Criterion - 7

Institutional Values and Best Practices

NAAC- SSR (2nd Cycle)

ETERNAL UNIVERSITY

BARU SAHIB, SIRMOUR-173101
HIMACHAL PRADESH

7.1.9(1)
Sustainable development Goals

ETERNAL UNIVERSITY
BARU SAHIB, SIRMOUR-173101
HIMACHAL PRADESH

SUSTAINABLE INSTITUTIONS OF INDIA

THE GREEN INSTITUTIONAL RANKINGS 2022

Certificate of Excellence

IN PURSUIT OF EXCELLENCE TOWARDS PRACTICING
SUSTAINABLE EDUCATION, THIS CERTIFICATE IS AWARDED TO

Eternal University

and is ranked No. 46 across India
in the Green Institutional Rankings 2022.

R
World Institutional
RANKING

Executive President

SUSTAINABLE INSTITUTIONS OF INDIA
GREEN RANKINGS 2023

Certificate of Excellence

IN PURSUIT OF EXCELLENCE TOWARDS PRACTICING
SUSTAINABLE EDUCATION, THIS CERTIFICATE IS AWARDED TO

ETERNAL UNIVERSITY

Institutional Grade : **A**

Institutional Band / Category : **Gold**

R
World Institutional
RANKING

Executive President

Eternal University

(World peace through value-based education)

Ref. No. EU/VCO/023/34

September 20, 2021

COMMITTEE FOR SUSTAINABLE DEVELOPMENT GOALS

The undersigned is pleased to constitute a committee for update and follow up on Sustainable Development Goals in the Eternal University:

a) Dr. Pritesh Vyas	-	Chairman
b) Col PPS Anand	-	Member
c) Dr. Manpreet Singh	-	Member
d) Dr. Yogendra Singh	-	Member
e) Mr. Ravinder Singh	-	Member

Vice Chancellor
Eternal University

Vice Chancellor
Eternal University
Baru Sahib (H.P.) 173101

Distribution:

All concerned

Office Copy

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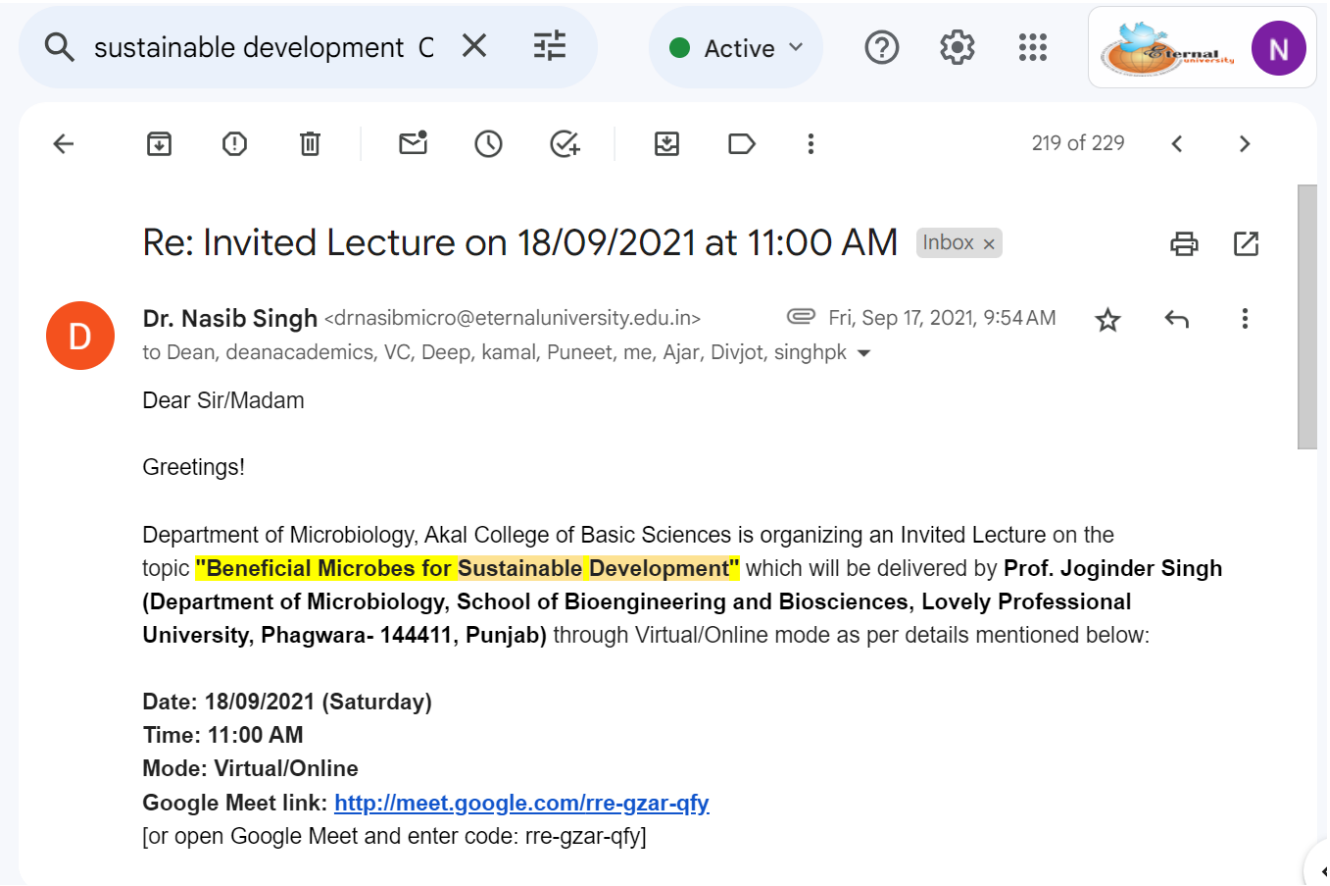
E-mail : contact@eternaluniversity.edu.in Web site: www.eternaluniversity.edu.in


