like malic acid, exuded by tomato plants, have been found to influence the growth of Pseudomonas fluorescens. However, variations are apparent when considering other crops such as Pearl millet, which covers approximately 30 million hectares of arid and semi-arid regions across Asia and Africa. The microbiome of Pearl Millets exhibited capabilities such as Hormone Stimulation, Plant Growth-Promoting Rhizobacteria (PGPR) activity, and cycling of carbon (C), nitrogen (N), and sulfur (S). This translated to significant growth enhancements: 37% increase in tillers, 44.3% increase in head growth, and 32% increase in test weight. These findings underscore the strong interaction and mutual communication between EPS (Exopolysaccharide)-producing bacteria and the plant, exemplifying the potential benefits of such associations. Particularly in India, Rhizosphere soil samples from rainfed pearl millet (40–60 days after sowing) were collected from eight locations covering five states (Delhi, Punjab, Rajasthan, Telangana, Haryana). A total of 75 putative Azospirillium isolates from 9 soil samples were purified after series of experiments. AIM19 and AIM 3 showed maximum Nitrogenase activity and shoot length. However, selection of stress adapted/ tolerant strains is the key to the successful deployment of microbial resources in the stressed ecosystems. The core objective of these endeavors has been to cultivate new millet varieties capable of attracting beneficial microbiomes through root exudates, thus promoting the adoption of sustainable agricultural practices. The exploration of plant-microbiome interactions has emerged as a promising avenue for the future of sustainable agriculture, with the potential to revolutionize farming practices and enhance crop productivity.

Keywords: Root exudates, microbiome, plant specialized metabolites. EPS- Exo polysaccharide bacteria, root adhering soil

Effect of biostimulants on grain yield and its components in semi dwarf high yielding variety of wheat (Triticum aestivum)

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Abstract

Biostimulants are formulated organic products which boost the plant growth, tolerance to biotic and abiotic stresses, nutrient use efficiency, water use efficiency hence crop yield. Biostimulants are used in small quantities. With the advent of development of semi dwarf high yielding varieties of wheat. Intensive use of agrochemicals including fertilizers, pesticides, and irrigation are being used which has led to problems of soil health due to secondary salinization and poor soil health. In that context organic adjuvents should be used to improve organic carbon content in the soil leading to higher input use efficiency. An experiment was conducted at agriculture research farm, MMDU, Mullana to investigate the effect of bio stimulants, namely Bhumi Shakti (Humic acid), Crop Grow (Seaweed Extract), Charcoal (organic carbon) and Hairamine (Protein hydrolysate of human hair). A semi dwarf high yielding wheat variety (HD-3086) was grown in randomized block design with 3 replications. Treatments included T1= control (only recommended dose of fertilizer), T2= SEAWEED EXTRACT, T3= HUMIC ACID, T4= SEAWEED EXTRACT + HUMIC ACID, T5 = ORGANIC CARBON, T6 = HAIRAMINE, T7= SEAWEED EXTRACT + ORGANIC CARBON, T8 = HUMIC ACID + ORGANIC CARBON, T9 = HAIRAMINE + SEAWEED EXTRACT. Bio stimulants were sprayed on wheat plant at 2 stages that is at tillering 30 days after sowing and second at pre flowering stem elongation stage. The foliar spray of bio stimulants resulted in increase in tillering, ear length biomass, chlorophyl stability and stem strength. The biostimulants applications also induced lodging resistance. On an average 10-15% increase in grain yield was realized. which is both economically and environmentally sustainable. Observations reveled that combined application of bio stimulants were more effective than individual application and various bio stimulants are complimentary. The maximum stem strength was revealed in combined application of seaweed extract and Hairamine whereas stem girth was maximum in organic carbon.It is concluded that biostimulants should be used for sustainable wheat production to enhance crop growth, reduce fertilizer doses, and enhance farmer´s income

Keywords: Wheat, humic acid, seaweed extract, organic carbon, hairamine

Keynote

Rhizosphere Microbiome a Potential Source for the Discovery of the Novel Antifungal Compound

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Abstract

Invasive fungal infections have increased considerably in the past few decades, posing an increasing threat to public health. However, despite the growing needs, treatments for invasive fungal infections remain unsatisfactory and are limited to a small number of antifungals. Microorganisms are an imperative source of conceivably valuable metabolites that includes antimicrobial agents. A huge number of molecules obtained from micro-organisms were reported with antifungal activity. Therefore, in the present work, 100 strains were isolated from the rhizosphere of medicinal plants of which 15 showed antifungal activities against *Aspergillus* and phytopathogenic species. These were identified as *Bacillus* sp, *Burkholderia* sp., *Acentinobacter* sp. and *Klebsella* sp. on the basis of morphological, physiological, 16S r RNA sequencing, and phylogenetic analysis. These strains were deposited in the GenBank database. From the above 15 isolates, 4 best isolate having anti-aspergillus activity was selected and the culturing condition of these isolates were optimized. Amberlite XAD-16 extract from the culture of each one of the 4 isolates was assayed to determine the anti-aspergillus activity. Anti-*Aspergillus* potential of a crude metabolite of *Bacillus sp.* (RC), *Burkholderia* sp. (RC1), *Acinetobacter* (RC2), and *Bacillus amyloliquefaciens* (PKR) was checked by MDA, and PSGI assay. The MIC of RC1 and RC2 were 97.5 ug/ml, whereas the MIC of RC and PKR1 were found to be 48.7 ug/ml. TLC combined with a bio-autography assay was performed to accurately determine the localization of antimicrobial activity on a chromatogram. The TLC bio-autography and GC-MS data showed that these isolates are potentially a very large reservoir of known and novel antimicrobial agents, especially those exhibiting antifungal activities. The metabolite extract of all 4 isolates did not show a cytotoxic effect against human erythrocytes and neuroblastoma cell lines. The crude metabolite extract was purified by Prep TLC, HPLC, and gel filtration chromatography. The purified metabolite of *Bacillus sp.* (RC) and *Bacillus amyloliquefaciens* (PKR) was estimated to have m/z of 1057.4930 and 1058.7386 and identified to be iturin and surfactin analog with liquid chromatography-mass spectrometry. Further confirmation of the compound was done with the help of the ^{1}HNMR and ^{13}CNMR. The results of this study recommended that secondary metabolites produced by *Bacillus* sp. could be a source of antimicrobial compounds to develop a new therapy against aspergillosis-induced infections.

Keywords: Microorganisms, Amberlite XAD-16, antimicrobial compounds, TLC, ^{1}HNMR

Phytohormones provide protection against biotic stress caused from fungi

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Abstract

Various phytopathogens, including bacteria, fungi, viruses, parasites, and pests, affect either the germination, growth, or yield of different plants. Plants synthesize various PHs that provide protection against pathogen attack by triggering signalling pathways and producing either induced systemic resistance (ISR) or systemic acquired resistance (SAR). However, the action of PHs is often multifaceted, so that they exert their effects either directly or through mutual interactions. With an integrated hormonal response, determining the biological role of a single PH in biotic stress becomes complicated. To simplify matters, we attempted to estimate the in vitro and in vivo antifungal activities of various phytohormones (PHs) against the hemibiotrophic fungus *Fusarium oxysporum*, using black chickpea [*Vigna mungo* (L.) Hepper] as a model system. Antifungal activities were evaluated using PHs such as salicylic acid, methyl jasmonate, melatonin, brassinolide, indole-3-acetic acid, gibberellic acid 3, ethephon, and abscisic acid by determining both minimum inhibitory concentration (MIC) and minimum effective concentration (MEC) in a microtiter plate-based assay. The results indicate significant antifungal activity of PH, with SA and MeJA showing strong activity even at the lowest concentration tested, with respective MIC_{90} values of 0.312 mM and 0.625 mM. A similar MEC profile was also observed for SA and MeJA with values of 0.078 mM and 0.312 mM, respectively. The microtiter results were confirmed by spore germination and mycelial susceptibility tests. These results were confirmed by the antifungal efficacy of PHs in vivo by recording germination characteristics in SA and MeJA-primed *V. mungo* seeds already exposed to *F. oxysporum* spores. Seeds primed with PHs typically exhibited longer seedling length and higher seed vigor index (SVI), which was associated with relatively increased ROS interception activity. Thus, in summary, priming *V. mungo* seeds with SA and MeJA appears to trigger a defence mechanism against *F. oxysporum* infection that also improves germination.

***Keywords*:** *Fusarium oxysporum*, stress, phytohormones, Microtiter plate assay, *Vigna mungo* (L.) Hepper, priming

Potential applications of botanical extracts of the *Balanites aegyptiaca* against *Helicoverpa armigera* reared on okra

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Abstract

The effect of oil and water extract on the 2nd instar larvae of *Helicoverpa armigera* reared on okra *Abelmoschus esculentus* were studied to evaluate the potential application of extracts of *Balanites aegyptiaca* as botanical pesticide. The efficacy of the oil and water extracts against the *H armigera* was tested with (2%,5% (v: v) oil extract and 5%, 10% (w/v) water extract) of seed kernel of *B aegyptiaca* Del. All treatments significantly influenced the larval survival of the *H armigera*. The 2% oil extract did not significantly differ from the 5% (0.469 ± 0.516 and 0.333 ± 0.488, respectively), however the number of survivals was higher in the negative control (0.869 ± 0.352) and Tween80 0.01% (v: v) (0.800 + 0.414) while for water extract it was higher in the control (0.867 ± 0.352) than in the 10% (w/v) water extract (0.333 ± 0.488). Furthermore, no significant difference was detected between the control and 5% (w/v) water extract. Oil and water extracts have properties of larvicidal against *H armigera* which could potentially be used as an attractive alternative for pest management.

Keywords**:** *Balanites aegyptiaca*, *Helicoverpa armigera*, botanical insecticide, larvicidal

Olfactory responses of *Pentastiridius leporinus* (Hemiptera, Cixiidae) nymphs to ATTRACAP®, a biological Attract and Kill formulation

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Abstract

ATTRACAP®, a biopolymer-based capsule that works on the principle of Attract and Kill, has already been used to control wireworms. The capsules produce plant producing CO2 because of the baker yeast in it, which attract the belowground insect and instead of food source the insect encounters the entomopathogenic fungus *Metarhizium brunneum* CB 15 III, which grows from the capsules. After the insects get into contact with the fungal spores' insects become infected and death occurs within few days however this is dependent upon temperature and soil conditions. We used belowground olfactometers to evaluate the attractiveness of ATTRACAP®, including different Odor sources like CO2, sugar beet, and wheat, to *P. leporinus*nymphs. We also conducted a mesocosm experiment to evaluate the efficacy of ATTRACAP® capsules in controlling the nymphs and its effect on adultemergence. Additionally, we directly exposed the nymphs to sporulated ATTRACAP® capsules to assess the ability of the entomopathogenic fungi to infect them. Our results showed that *P. leporinus* nymphs were attracted to high doses of ATTRACAP® capsules. It is possible that nymphs are drawn to plant odor sources, but other factors, such as primary and secondary volatile compounds from the plants, including CO2, might be influencing their movement toward the plant. In the mesocosm experiment, there was no significant difference in the number of alive and dead nymphs between the containers with ATTRACAP® and the negative control. Similarly, there was no significant difference in the number of adults that emerged from ATTRACAP® treatment and the negative control. However, direct exposure to sporulated ATTRACAP® capsules resulted in mycosis in some nymphs. Overall, our study suggests that olfactory cues may play a role in *P. leporinus* nymphs' ability to locate their food source, and high doses of ATTRACAP® capsules may be effective in attracting the nymphs with entomopathogenic fungi. However, more research is needed to fully understand the factors influencing *P. leporinus* nymph behaviour and the potential use of ATTRACAP® for controlling this vector.

***Keywords*:** *Metarhizium brunneum*, *Pentastiridius leporinus*, ATTRACAP®, nymphs, olfactory

Keynote

Prospecting for Plant Derived Anticancer Agents: *Mussaenda Frondosa* A New Source of The Alkaloid Camptothecin

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Abstract

Phytochemicals found in plants have been exploited by mankind as sources of numerous cancer chemotherapeutic agents. Camptothecin (CPT), a pyrole quinoline alkaloid, is one of the most promising molecule for anticancer drugs. CPT and its derivatives are known to target topoisomerase I . It was first extracted from a Chinese tree *Camptotheca acuminata (*Nyssaceae), since then it has been reported to exist in several plant species like *Nothapodytes foetida*, (Icacinaceae), *Ophiorrhiza* species (Rubiaceae), *Ervatamia geyneana* (Apocyanaceae), *Mostuea vrunonis* (Gelsemiaceae). Due to the inability to chemically synthesize camptothecin and the high demand the indiscriminate harvesting of these species for drug has led to a serious threat to the survival of these species. Prospecting for camptothecin in other species could potentially help in relieving pressure on existing sources. *Mussaenda* species (Rubiaceae) are native to the old world tropics and have historically been used in many parts of the world as traditional medicine. The genus *Mussaenda* is reported to be important source of natural products of medicinal value. Several species of *Mussaenda* have been found to be biologically active and utilized as diuretic, abortifacient, antiphlogistic, expectorant, antimicrobial, and antipyretic. Locally available *Mussaenda frondosa* plants were analyzed for camptothecine presence at two different seasons. Camptothecin was extracted from fresh material in methanol using microwave extraction technique. CPT was separated and quantified by HPLC with reverse phase C18 column and UV detector at 254nm. Presence of camptothecin in *Mussaenda frondosa* extract was confirmed by matching retention time with authentic camptothecine standard. The leaf extract was found to contain 0.05% of CPT in August sample and 0.02% in April samples. Although many alkaloids have been reported in this plant, this is the first report of the presence of CPT in *Mussaenda frondosa.*

Keywords: Camptothecin, *Nothapodytes foetida*, *Mussaenda frondosa*, Rubiaceae

Global Environmental Balance: Role of Sustainable Green Technologies

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Abstract

Earth, a natural system known for its organization and self control. Whereas, the current scale of anthropogenic activity is not precedented in history of mankind. The current rate of increasing need of various resources their rapid use and consumption pattern are destroying and depleting Earth's never to end resources and bringing an adverse effect on life- supporting ecosystems. Rate of toxic substances found in air, water, soil and environmental bases are increasing day by day. The 5 Elements – Earth, Water, Fire, Air, Sky which pays an essential role to maintain the Environmental Balance. We are at the midst of eradicating era which can soon lead to the massive drastic result of the era. The environment on account of human's action has been experiencing imbalances and ecological catastrophe. The various Environmental issues like Global Climate Change, Biodiversity Loss, the rapid depletion of natural resources, degradation of global commons, stratospheric ozone depletion have been restricting the safe operating space and transgressing the planetary boundaries endangering the existence of human societies. The global environmental problems if not ended up managed by scientific means may end up in the civilization collapse. Nevertheless, the underlying commonality among these environmental issues is interrelatedness, complexity and difficulty in identifying and implementing solutions. The global environmental challenges can be managed by adopting Sustainable Green Technologies which maintains the principles of environmental and ecological sustainability. Green growth can be well known as the development paradigm which sustains economic growth as well as ensuring environmental and ecological sustainability.