sustainable development C
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219 of 229
Re: Invited Lecture on 18/09/2021 at 11:00 AM
Inbox ×
D
Dr. Nasib Singh <drnasibmicro@eternaluniversity.edu.in>
Fri, Sep 17, 2021, 9:54 AM
to Dean, deanacademics, VC, Deep, kamal, Puneet, me, Ajar, Divjot, singhpk
Dear Sir/Madam
Greetings!
Department of Microbiology, Akal College of Basic Sciences is organizing an Invited Lecture on the topic "Beneficial Microbes for Sustainable Development" which will be delivered by Prof. Joginder Singh (Department of Microbiology, School of Bioengineering and Biosciences, Lovely Professional University, Phagwara- 144411, Punjab) through Virtual/Online mode as per details mentioned below:
Date: 18/09/2021 (Saturday)
Time: 11:00 AM
Mode: Virtual/Online
Google Meet link: http://meet.google.com/rre-gzar-qfy
[or open Google Meet and enter code: rre-gzar-qfy]

Eternal University, Baru Sahib

(Under the Aegis of The Kalgidhar Trust)

Sustainability Report 2021

UN **SDG 17 Goals** mapping to our impact programs

Our Founding Saints

Sant Attar Singh Ji
(1866-1927)

Sant Teja Singh Ji
(1877-1965)

Baba Iqbal Singh Ji
Former Director
Agriculture-HP,
President-The Kalgidhar
Trust

Late Dr. Khem Singh Gill
Former V.C, PAU
Ludhiana

Our Visionaries

Entire Campus of
Eternal University, Baru Sahib, Himachal Pradesh

KEY PROGRAM SUMMARY

EDUCATION & SKILL BUILDING

PROGRAMS

- ✓ **Akal Institute of Rural Empowerment** – A flagship **Primary Teachers Capacity** building program : **100% tuition & residential aid** targeting **bottom 20%** of family income group
- ✓ **Community Kitchen** to provide **all-day FREE meals** support for over 500+ students & 50+ university staff members
- ✓ **STEM for Girls**- Programming & AI boot camps outreach programs for high school girl students by University Student volunteers & Industry experts
- ✓ **Integrated Farming Workshops** in collaboration with **NABARD**

SDGs

KEY PROGRAM SUMMARY

HEALTH & WELLNESS

PROGRAMS

- ✓ **Akal Charitable Hospital: Managed by** Volunteer students & Staff of Akal College of Nursing.
- ✓ **5 Village Adoption by Center of Public Health and administration, Eternal University** & MoUs with local Panchayats to deliver community impact programs in **Women & Child** Health, **Maternal** health, **Covid Pandemic** support, **Nutrition** awareness, **Sanitation & Cleanliness** drives, **Cognitive & Emotional health** development of child with **special needs**.
- ✓ 13 Villages in five different gram panchayats have been adopted by Dr. Khem Singh Gill Akal College of Agriculture under Mera Gaon Mera Gaurav scheme.
- ✓ **Akal Drug de-addiction Center, Baru Sahib** volunteer managed by Akal College of Health & Allied Sciences.
- ✓ **Dedicated Mental Health Counselling** Helpline for University Students.

SDGs

KEY PROGRAM SUMMARY

CLIMATE & ENVIORNMENT

PROGRAMS

- ✓ Promoting Green:
- ✓ A policy to only use stationary like file covers & Brochures which are made from recycled waste paper from Akal Waste Management System
- ✓ Promoting Sustainable Energy Solar energy panels for generating renewable energy.
- ✓ Biogas is generated using Cow dung and is used to prepare silage for animals at Akal Dairy Unit.
- ✓ Bio-diversity conservation & Enhancement Program
  - ✓ University Bee-keeping Apiary Unit at Maccher Village
  - ✓ Growth of Herb & Medicinal plants at Botanical garden
  - ✓ Vermicompost units to convert organic waste into manure

SDGs

KEY PROGRAM SUMMARY

ART & CULTURE

PROGRAMS

- ✓ Conserving Heritage: Unique distinction of Akal College of Music offering UG/PG in 9 heritage musical instruments – Tanti Saaz to women & thereby also addressing a critical gender inequity in Music
- ✓ Promoting Spirituality & Peace via daily performances in Gurmat music & global musical events & World Peace Day Webinars
- ✓ Achieving 100% employment of all Music graduates
- ✓ Promoting a culture of Volunteering & inculcate the values of giving back to community via several community outreach programs

SDGs

Community Development & Women Empowerment Success Stories

Akal Institute of Rural Women Empowerment (AIRWE) Eternal University

Empowering Rural Women

Akal Elementary Teacher Training Academy at Eternal University empowers **underserved** & **underrepresented rural women via valuebased education**

The Magic

Yearly **500 girls** belonging to low income group with several being orphans are educated from 10th until their graduation in Humanities, Commerce & Music.

Road Ahead

With more than 350 schools to be built this is a unique initiative which is not only transforming lives but also reducing a critical gap of quality teachers in the most remote areas of India

Impact Story : **Sustainability** with livelihood **via value-based education**

- **4,172** teachers employed till date in 129 Akal Academies in Northern India region
- **100% of the students are supported via employments in Schools or at University**
- Program serves low-income families falling into the bottom **10% of household income**
- More than **80%** of these students are **FIRST generation students** in their family
- The Kalgidhar Trust bears expenses of boarding, lodging & training