Keywords: Global environmental, toxic substances, ecosystems, sustainable green technologies, ecological sustainability

Heavy Metals quantification in Wheat Grains and Assessment of associated Health Risks in Punjab, India

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Abstract

The present study was conducted to quantify heavy metals in wheat grains, their accumulation and health risk due to their consumption by the people living in the Sangrur district of Punjab, India. The soil and wheat grain samples were collected from different sampling locations in study area. The samples were analyzed for heavy metals by Atomic Absorption spectrophotometry. The heavy metals, viz., Fe, Zn, Cu, Pb, Ni, Cd, Cr and Co in wheat grains ranged 36.28 – 125.99, 4.09 – 32.65, 2.03 – 9.48, 0.01 – 0.21, 0.09 – 0.74, 0.01 - 0.09, 0.01 – 0.08 and 0.01 – 0.06 mg/kg respectively. Bioaccumulation factor from soil to wheat grains for Co, Cd, Fe, Cu, Ni, Zn, Pb and Cr were 0.004, 0.09, 0.03, 0.04, 0.02, 0.79, 0.14 and 0.02 respectively. The results showed that bioaccumulation factor of different heavy metals were variable over different locations. This could be due to differences in soil properties, crop characters and metal chemistry. Bioaccumulation factor was maximum for zinc and minimum for cobalt. Health risks were calculated in terms of chronic daily intake and total hazard quotient. Chronic daily intake (CDI) was maximum for Fe (1.85E-01mg/kg/day) whereas minimum for Cr (6.66E-05 mg/kg/day). Total Hazard Quotients was calculated and found to be less than unity. Based on Total Hazard Quotient it could be interpreted that wheat grains produced in Sangrur district are safe for human consumption.

Keywords: Heavy metals, atomic absorption spectrophotometer, bioaccumulation factor, chronic daily intake, total hazard quotient

Are trade-off and wins-wins among biodiversity and ecosystem functioning shaped by environmental conditions?

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Abstract

Climate change has had a significant impact on native forest ecosystem dynamics in Central Europe, and this impact is expected to continue. Promoting mixed forest stands and integrating non-native tree species that are well-suited to anticipated climate conditions is considered as an adaptation strategy for forest management. In recent decades, Douglas-fir has been planted in managed forests of Central Europe with the native broadleaved species European beech mainly because of its high productivity and resistance to drought. However, the implication of such enrichment at ecosystem level is not yet fully explored. Therefore, in my thesis, I investigate the trade-offs and win-wins among biodiversity and ecosystem functioning across pure and mixed forest ecosystem enriched with native (Spruce) and non-native tree species (Douglas fir) located in Lower Saxony, Germany. Further, I am assessing if environmental conditions influence these relationships. Comprehensive data on a number of taxa such as Collembolan, Oribatida, Soil fungi, natural regeneration and several ecosystem functions such as stand structure, microbial biomass, basal respiration, pH, cation exchange capacity, among others have been compiled from the project - "Enrichment of European beech forests with conifers: impacts of functional traits on ecosystem functioning (Enrico)". The data analysis in this study will employ partial correlation network approach to identify the direct and indirect associations among variables with regions, which differ on soil condition for instance soil fertility. Across regions, a decrease in the proportion of European beech (*i.e.*, mixed forest stands) is expected to be positively associated with higher microbial biomass and activity as well as greater fine root biomass due to increased diversity of tree species and associated micro-organisms. Further, the influence of changes in the proportion of European beech on biodiversity and ecosystem functioning is expected to be stronger at nutrient poor sites in the northern region (characterized by lower annual precipitation, sandy soil) compared to southern region. By considering the role of soil condition, we will gain a better understanding to elucidate context-dependent relationships which will contribute towards tailoring forest management strategies in the face of climate change in Central Europe.

***Keywords*:** Climate change, ecosystem, biomass, douglas-fir, taxa, drought, biodiversity

Keynote

Feed additives for ruminants in the European Union (EU)

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Abstract

Regular aspects of feed additives in ruminant nutrition in the European Union are considered in the present paper. The introduction deals with some fundamental problems of animal and human nutrition. Because of the growing global population the human edible fraction (hef- fraction) of feeds and the resource efficacy as well as environmental aspects of food production on the animal base will be more important in the future. The supplementation of animal diets with amino acids, trace elements, vitamins and some non essential additives is an important prerequisite for an optimal conversion of animal feed into human food. Essential nutrients, such as amino acids, trace elements and vitamins and non essential supplements, such as enzymes, methane and mycotoxin inhibitors, silage additives and some other additives are important substances for animal health and an optimal conversion of animal feed into human food. The paper informed about activities of the European Food Safety Authority (EFSA) in this field.

Keywords: Feed additives, ruminants, food safty, edible fraction, European Union, mycotoxin inhibitors

Keynote: Online

Precision livestock farming to select climate-adapted animals for grazing systems

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Abstract

Grasslands cover above one third of ice-free terrestrial surface, playing a key role in food production, but also in the provision of numerous ecosystem services, such as carbon sequestration, water supply or erosion control. Such provision is highly influenced by grassland management, which is based on four principles: type of animal, stocking rate, and timing of grazing and grazing distribution. Traditionally, the type of animal and stocking rate were decided according to grassland features, but nowadays market forces have led to an intensification of extensive livestock production in many regions of the world, where cattle have substituted sheep and other ruminants, while stocking rates have been increased by adding external energy to grazing systems (mostly feed). The timing of grazing used to be optimised through traditional practices, such as transhumance, which is endangered in modern countries. In relation to the spatial distribution of grazing, shepherding was the main tool in traditional systems, but it has been almost completely substituted by fencing. Thus, nowadays, most grasslands lack an adequate grazing management, compromising their environmental sustainability, especially under climate change conditions. Precision livestock farming (PLF) tools, especially GNSS tracking, have the potential to automatically gather data to support management decisions aimed at improving grazing management, particularly in relation to its temporal and spatial components. In current continuous grazing systems, animals tend to congregate in some areas within paddocks, normally close to water points and avoiding stepper slopes, which may lead to overgrazing of some areas, while other receive little attention. Optimising livestock distribution may help to alleviate the effects of climate change, such as reduced pasture availability and shortened grazing seasons, through making animals to graze areas that they normally avoid. Fortunately, phenotypic and genetic variability exists in relation to the spatial use of pasture by grazing animals. These traits have not been included in selection schemes because they are difficult to measure objectively, but PLF is a paradigm shift in that sense. In this study, we discussed the possibilities of building objective metrics from GNSS tracking data aimed at selecting climate-adapted animals, i.e., those able to optimise the temporal and spatial domains of grazing under current management practices.

Keywords: Precision livestock farming, climate-adapted animals, grazing systems, GNSS tracking

Keynote: Online

Contribution of Tunisian Livestock Systems in GHG Emissions: Measuring and Mitigating Options