AKAL Waste Management System– Our CLIMATE Action
Towards a sustainable Community

800-1000 Kg/day

Wet Food, biomedical, paper, Dairy, plastic

Vermicomposting Unit

Incinerator

Biogas Digester

Sewage treatment Plant with capacity of 10 lakhs liter of water

Plastic bricks Making

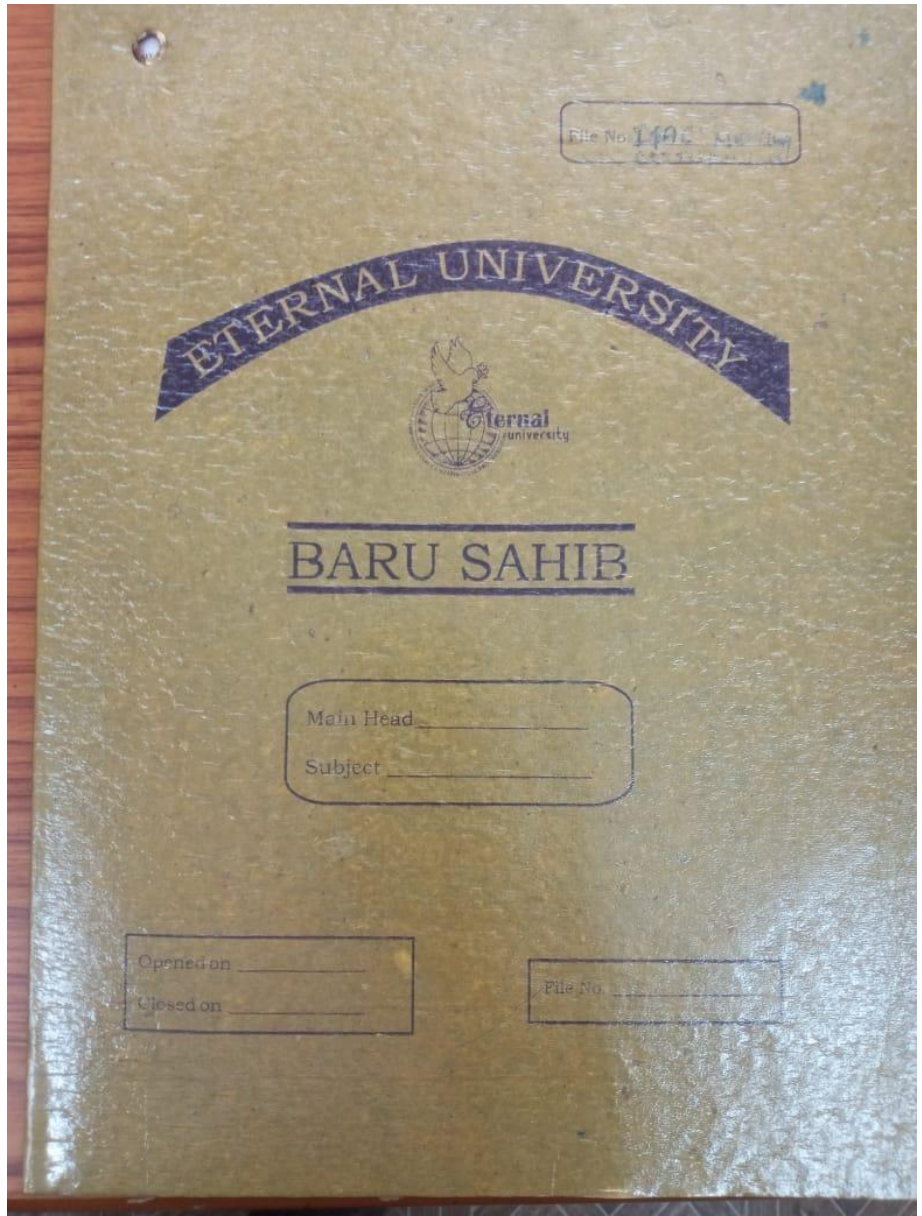
GREEN Pledge: Our CLIMATE Action

Made with waste recycled Paper

By Akal Waste Management Unit

As per green pledge, all our file folder covers are now 100% replaced with the recycled Waste paper and a pilot project is in session to print all brochures on the same paper.

This is a significant step in reducing the carbon footprint by Eternal University and our commitment to Climate Action



Parternship that Matters – IMPACT STORY of SUSTAINABLE Community Impact

Memorandum of Understanding

This Memorandum of Understanding is entered on 10 January, 2019.

Between:

Akal College of Nursing and Centre for Public Health and Healthcare Administration, Akal College of Health and Allied Sciences and Akal College of Education, Eternal University, Baru Sahib, District Sirmaur of the one part.

And

Panchayat, Lana Bhalta, Block Pachhad, District Sirmaur of the second part.

Each of Akal College of Nursing and Centre for Public Health and Healthcare Administration, Akal College of Health and Allied Sciences and Akal College of Education, Eternal University, Baru Sahib, District Sirmaur will be referred to as one party and Panchayat Lana Bhalta Block Pachhad, District Sirmaur, will be another Party and collectively both of them will be referred to as Parties.

Preamble

For the improvement of Maternal and Child health, providing health education to mother and children and appropriate schooling to the children, the need for cooperation has been realised by Akal College of Nursing and Centre for Public Health and Healthcare Administration, Akal College of Health and Allied Sciences and Akal College of Education Eternal University Baru Sahib, District Sirmaur and Panchayat, Lana Bhalta, Block Pachhad, District Sirmaur.

Co-operation between Akal College of Nursing and Centre for Public Health and Healthcare Administration, Akal College of Health and Allied Sciences and Akal College of Education, Eternal University, Baru Sahib and Panchayat, Lana Bhalta, Block Pachhad, District Sirmaur.

To formalize this co-operation, it has been agreed to sign a Memorandum of Understanding (MoU) between Akal College of Nursing and Centre for Public Health and Healthcare Administration, Akal College of Health and Allied Sciences and Akal College of Education Eternal University Baru Sahib and Panchayat Lana Bhalta, Block Pachhad, District Sirmaur:

a. Akal College of Nursing will undertake responsibility for providing consultation to Panchayat Lana Bhalta for Women and Child health and will suggest new interventions for the improvement of the same as required.
b. Centre for Public Health and Health Care Administration will generate awareness on the nutritional requirements of pregnant and lactating mothers and children under five years of age in the wards covered by Panchayat Lana Bhalta.
c. Centre for Public Health and Health Care Administration will also provide health education to adolescent girls in the wards covered by Panchayat Lana Bhalta for maintaining their nutritional status and menstrual hygiene.
d. Akal College of Education will undertake responsibility for providing consultation on best education practises for the child population in the wards covered by Panchayat, Lana Bhalta.
e. Akal College of Education will also work in close collaboration with Panchayat Lana Bhalta for cognitive, emotional and mental development of the children with special needs.
f. Akal College of Education will safeguard the admission of students in Akal Model School (for which it acts as a consulting body) residing in the wards covered by Panchayat Lana Bhalta.
g. All the parties will jointly administrate projects with both long term and short-term goals, keeping in view the interests and philosophies of both the parties.
h. The MoU shall remain valid for a period of five years w.e.f. the date of signing and shall be extendable further on mutual consent.