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Abstract

In Tunisia, about 20% of the population is employed in agriculture, which accounts for about 10% of the country's gross domestic product, and about 10 to 12% of total exports. As such, agriculture is essential for the overall economy. On the other hand, the agricultural sector, based on crop and livestock production, contributes globally to about 11% of global greenhouse gas (GHG) emissions, accounting for 5.4 Gt CO_2e in 2012. About 60% of the total agricultural emissions are due to livestock emission sources. Enteric fermentation is considered the biggest contributor (about 63%) of livestock emissions, followed by manure management (12%) and application of dung and urine on pasture (25%). Systems for grazing ruminants occupy an important part of global land surface and are therefore an important contributor to global enteric methane emissions. Grazing livestock systems face the challenge of reducing their overall environmental impact, especially enteric methane emissions, and at the same time, improving ecosystem function and providing for the livelihoods of rural communities, especially in developing countries. Therefore, more knowledge is needed on proven methane mitigation strategies that can be applied in a practical way on intensive and extensive grazing systems. This current research seeks on innovative application of methane mitigation strategies and measurement methods that can be applied to grazing systems. While total GHG emissions from livestock production in Tunisia as a whole have declined in recent decades, emissions from cattle and small ruminants have increased. Since determination of GHG emissions per head of livestock is based on Tier 1 methodologies, using fixed values, changes in total emissions are responsive only to changes in livestock populations. The critical influence of the values assumed for each emission factor reveals that there is a need for more accurate coefficients, specific for each geographic region or for identifiable farming systems. Hence, there are urgent needs to understand the various factors affecting the variability in enteric CH4 production, to reduce the uncertainty in GHG emission inventories, and to identify viable strategies for GHG reduction from livestock. In the future, worldwide emissions are expected to increase substantially as a response to an increasing demand for animal products. This can only be achieved by increasing

animal productivity, even though the number of animals farmed is not increased or is even decreased slightly, as in Tunisia. These aspects need to be considered to refine the factors used for estimating GHG emissions more accurately, and priority should be given to creating an appropriate database for GHG inventory to facilitate the study of livestock contribution to GHG emissions. As part of the baseline and mitigation scenarios determination, 2010 was defined as the reference year, and 2030 as the horizon year. The mitigation objective requires a total investment of up to 17.5 billion U.S. dollars over the period 2015–2030, with 85% of this amount allocated for the energy sector and only 5% for the livestock sector. In the agricultural sector, preliminary actions aiming at GHG mitigation include promotion of biological agriculture and reduction of pollution caused by the use of chemical fertilizers in excess in some intensive crops, stepping up the role of legumes in arable land, and the conservation and planting of biomass.

Keywords: Livestock, GHG emissions, ecosystem, conservation, biomass

Effect of Climate Change on Livestock in Palestine

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Abstract

Palestine's unique climate marked by aridity and varying rainfall patterns, is vulnerable to climate change. Livestock and agriculture are affected, with reduced crop yields, increased water scarcity, and shifting disease patterns. Livestock, particularly in hotter regions, faces amplified heat stress due to rising temperatures and reduced water availability. This stress could lead to higher mortality rates, particularly among poultry. Livestock health is compromised due to dehydration, reduced feed intake, and lower milk production caused by changing water availability and temperature fluctuations. Disease dynamics shift as climate change affects the prevalence of livestock diseases, driven by altered temperature and precipitation patterns. Climate change also affects farming economics, especially for small-scale farmers, increasing investment risks and disproportionately impacting them. To address these challenges, on-going studies are assessing the impact of incorporating specific agricultural by-products into sheep diets in Palestine and Tunisia. These studies aim to reduce feed costs, enhance immunity, improve food security, and boost small ruminant productivity. Is expected therefore some practical solutions in terms of using agricultural by-products as cost-effective supplementary animal feed could be applied at farmer scale. The aim is to empower farmers, enhance livestock management, and promote sustainable practices within the agricultural sector.

***Keywords*:** Climate Change, Livestock, immunity, food security, ruminant productivity

Sustainable genetic improvement programs and conservation issues for indigenous dairy cattle breeds under the harsh environmental conditions of Africa: Sudan as an example in practice

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Abstract

Cattle are one of the most important livestock species in Sudan because they offer farmers a variety of services and help to support the national economy. Although they perform well in the challenging environmental conditions, they typically produce low milk yields. A well-planned genetic improvement program is one of the key ways to conserve the indigenous breeds, increase productivity and improve farmers' livelihoods. However, after many years of breeding and genetic improvement programs, Sudan still struggles to implement sustainable breeding programs that improve the milk yield performance and maintain the genetic diversity of the indigenous cattle. The purpose of this paper is to discuss various genetic improvement programs carried out for raising the milk production level of indignation cattle in Sudan while highlighting the difficulties and opportunities for better utilizing them. Evidence from the literature indicates that indigenous cattle have widely been crossed with exotic high-yielding breeds from temperate region. Crossbred cows, however, are unable to fully utilize their genetic potential for milk production due to poor management under low input production conditions and due to the constraints of the local physical and biotic environments. This will consequently reduce the profit gain from the milk sale under such production system. In intensive production system of large-scale operation, where sufficient management can be provided crossbreeding seem to be the quickest and most effective way to raise production levels. Nonetheless, the continued upgrading of indigenous purebred breeds toward exotic breeds under either low input production or intensive production systems poses a threat to the future existence of the indigenous breeds. Especially, in view of the effects of climate change, which include increasing occurrence of hotter temperatures, long drought periods with water and feed scarcity, there is need to conserve environmentally well-adapted indigenous breeds and their genetic makeup. We conclude that when production environments are extremely harsh, it is crucial to enhance genetics within the local breeds through selection. Incorporating adaptive traits into breeding objectives could also help preserve the potential adaptation of indigenous breeds and prevent genetic erosion. Molecular technology could be used to identify the adaptive traits that could be incorporated into selection programs. Furthermore, additional research is required, particularly to identify the optimum level of exotic inheritance in crossbred genotypes, which suit each production environment in the country. More importantly, efficient breeding organizations are essential for carrying out long-term breeding plans for genetic improvement and conservation of the indigenous breeds.

Keywords: Indigenous cattle; Sustainable genetic improvement; conservation

Evaluation of milk adulteration in dairy farms and markets of El-Fashir city

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Abstract

This research was aimed to study milk Adulteration in El Fisher. Parameters studied were: milk density, chemical composition and adulterants. In this study the experimental method was adopted and SPSS version 15 for windows was used to analyse the samples and to calculate means and slandered deviation between groups. Moreover, T-test, Chi-Squire, and correlation were used to show significance between means. Thirty (30) milk samples were collected randomly from the farm and the market with 15 samples for each. The analysis concluded to the following results: the density value was 1.032±.002 for the farm and 1.033±.003 for the market. Total solids were 12.19±1.15 and 12.45±2.39 for the farm and the market, respectively. Crude protein was (3.85±.67, 3.96±0.51), fat was (3.57±.74, 3.29±0.63), lactose was (3.93±.98, 4.21±1.35) and ash was (0.73±.07, 0.73±0.13) for the farm and the market, respectively. For detection of adulterants in milk the following Reagent were used: M-1 for mastitis, ST-1 for starch, UR-1 for urea and DT-1 for detergents. T- Tests did not secure any significant differences ($P \leq 0.05$) among all adulterants. There was a positive correlation in paired samples between urea and mastitis and starch and detergents, however, there was a negative correlation between urea and starch and mastitis and detergents.

***Keywords*:** nutritive value, bacteria, milk adulteration, health hazards, diseases

Benchmarking Regional Variations in Dairy Production and Feeding Management to Enhance Sustainability in the major Milk-Producing Regions of Bangladesh

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Abstract

Sustainable dairy production plays a pivotal role in ensuring food security amidst the challenges posed by climate change. Therefore, the objective of this research is to benchmark and compare dairy production and feeding management practices in the Northern part of the country which is considered as the major milk-producing areas of Bangladesh to assess regional variations in dairy production and feeding management. The study also aims at shedding light on the potential enhancements to promote sustainable agriculture for food security under changing climatic conditions. The International Farm Comparison Network (IFCN) methodology was applied which was calibrated with locally developed Integrated Dairy Research Network (IDRN) methodology. A total 419 dairy farmers were selected from two prominent milk districts from Northern part of the country such as Sirajgonj and Bogura. The average milk yield in Bogura and Sirajgonj is 6.48 and 7.02 lit/cow/day respectively. Regarding the dairy herd structure in Bogura 38.4% lacting cow, 26.8% dry cow, 15.0% heifer and 19.8% female calf whereas in Sirajgonj 44.0% lacting cow, 21.3% dry cow, 11.8% heifer and 22.9% female calf. Regarding the dairy farm types, household, family and business farms represent 29.3%, 53.1%, 17.6% in Bogura and 28.7%, 61.0%, 10.3% in Sirajgonj respectively. However, the district of Sirajgonj has mostly family farms while the highest number of business farms is located in Bogura.In case of dairy ration concentrate share, concentrate intake, share of purchased feed 21.97%,1.12ton/cow/yr and 30.52BDT/kg in Bogura where as 22.18%,4.9ton/cow/year and 29.09 BDT/kg in Sirajgong. The farmers from Sirajgong has the highest level of experiences as 18.8%and 85.3% in Bogura and Sirajgonj respectively of the farm owner starts their dairy farms with prior knowledge. The lactation length varies from 248 days in Bogura to 242 days in Sirajgonj. These finding expose that Sirajonj seems to be noticeable milk producing areas while Bogura could be next potential areas in terms of milk production, nutrition and management. The results might be useful for designing for improving the management and changing the feed for decreasing feed cost, thus increasing sustainable milk production in a Bangladesh.

Keywords: dairy farm management, benchmarking, regional performance feeding management, milk production

Keynote

Technologies and Options for Securing Energy & Food Flows in View of the Ukrainian Crisis

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Abstract

The Ukrainian Crisis has already caused great destruction in the infrastructure and forced millions to flee and induced a Serious Energy, Food, Climate and Economic Disaster Worldwide. However, the uneven distribution of energy supplies among countries has led to significant vulnerabilities. The Secretary General of the United Nations stressed on 23rd March 2022 that the war in Ukraine is a global crisis, given the impact it is having on energy, food and fertilizer markets. The great risks pose to all countries, especially the poorest ones. He stated, "No country will be able to insulate itself from a meltdown of the global economic system; from the domino effect of hoarding food or fuel; or from the long-term impact of increased poverty and hunger and climate change." With rapid and continued population growth in the world, depletion of the natural resources and climate change, it is no longer a question of when we will incorporate various renewable energy sources into the mix, but how fast the transition can be managed. It uncovered the at same time dilemma of the German and worldwide energy and climate policy and its vulnerability. This lies in the inability to develop comprehensive energy policies which concentrate only on wind and solar energy. They alone could never replace the fossil energy resources even by the year 2050 and beyond. It neglects the vital role of biomass, biogas, bioenergy and other biofuels and the innovative synesthetic biofuels for automotive mobility, heating, and electricity. The Decentralized Renewable Energy supply etc. does not even exist in the vocabulary of the new administration in Berlin. Denmark has combined these technologies (Mix) and has quite a large number of communities supplied with 100 % renewable and 100% fossil free resources including the introduction of Concentrated Solar Thermal Power Technology for heating, power, and fuels. The German energy and climate policy in the era of previous chancellor Angela Merkel had achieved a substantial breakthrough: They ensured relatively cheap Russian gas supply for decades through negotiations and built the gas pipeline North stream 2. Merkel's government had decided to close down all nuclear and coal power plants successively. That was a unique step worldwide towards climate protection and energy security. That enabled the government to promote alternative energies, although it was insufficient to achieve a real energy transmission. The current Federal government imposed severe sanctions against Russia and to stop the import of gas, fertilizers and other commodities and blocked the

pipeline North stream 2. These drastic measures led to severe shortages and a bottleneck in the energy flow. The consequences are visible: Higher energy prices and higher inflation rate. The poverty of the population in Germany is projected to be 15 % by the end of this year. Also, the climate policy undergoes a severe setback: Some of the coal and nuclear power plants should be reactivated, and the government is discussing the possibility to allow the gas and oil extraction through fracking which could lead to severe environmental damage. The situation in other regions of the world, especially in many Developing Countries is even worse. Technology is transforming our society, business, environment, and even our own reality, at an unprecedented rate. A breakthrough achievement in the energy transition requires great efforts, research, and new incentives which should lead to a new Industrial Renewable Energy Revolution which should concentrate on innovative and future oriented technologies for heat, electricity, and fuels generation as well as on fusion power plant and green hydrogen technologies pressurized alkaline electrolyzes, and development of microalgae reactors on industrial scales. Never the less the international policy should insist on opening more corridors to secure the export of Ukrainian and Russian grains, fertilizers, and energy commodities to the world and to increase the capacity of Ukrainian grains flow which was opened on 01.08.2022 with the Turkey and UN joint efforts. The global policy should secure food and energy supplies in poor countries. What is also needed is to stop all wars around the world and to start negations and dialogue towards peace achievements for the sake of mankind and our planet.

***Keywords*:** Technologies, securing Energy, food Flows, Ukrainian crisis

Keynote: Online

Advanced Technologies to Accelerate Yield Improvement in Food Crops under Climate Change

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Abstract

As global food demands continue to increase with a growing world population, yield increases achieved using traditional methods have become insufficient to meet current and future food demands, particularly in major food crops. This has led to the development of novel techniques and protocols in agriculture research including molecular and genomics breeding, genetic modification, computational biology, crop models, digital phenomics, precision agriculture management, etc. Performance of a given crop variety in terms of growth and yield is governed by its inheritable genetic composition and the environmental conditions. Plant performance or more scientifically plant phenotype is observed through morphological, phenological, physiological, agronomical, and biochemical traits such as plant height, biomass accumulation, growth rate, phenology, plant architecture, water content, pigments, etc. Plant phenome can be defined at all levels from individual cells to plant organs, to whole plants to plots and field levels, and across growth stages. It is the challenge of modern phenotyping to capture these dynamic changes in effective, accurate and efficient manner. The assessment of phenotype-environment dynamics therefore plays a significant role in the advancement of crop breeding and management programs, through the power to correlate gene function, plant performance and environmental responses. The use of quality phenotypic and genotypic data, in conjunction with statistical tools, will allow candidate genes to be assessed against gene × variety, and gene × environment interactions. Significant advances have been achieved in genomics research in last two decades such sequencing and annotation of major crop genomes, marker-assisted breeding, genome-wide association studies and genomics selection that have revolutionized the crop breeding. While these new breeding approaches rely heavily on genotyping and genomics, equally the phenotypic data is essential as the basis for the development and training of statistical models used to predict phenotypic performance. This has led to the development of high throughput phenotyping platforms utilizing a wide range of sensor-based technologies and encouraging enhanced data collection to assist in faster breeding of improved crop varieties. These advanced phenotyping platforms utilize digital sensors, automation, computer learning and data integration, and are increasing the precision, accuracy and throughput of data

collection, while reducing costs and resource usage. Technologies such as digital sensors and cameras, automated glasshouses, ground-based vehicles, UAVs and satellites, not only allow us to access data on key traits efficiently and effectively, but also access novel traits previously unexplored due to method or resource difficulties. Much of the revolution in phenotyping has occurred with developments in various imaging or sensing techniques, utilizing sensors and software pipelines which can record and analyze data on plant structure, phenology, biomass production, plant health and biochemical parameters. This presentation will cover how recent genomics, physiological, breeding approaches in conjunction with advanced digital, high throughput, non-destructive and precise phenotyping technologies have been deployed in agriculture research. With some practical examples to improve some of the crop traits such as biotic and abiotic stress tolerance, improved nutrient use efficiency and higher yield in food grain crops.