Areas of co-operation

The areas of co-operation will be defined and modified from time to time by mutual decision of both the parties.

Seal of parties

This MoU has been executed in two originals; one of these has been retained by Panchayat, Lana Bhalta, Block Pachhad, District Sirmaur and the other by Akal College of Nursing, Centre for Public Health and Healthcare Administration, Akal College of Health and Allied Sciences and Akal College of Education, Eternal University, Baru Sahib, District Sirmaur.

For and on Behalf of Panchayat, Lana Bhalta

Signed by:

(.....)

प्रधान
ग्राम पंचायत लाना भलटा
डा॰ छपाग त॰ पच्छाद
जि॰सिरमौर (हि.प्र.)

Panchayat, Lana Bhalta

Witness:

BAKHSISH SINGH

(.....)

For and on Behalf of Akal College of Health and Allied Sciences and Akal College of Education

Signed by:

(.....)

Dr. Neelam Kaur
Dean of Faculty
Health Sciences
Eternal Univers
Baru Sahib (HP

Baru Sahib (H.P.)

Dean
Akal College of Health and Allied Sciences and Akal College of Education, Eternal University, Baru Sahib, District Sirmaur

Witness

(.....)

JR. SAHIBSINGH ADVANI

कार्यालय ग्राम पंचायत लाना भलटा

विकास खण्ड व त० पच्छाद, जिला सिरमौर (हि०प्र०)

प्रधान
रूपिन्द्र कौर

क्रमांक: -

दिनांक:- 20/08/2020

LETTER OF APPRECIATION

The Panchayat Lana Bhalta extends its appreciation to the Centre for Public Health and Healthcare Administration, Eternal University, Baru Sahib for its guidance and extending its scientific temperament for sanitation and cleanliness in the wards governed by the Panchayat.

The Panchayat Lana Bhalta was awarded the Deen Dayal Upadhyay Panchayat Sashaktikaran Puraskar 2020 for sanitation at the National Level. A considerable credit for the same goes to the consultation provided by Centre for Public Health and Healthcare Administration, Eternal University, Baru Sahib.

प्रधान,

प्रधान
ग्राम पंचायत लाना भलटा
डा॰ छपाग त॰ पच्छाद
जि॰सिरमौर (हि.प्र.)

ग्राम पंचायत लाना भलटा

जिला-सिरमौर (हि.प्र.)।

Sustainable Development Goals & Universities: Way Forward
National Conference on Sustainability

Key Action & Pledges

- Eternal University will further develop the Sustainable initiatives like Waste Management, Rural Agriculture empowerment & Gender Upliftment via partnerships like IRMA, SED industries

- EU will establish more formal mechanisms and programs to create awareness in community for SDG goals and bring to the front the already significant impact programs like Poverty alleviation, Food security & uplifting the underserved

- EU will create Carbon offsetting projects & invite the corporates and organization to contribute in reducing the overall carbon footprint

The conference was organised through **nine different sessions** which included inaugural, valedictory and seven technical sessions. More than 100 participants including faculty members, research scholars and postgraduate students from various colleges of Eternal University participated on the above theme about Sustainable Development Goals (SDGs).

Sustainable Development Goals & Universities: Way Forward
Poster Competition from biodegradable wastes

Sustainable Development Goals & Universities: Way Forward

1. Poster Competition (23 rd October, 2021)

A total of 91 EU students participated and prepared Hand- made Posters on the chart papers (developed from biodegradable wastes) and depicted different SDGs through their art and painting.

2. A Talk by Dr. N.P. Singh on Sustainable Development Goals & Universities: Way Forward (27 th October 2021)

A seminar was delivered by Dr. N.P. Singh on the Topic Sustainable Development Goals & Universities: Way Forward in which the role of University was comprehensively explained in achieving sustainable goals. Hon'ble Vice Chancellor Dr. Davinder Singh reiterated the need of sharing the resources and helping the neediest. At the end of the event, Dr. Pritesh Vyas, Chairman of the SDG committee delivered his Vote of Thanks.

Sustainable Development Goals & Universities: Way Forward
Climate Action & Deliberations on SDGs

Eternal University Baru Sahib organized a workshop on "Fabrication of Low Cost Solar Drying System"

Sustainable Development Goals & Universities: Way Forward
Integrated Farming FREE training for Local & Marginal Farmers – Impacting Poverty

5-days targeted training program impacting **40 local small & marginal farmers** was organized at the premises of Eternal University in collaboration with **NABARD** entitled "Integrated Farming System with Allied Sectors for Socio- economic Upliftment of Rural Farmer Families of Himachal Pradesh".

The training was given on enterprises as:

- Dairy farming
- Vermicomposting
- Silage making
- Horticultural/Agricultural farming
- Food processing
- Rain water harvesting.

2nd Farmer's Training

NABARD sponsored 5 days On-Campus Training Program

2nd Farmer's Training

5-days training program was organised at the premises of Eternal University under the NABARD sponsored project entitled "Integrated Farming System with Allied Sectors for Socio-economic Upliftment of Rural Farmer Families of Himachal Pradesh". In this program demonstration was given to the farmers on Integrated Farming Model (IFS) at University farm. IFS represent an appropriate combination of farm enterprises. The waste material of one enterprise is used as input for the productive functioning of other enterprise. This is an effective strategy in raising incomes, generating employment and alleviating poverty among small and marginal farmers. The training was given on enterprises as dairy farming, vermicomposting, silage making, horticultural/agricultural farming, food processing and water harvesting. It will impart awareness and new learnings to the local farmers of this area. These trainings were for 05 days with 40 participants and also including one day exposure visit to UHF, Nauni.

Development of biofortified wheat with high grain iron and zinc for alleviating hidden hunger

About two billion people of the world dependent on staple cereal and tuber food crops are suffering from iron and zinc micronutrient deficiency. The project proposal was aimed at alleviating the micronutrient deficiency through biofortification of wheat cultivars for higher grain iron and zinc content. A number of related wild progenitor and non-progenitor species possessing high grain iron and zinc had been identified and their chromosomes carrying the genes for micronutrient uptake, translocation and sequestration introgressed into elite wheat cultivars as alien transfers, substitution and addition lines through wide hybridization and molecular cytogenetic approaches. Such derivatives were used for dissecting the alien genomes for detailed investigation of the pathways and genes leading to high grain iron, zinc and other micronutrients. Wheat cultivars with different small alien transfers controlling high grain iron and/or zinc without any appreciable linkage drag were used for pyramiding and development of cultivars with higher grain micronutrients for meeting the RDA of the micronutrients. Such biofortified cultivars can be further used for studies for enhancing bioavailability of the micronutrients and cloning genes affecting grain micronutrient concentration.

Achievements:

The wheat-*Aegilops* derivatives with high grain micronutrient have mostly the substitution/addition of group 2 and 7 chromosomes indicating that the most of the genes for micronutrients uptake/translocation/seed sequestration are on these chromosomes as reported in QTL mapping studies.

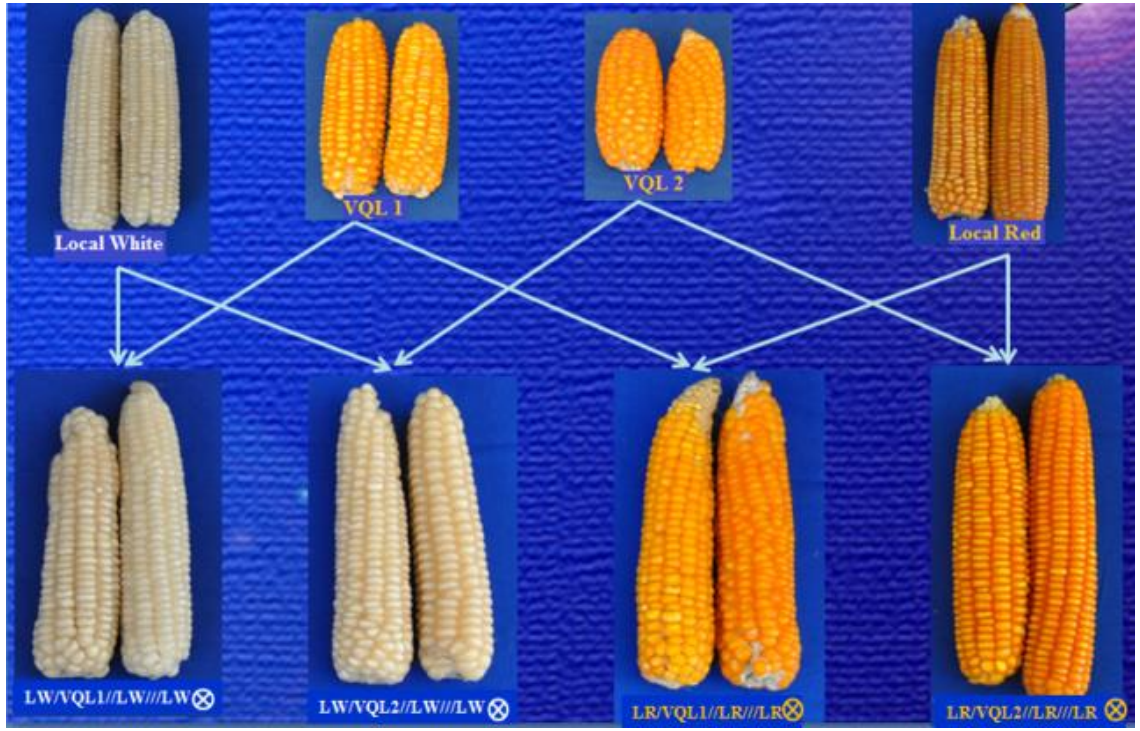
Most of these alien-*Aegilops* chromosomes in the addition/substitution lines having high micronutrient content have been transferred to high yielding and rust resistant backgrounds of predominant wheat cultivar PBW343 *LrYr*.