Keywords**:** Phenotyping, yield improvement, food crops, climate change, nutrient use efficiency,

Resource-integration and optimization-approach for plant-genotyping and -phenotyping for efficient biodiversity characterization under different agro-ecological situations

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Abstract

Tremendous progresses in sensor technology and data analysis methods drive the digitization of life- and applied-science applications on different scales for deriving the associations between the kinetics and dynamics of actuaries near to realities. Offering solutions to application problems in these spaces require an inter-disciplinary mindset and allied teamwork with a comprehensive strategy and an extensive setup within a framework of industry-academia collaboration in place and in concurrence with sound experience and exposure. An exemplary agricultural research innovation has been conceptualised and conducted with the primary aim to showcase how well and efficiently the digital transformation needs can be achieved for academia as well as research or production environments. The advancements involved in the research process include the integration of advanced robotics, digital sensors, imaging systems, and computing power to unravel the genetic basis of complex traits associated with plant growth and development. For instance, a comprehensive experiment has been conducted on automated phenomics system at the Nanaji Deshmukh Plant Phenomics Center, New Delhi, India to phenotype 150 wheat-genotypes from different parts of the world including UK, Australia and International Maize and Wheat Improvement Center (CIMMYT)-Mexico for drought tolerance. To achieve the outcome efficiently the team considered and integrated closely the required basic science components allied to the observed target of interest with the associated light sources and multi-modal sensors for non-invasive observations and further a very scientific and comprehensive approach has been adopted to generate, curate, process and analyze the scientific data and the associated metadata to derive really the actuaries more closer to reality instead of experimental mesh of mess. Furthermore, advanced bioinformatics tools have emerged to analyze the vast amounts of multi-dimensional, high-resolution data collected through phenotyping at both the genetic and whole-plant levels, considering specific environmental conditions and management practices. The whole experimental

data observations and the metadata are being curated and processed through an automated software pipeline that can ingest the multi-dimensional and multi-modalities in batch-mode process and provide a comprehensive, detailed and insightful analytical report for easy dissemination and further implementations. The overall purpose has been aimed to minimize and handle the complexities while solving the hidden challenges and the parallax situations allied to developing the basic as well as advanced-plant-phenotyping knowledge, skills, capacity and infrastructure for working groups allied to biodiversity characterization under different agro-ecological conditions. The strategy implemented here allows to follow up the goals of multi-lateral users with limited resources and to innovatively answer existing and future challenges.

Keywords: Biodiversity-characterisation, digital transformation, imaging, AI, agriculture, design-optimisation, genetics, genomics, phenomics

Depth Map Estimation of Crop Fields using Stereo Vision

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Abstract

The research described in this paper addresses the creation of crop field depth maps using a stereo camera attached to an autonomously flying drone. The system created in the course of this work shall be used to gather information about the health, size and distribution of crops. The selected stereo camera and drone were combined and software was developed that enables stereoscopic videos to be recorded during flight. The drone was initially flown manually over a crop field to gather measurement data about crops to enable a qualitative comparison of different processing methods and subsequent representations of the calculated information. A fused point cloud, computed using an algorithm created by the developers of the stereo camera, provided only a few details of the acquired field, as too many details were lost due to smoothing of the processed shapes. While merging the recorded depth images using sensor data from the stereo camera was ineffective due to inaccuracy of the sensor data, the images were successfully merged using panoramic software. The resulting stitched depth image provides information on the growth height and shape of all plants across the field, accurate to within a few centimetres. Video compression should be avoided as it causes a visible impact on the quality of the images, even though the number of processable images is reduced. Flying the drone using an autopilot caused difficulties due to lack of compatibility between hardware and software and can be optimized in further development.

***Keywords*:** Drone, autonomous flight, plant health, stereo vision, image stitching, topology

Mechanical Interventions for *In-situ* Management of Paddy Straw

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Abstract

Rice-wheat rotation is followed in North-West plain zones of India including Haryana, Punjab, part of Himachal Pardesh, Delhi and parts of U.P. Soon after the harvest of paddy agricultural fields have to be prepared for wheat sowing. The intermittent period between harvest of paddy and sowing of wheat is limited to 2-3 weeks or sometimes even less. In order to prepare seed bed for wheat sowing, farmers prefer burning of paddy straw left over after paddy harvest, then clearing the field either through manual labour or machines due to time and economic constraints. Burning of paddy straw in field conditions causes havoc in terms of soil health and environmental pollution as burning leads to impairing soil microflora, organic carbon and soil structure coupled with gaseous emissions contributing to health hazards. Honorable Supreme Court of India has therefore prohibited paddy straw burning in field conditions. This calls for development of innovative strategy using mechanical intervention for early removal of paddy straw from the field or chopping it to smaller pieces using chopper and mixing it with soil using rotary tiller and placing it deeper profile with the help of MB plough for decomposition in field conditions. This willlead to converting agricultural waste to potential organic manure to enrich soil fertility by nutrient recycling, enhancing soil organic carbon and physical properties for water holding capacity and nutrient dynamics. The other alternative is to use Happy Seeder for sowing of wheat while paddy straws still standing in the fields. The paddy straw gets decomposed in space and time in due course. The germination of wheat seeds is good as the moisture content in paddy fields is reasonable, so it permits sowing of wheat soon after paddy harvesting. Such mechanical interventions are being adapted by farmers in Haryana and Punjab, India and can be emulated by farmers elsewhere in Africa and Asia for sustainable crop production.

***Keywords*:** Paddy straw, chopper, MB plough, happy seeder *etc*

Rural Technologies' for Women Empowerment

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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 empower of rural women in the surrounding villages. Technologies such as Puff Rice (muri) making machine puffed rice at a desired temperature of around 200-210^{o}C. Rice expands almost instantaneously and translates into puffed-rice within 18-20 seconds. This is a simple but highly efficient machine, which increases the productivity to the tune of about 15 times as compared to of a conventional rice puffing artisan. Destitute women of Gandhi Ashram, Haldia, performing of puffing rice (muri) about 30 quintal and earns Rs. 18,000/- to Rs. 20,000/- in a month. They packages, stores and market their own branded puffed rice (muri) to nearby local markets Haldia city and also in fairs and festivals. **M**echanized Dhenki for paddy dehusking process with an identical frequency, amplitude as well as the gravity fall of the impactor and a suitably designed cam-follower arrangement, which is operated by women in rural India not only reduces the drudgery but also decreases labour requirement to one person. The productivity increases by 5-6 times and earns Rs. 6,000/- to Rs. 6,500/- per month. Dehusker rice is in demand in shopping malls. **P**ortable Paddy De-husking Machine and medium capacity with two rubber rollers for perform dehusking of paddy. NOGs and SHGs women members mainly involve in carryout the dehusking process. The dehusked brown rice contains high amount of crude protein, carbohydrate and nutrients. Fetches 3 times higher price than milled rice. Productivity is 40 kg of de-husked rice per hour. **R**ice Flake making machine medium capacity with three layer roller system. Feed rate of 24kg/hrandflake recovery of 64%. Husk separation efficiency 80% and capacity of 10-12 kg per hour. This machine mostly used by women of rural India along with other activities and earn Rs. 4,000/- to Rs. 5,000/- per month. **S**imple 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. The productivity increased from 16 spindles to 32 spindles. Introduction of such technologies have helped the rural women to increase their daily income while reducing drudgery, which makes a great makeover on socio-economic status and their livelihood. 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 and SHGs engage in women empowerment interested to leverage on S&T to improve the source of revenue for rural women. These technologies are not only to improve their income but also to generate employment opportunities at village level to reduce migration of rural women to cities in search of job.

Keywords: Rural Technologies', women empowerment, puff rice (muri) making machine, ngos and shgs, socio-economic

Warehouse Technology for Safe Food Grain Storage

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Abstract

A warehouse is a building for storing items. Warehouses are utilized by manufacturers, importers, exporters, wholesalers, delivery groups, customs, and many others. They're usually big plain buildings in business parks on the outskirts of cities, cities, or villages. Warehouses commonly have loading docks to load and dump goods from vans. They often have cranes and forklifts for moving goods, which are commonly positioned on ISO popular pallets after which loaded into pallet racks. Stored goods can consist of any raw materials, packing substances, spare elements, additives, or completed goods associated with agriculture, production, and production. In India and Hong Kong, a warehouse may be referred to as a "go down".

In order to deliver food to the ever-developing population of India, FCI purchases grains and stores them in warehouses. Guarantees meals remains clean for an extended time period. A variety of techniques may be used to save one-of-a-kind styles of food. Meals objects along with meat, as an example, ought to be saved within the fridge as their high moisture content material way that they decay quickly. Proper garage ensures that produce is evenly dispensed throughout the year. It is helpful in emergency situations including famines.

Grain Storage and Temperature: Meals loss for the duration of storage is significantly affected by warehouse and granary temperatures. Maintaining temperature with aeration is viable. This natural airflow lowers the temperature within the storage space and prevents sweating. To shield stored food grains, it's far critical to hold the temperature. That allows you to ensure that grains are stored in precise condition and amount, they need to be cooled earlier than storage.

The Role of Moisture in Grain Storage: Numerous elements influence the safety of stored grains, such as moisture. Conditions like warm temperature and moisture are conducive to the boom of diverse biotic components along with molds, fungi, pests, bugs, and so forth. Water damages grains with the aid of discoloring them and reducing their great. To be able to ensure grains are stored on the right moisture stage, they need to be inspected regularly. Similarly to digital moisture meters, there are actually also a selection of electronic measuring devices available.

Damages during the Storage: If the grains are not stored properly, or not taken care of, it will lead to various damages which will affect the progress of the farmer as well as the country. These damages can be direct or indirect.

Keywords: Warehouse, food storage, temperature, damages, grain Storage

Physicochemical and sensory characteristics of Sudanese white cheese packed in beeswax during storage

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Abstract

Synthetic packaging materials are considered perilous and can cause chemical pollution in the cheese, which makes it detrimental to human health. Therefore, biodegradable packaging materials can be used as an ideal and natural substitute for synthetic packaging materials. Thus, in this study we evaluated the physicochemical and sensory characteristics of Sudanese white cheese packed in beeswax during storage. In this trial seventy-five liters of fresh raw cow's milk were used to make cheese, two storage containers (beeswax and plastic containers) were used. Sudanese white cheese was made in Sudan University of Science and Technology laboratory. The cheese samples were stored for 60 days and analyzed in different times (zero, 10, 20, 30, 40, 50 and 60 days). Weight loss, chemical composition and sensory characteristics of Sudanese white cheese were determined. Results indicated that the total solids, crude fat, crude protein, ash, acidity, and volatile fatty acid (VFA) content of the cheese samples were significantly ($P<0.001$) affected by storage period. However, the cheese samples packed in beeswax showed a higher percent of protein, fat, and total solids, and a lower percent of ash, titratable acidity and VFA content in comparison with those packed in a plastic container. The storage period significantly ($P<0.05$) affected all the sensory characteristics except the taste, however, all the sensory parameters scores improved during the storage period from day zero till day 60, while all the sensory characteristics did not affect significantly ($P>0.05$) by the packaging material.

***Keywords*:** Sudanese white cheese, storage period, storage containers, beeswax, plastic containers.

Super conductivity and BCS Theory: Foundations and Implication

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Abstract

Superconductivity, the phenomenon where certain materials conduct electricity without resistance at extremely low temperatures, remains a fascinating subject. The BCS theory (Bardeen-Cooper-Schrieffer) plays a central role in understanding this phenomenon. It suggests that electrons form Cooper pairs due to interactions with lattice vibrations (phonons). These pairs, bound by an attractive force, can traverse the material without collision, resulting in the absence of electrical resistance. Understanding superconductivity holds both technical and environmental implications. Mastery of superconducting materials could revolutionize energy efficiency, with potential applications in energy transmission, storage devices, and transportation systems. This could contribute to reducing greenhouse gas emissions and promoting sustainability. However, high-temperature superconductivity remains an unresolved challenge. While the BCS theory explains low-temperature superconductivity, the mechanisms for high-temperature superconductivity remain enigmatic. Solving this mystery could pave the way for superconducting materials at more practical temperatures, with significant impacts on energy and the environment. In conclusion, the BCS theory provides a solid foundation to comprehend and exploit superconductivity, while presenting intriguing challenges for future research.

Keywords: Superconductivity, BCS theory, cooper pairs, electrical resistance, energy efficiency, energy transmission, sustainability, high temperature

Keynote

Agri-entrepreneurship and Agri-business Ecosystem for Sustainable Agriculture and Food Security in Agricultural Economies of the World

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Abstract

Climate change is impacting the agricultural sector in most countries, developed or developing, agricultural or industrial, in one way or another. Naturally, the type and intensity of impact is different for different countries. Some are facing excessive rainfall while others are facing drought conditions. Some countries are facing both. It is also an opportunity for agricultural inputs and produce supplier countries, as prices have risen, while for buyer poor countries it is not less than a nightmare. Many agriculture technologies, processes and measures have been suggested for sustainable agriculture and food security under the conditions of climate change. Development of Agri-entrepreneurship and agri-business eco-system is one such measure which can help enormously, especially in less developed and developing countries. Lots of business opportunities are available in areas like apiculture, horticulture, poultry, piggery, fisheries, dairy, mushroom production etc. Farmers in developing countries have small land holding and low income. They can be motivated and helped to start small agri-businesses. This will help in increasing their income on one hand and will create an agri-business ecosystem which can supplement and help in sustainable agriculture and attaining food security. An attempt has been made in this paper to critically analyze the entire scenario, judge the available options and recommend appropriate strategies for developing, promoting, and sustaining agri-business eco-system and promoting agri-entrepreneurship that may help in sustainable agriculture and achieving food security in agriculture dominant developing countries.

Keywords: Developing countries, agricultural economies, agri-business, food security, climate change, agri-entrepreneurship, agripreneurship, strategies

The Impact of Remittances on Poverty - Empirical Evidence from Afghanistan

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Abstract

In this paper, I use quasi-panel data from the 2005-2012 National Risk and Vulnerability Assessment (NRVA) survey to examine the impact of international remittances on household poverty in Afghanistan. To estimate the causal effect as close as possible, this study applies propensity score matching to address household self-selection into international migration, beyond using a linear probability model with fixed-effects. I find that receiving remittances reduces the probability of falling into absolute poverty by 3 percentage points. However, the treatment effect on household poverty, as measured by caloric intake, is not statistically significant. Moreover, there is heterogeneity in the impacts of international remittances. I find a statistically insignificant treatment effect for urban households, while treated households in rural areas experience a significant and more pronounced effect. The results are robust to propensity-based weighted least square and also survive a series of robustness tests. The findings suggest that policies to facilitate foreign labor employment from urban areas may extend the desired effects to urban households. In addition, creating a competitive environment that lowers the cost of remittance inflows into the country may enhance the magnitude of the treatment effect.

***Keywords**:* Remittances, absolute poverty, calorie consumption-based poverty, rural, urban, Afghanistan

Creating Awareness about Biodiversity Conservation and Mitigation of Climate Change among College Students

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Abstract

Biodiversity or Biological diversity is the variety of life on Earth, in all its forms from genes and bacteria to entire ecosystem such as forests and coral reefs. Conserving and restoring the biodiversity is essential for limiting emissions and adapting to climate impacts. Biodiversity forms the web of life that we depend on for so many things *i.e.* food, water, medicine, a stable climate, economic growth, among others. Land and ocean absorb more than half of all carbon emissions. Today about one million species are threatened with extinction, many within decades. Irreplaceable ecosystems are turning from carbon sinks into carbon sources due to deforestation. About 85 percent wetlands, which absorb large amounts of carbon, have disappeared. Human activity has already altered over 70 percent of all ice-free land. When land is converted for agriculture, some animal and plant species may lose their habitat and face extinction. Climate change has altered marine, terrestrial and fresh water ecosystems around the world. It has caused the loss of local species, increased diseases, and driven mass mortality of plants and animals, resulting in the first climate-driven extinctions. Higher temperatures on land have forced animals and plants to move to higher elevations or higher latitudes. In the ocean, rising temperature increase the risk of irreversible loss of marine and coastal ecosystem. Climate change affects the health of ecosystems, influencing shifts in the distribution of plants, viruses, animals and even human settlements. These ecosystems and the biodiversity they contain, are natural carbon sinks, providing so called nature based solutions to climate change. Protecting, managing, restoring forests offers roughly two thirds of the total mitigation potential of all nature based solutions. Despite massive & ongoing losses, forests still cover more than 30 percent of the planet's land. Wetlands such as marshes and swamps cover only 3 percent of the world's land but they store twice as much carbon as all the forests. Preserving & restoring peat lands means keeping them wet so the carbon does not oxidise and float off into the atmosphere at the rates up to four times higher than terrestrial forests can. Their ability to capture & store carbon makes mangroves highly valuable in the fight against climate change.