Appropriate crosses of most of the wheat-*Aegilops* derivatives have been made with *ph1bph1b* stock or through their pollen irradiation for fine transfer of useful variability with reduced linkage drag.

Analysis of intron targeted amplified polymorphic (ITAP) markers confirmed the precise transfers of the genes for micronutrients uptake/translocation/seed sequestration from *Aegilops* species.

Development of Maize lines with high protein content and popping volume

Maize (*Zea mays* L.) is a major cereal crop for livestock feed, human consumption and several industrial uses as well. Because of all these benefits, maize has become a choice among major crops for farmers in developing countries. But maize is deficient in lysine and tryptophan. Deficiency of these two amino acids causes some of the fatal diseases like pellagra, kwashiorkor etc and also malfunctions due to lack of proteins. Genotypes with *opaque 2* (o2) allele and o2 modifiers having increased lysine and tryptophan level but without the negative effect of soft endosperm were developed and termed as 'Quality Protein Maize' (QPM). Here in Eternal University we have developed maize lines with high protein content (high Lysine and Tryptophan amino acids) and popping volume in the local white and local red background using molecular breeding.



Development of Maize lines with high protein content.

Development of Maize lines with high popping volume

Sustainable Development Goals & Universities: Way Forward
Sustainable Agriculture

Akal College of Economics, Commerce and Management, Eternal University, Baru Sahib and HP Crop Diversification Promotion (HPCDP-JICA-ODA) Project, Hamirpur jointly organized two days seminar sponsored by ICSSR, North-West Regional Centre, Chandigarh on A**griculture Diversification and Vulnerability of Climate Change for Sustainable Food Security and Livelihoods in North-Western Himalayas** on 25-26th March, 2019.

In all, 13 research papers and 2 progressive farmers' success stories were presented and thoroughly discussed during different technical session with focus on

- Diversification of crops with high nutritional values
- Impact of different levels of crop diversification on cropping pattern
- Income & employment generation;
- Current status of agriculture diversification and problems and prospects of crop diversification in horticulture farming of H.P

Sustainable Development Goals & Universities: Way Forward
Sustainable Agriculture

Research and Development Related toSustainable Development Goals (SDGs) on Organic Farming (Department of Zoology)

The major industry responsible for fulfilling the nutritional requirement of every person is the agricultural industry. But the major challenge in the agricultural industry is the crop losses due to attack of insect pests. We are working over the biocontrol attribute of entomopathogenic nematodes (EPNs) against various lepidopteran insect pests since 2019 at Eternal University Baru Sahib, Tehsil Pachhad, District Sirmour, Himachal Pradesh. EPNs were isolated from the soil of fruit orchards from various districts of Himachal Pradesh. Bio-formulations were prepared in the form of sponge stock as a liquid formulation. Various bioassay studies were performed in the laboratory to instigate the insecticidal potential of these isolated EPNs.

After getting the successful results under the laboratory bioassay studies, these EPNs were then applied against the lepidopteran insect pests under protected cultivation. Application of these EPNs has been found as an excellent approach in the field of sustainability. The EPNs are highly virulent, easy for application, safe for non-target animals and are the best alternative in comparison to harmful chemical insecticides. Under the protected cultivation sponge stock formulation of EPNs were applied against the insect pests of cabbage and broccoli. These EPNs were proved as a brilliant source of biocontrol agents than harmful chemical insecticides, in managing the insect pest's population. The produce thus recovered was organic and is free from chemical residue. Even studies were going on in the Department to evaluate the insecticidal potential of these biocontrol agents in the open field also. The application of nematode based formulations will become a boon to the local farmers of this region, for the management of wide range of insect pests.