Keywords: Awareness, biodiversity conservation, climate change, college students

India Newborn Action Plan: Transforming Newborn Health and Mortality Outcomes

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Abstract

The India Newborn Action Plan (INAP) is an extensive framework developed by the Government of India, under the umbrella of a larger Reproductive, Maternal, Newborn, Child and Adolescent health (RMNCH+A) strategy. Launched in 2014, it aligns with the Global Every Newborn Action Plan (ENAP) and aims to contribute towards the Sustainable Development Goal target of reducing neonatal mortality. The INAP directs focus on evidence-based interventions to reduce preventable deaths. It promotes essential newborn care practices, such as early initiation of breastfeeding, thermal care and infection prevention, while addressing key issues like preterm birth complications, birth asphyxia and neonatal sepsis. By equipping healthcare providers with necessary skills and resources, the program aims to enhance the quality of care delivered. It advocates the establishment of Newborn Care Corners (NBCCs) and Specialized Newborn Care Units (SNCUs) at different levels of health facilities, particularly in High-burden areas, to ensure availability of essential equipment, drugs and supplies for sick and preterm neonates. The INAP also emphasizes the integration of newborn care services with existing maternal and child health programs, creating a seamless continuum of care from pregnancy through early years of life. Human resource capacity building, including training programs for healthcare providers and motivating community participation is another essential pillar of the plan. Despite its significant demographic and cultural diversity, including rural-urban disparities, socio-economic gaps, gender inequalities and regional differences, India's progress in reducing child, infant and neonatal mortality rate has outpaced global decline. By 2020, it had surpassed most of the major targets set by ENAP, including establishment of SNCUs in over 83% of districts. The country aims to further reduce its current Neonatal Mortality Rate (NMR) and Still Birth Rate (SBR) of 21 and 17, respectively, to less than 10 by 2030.

Keywords: Neonatal mortality, RMNCH+A, specialized newborn care units

Patent analysis overview

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Abstract

For legal, commercial and scientific purposes, different search tasks arise in patents. These search tasks turn out to be non-trivial due to the mostly extensive material, but rather error-prone and time-consuming. This leads to the expectation to automate or at least simplify these search tasks with the help of search methods of natural language processing (NLP) and to increase their efficiency at the same time. For most search tasks, a classical keyword search does not really help: For example, it turns out to be difficult that patents sometimes operate with very general terms, because they try to "fence in" as large an area of intellectual property as possible. On the other hand, there are also very specific terms, such as neologisms or synonyms, which are also less suitable for a normal keyword search. When creating search algorithms, it must also be taken into account that the patent texts comply with certain formal rules (meta information, largely uniform patent sections), which give them a fundamentally similar structure. This workshop wants to explain some of the most common search tasks and search methods and how they can be and are automatized.

Keywords: NLP, **Patent,** error-prone, intellectual property, neologisms

Tradition and Modernity: African Cultural Perspectives on Death and after life

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Abstract

This article explores African cultural perspectives on death and afterlife. The concept of death is viewed differently in African cultures, where it is seen as a natural and inevitable part of life. Death is viewed as a transition from the physical world to the spiritual realm, and the afterlife is believed to be a continuation of life in another realm. The article discusses the beliefs, rituals, and practices surrounding death and the afterlife in different African cultures. It highlights the role of ancestors, spirits, and deities in the afterlife, as well as the importance of funerals, burial ceremonies, and mourning practices. The article also touches on the impact of modernization and globalization on African cultural beliefs about death and the afterlife. Overall, this article provides an insightful look into the rich and diverse cultural perspectives on death and the afterlife in Africa.

***Keywords*:** Africa, death, after life, culture, religion, ancestors

Why should you visit Ethiopia? Short story about Mama-Ethiopia-Africa (MEA)

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Abstract

The history of Ethiopia, like many ancient civilizations, stretches back thousands of years from 5th century, Kingdom of D'mt. We Ethiopians do not celebrate Independence Day; instead we have Adwa Victory Day over Italian army, on March 1, 1896. Therefore, all the heritages including domestic languages were kept as ancient. So that we don't have foreign language spoken as second language. We have our national language Amharic and about 100 ethnic group languages spoken. Ethiopia is also known as the Cradle of Humanity, because most famous, most iconic hominid fossils have been discovered within the country's borders. All current African ethnic groups are believed to descend from her kin who migrated into the heartland of Africa. Anthropologists have discovered the remains of the earliest known human ancestor in Ethiopia, Lucy/ Dinkinesh, dating to between 5.2 and 5.8 million years ago. Addis Abeba national museum is the right place to visit the historical ancient fossil. Another interesting trend in the country is the family structure. The societal values and family are major concerns of the community. Every neighbor is responsible to discipline every neighbor child when they see any wrong actions. Beside this the society is highly twisted with the trend of sharing and there is almost no space for individualism. A coffee ceremony is one of the most powerful tools strengthens the social life. Ethiopia is the foundation of coffee. It is common to drink coffee with others that can build strong social interaction. Public dish is the most common way how we enjoy our meal. We also have a special trend of feeding each other called GURSHA (□□□). Ethiopia is rich in various ancient stories, cultural adventures, and natural resources. The major reasons everybody should visit Ethiopia is because of Historical and Cultural Heritages, Unique Architecture, Breathtaking Landscapes, Rich Wildlife, Cultural Diversity, Delicious Cuisine, Warm Hospitality, and Adventure. You are welcomed to Visit Ethiopia!

***Keywords*:** Ethiopia, amharic, Addis Abeba, anthropologists, cultural heritages

The role of Religion in Tsore refugee Camps (Assosa Ethiopia)

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Abstract

In this study, we will touch on issues related to refugee camps in South Sudan, the events that led to the creation of camps, as well as religious life in the camps, the importance of religion in solving problems, religious conflicts and solutions, and then we will try to evaluate and conclude the article from the theological aspect based on our own experiences. The only safe environments that Sudanese people trusted and used throughout wars were camps. Southern was where the majority of neighbouring nations' camps was located; the oldest camp was Kakuma in Kenya, where South Sudanese refugees predominated; Pinyudo camp in Ethiopia, which was founded in 1993, was second to Kakuma. Sherkole and Bambasi, followed by Tongo, Tsore, and Gure Shambulla, were camps built during the Sudanese revolution and provided subsistence due to the legitimate policy that influenced how communities interacted with cultural change. Since independence; Sudan has become a weakened and impoverished state due to conflicts between governments in Khartoum and the South. In addition, years of violent fighting between the SPLA militia and the central government in South Sudan made it impossible to address the issues in other regions of the nation as the central government concentrated all of its resources on this one issue. The Republic of South Sudan's independence did not stabilize the region. On the contrary, South Sudan is experiencing new internal unrest due to new issues between South Sudan and Sudan. After the country declared independence in 2011, internal unrest-related deaths, immigration issues, and famine crises continued in South Sudan.

***Keyword*:** Refugee camps, shambulla, pinyudo, sherkole, cultural change, religion,tsore