APPLICATION OF BIOPESTICIDE (EPNS) UNDER PROTECTED CULTIVATION

Extension Activities report on field trail at farmer's field

Field trail at farmer's field under Department of Science and technology (DST) sponsored project entitled **"Application of indigenous entomopathogenic nematodes as biocontrol agents for the management of insect pests of tomato (SP/YO/506/2018-G)"**

Name: Dr. Neelam Thakur

Demonstration location: Village Pab (Wasni), Sirmour

Number of participants: 15-20 farmers

Date: 23rd & 24th August, 2021

Sustainable Development Goals & Universities: Way Forward
Sustainable Agriculture

Research and Development Related to Sustainable Development Goals (SDGs) on Vermicomposting (Department of Zoology)

Eternal University, Baru Sahib is the first girls University of Northern India located in the Sirmour district of Himachal Pradesh. It is an academic institution with an emphasis on research work that helps in upliftment of the rural people in district Sirmour of Himachal Pradesh. The faculties and students of this university have adopted 5 village Panchayats of Sirmour district under Unnat Bharat Abhiyan for extension services, training and transfer of latest technology among the villagers for their inclusive development. Keeping this in view, our University has established two **"Vermicompost Units"** each of approximately 20x20 feet. In these units, we are using *Eisenia fetida* species of earthworm for conversion of organic waste into compost. This species of earthworm is considered as the most promising species for decaying organic matter in a less time. We are providing training to Agricultural students and to local farmers on the process of making vermicompost from organic waste materials. We are also organising on campus training programmes for local farmers and during these trainings farmers were made aware about the uses of bio fertilizers (compost) which is economically viable and sustainable.

UNIVERSITY VERMICOMPOST UNIT ATKAKHLI

Research and Development Related to Sustainable Development Goals (SDGs) on Beekeeping (Department of Zoology)

We have established beekeeping **"Apiary Unit"** in 2017-2018 at Eternal University Baru Sahib, Tehsil Pachhad, District Sirmour of Himachal Pradesh with 10 bee hives boxes of European honey bee (*Apis mellifera*) especially to meet the SDGs as it is mainly focused on socio-economic upliftment of rural farmers as well as maintained the environmental sustainability. Due to quality production, our honey is in huge demand but production cannot meet the demand thus we expanded this unit.

The main products of beekeeping are honey, bees wax, propolis, royal jelly and pollen. Bee products, especially honey is an important source of nutrition, medicine and additional enterprise to the farmers to generate extra income. Small farmers consider honey as a cash crop instead of a product for home consumption. The nearby areas of Eternal University have large proportion of unapproachable lands for agriculture and are covered with various types of medicinal plants and wild flowers that make this part of the region a high potential area for beekeeping. During on campus beekeeping training programmes, local farmers were made aware about the production of high quality wax and honey using local technology. When beekeepers were taught about the value of ' bee-loving' trees and the bees' pollination activities, they were more willing to preserve forest habitat intact thus reducing erosion and landslides which are common in this steeply mountainous area. Beekeeping is a sustainable resource-based farming system without negative impact on ecology, agricultural activities and resource conservation programs.

UNIVERSITY BEEKEEPING APIARY UNIT AT MACHHER

Solar and Smart Energy Systems for Sustainable Environment

Akal College of Engineering and Technology, Eternal University, Baru Sahib organized a National Workshop on "Solar and Smart Energy Systems for Sustainable Environment on 6-7 April 2018. This workshop began with inaugural speech of Baba Iqbal Singh Ji, Hon'ble Chancellor of Eternal University and other expert lectures. More than 130 delegates will came for participating this workshop. This workshop covered theoretical and hands-on experience on Solar Photo-voltic, Solar Thermal Energy Conversion and Storage Devices, Smart Grid, Energy Management and Audit.

Sustainable Development Goals & Universities: Way Forward
Sustainable Agriculture & Climate Awareness

Plantations Drives

Plantation Drive was conducted in Akal College of Education on 6th April,2019 under Eco Club. All B.Ed. trainees participated in it by planting plants near road.
The objective of it was to create environment awareness among students and at the same time making our earth pollution free

Kisan Mela-2019

Kisan Mela-2019

The Akal College of Agriculture, Eternal University organized the annual 4th Kisan Mela on April 14, 2019. Hon'ble Sh. Rakesh Kanwar (IAS), Director-cum- Ex-Officio-Spl. Secretary, Panchayati Raj Department, Govt. of Himachal Pradesh was the Chief Guest of the occasion

Sustainable Development Goals & Universities: Way Forward
Impact Story for Women Empowerment through value-based Education

Vaishali Panwar
Age: 24 Years

**VILLAGE SARPANCH,
PANCHAYAT NARANG**

BSc.(Hons)Agriculture
Eternal Univesity,
Baru Sahib

Member of Disha Committee
District Sirmaur, Himachal Pradesh

Meet the Entrepreneur

Technology can be liberating !

Mandeep Kaur, Age 22 years
Btech Comp Science bagged a plush job with highest package in a product based company.

But she wanted to solve a problem for the region and hence created a non-profit startup called Techshilla ,Baru Sahib incubated at Eternal University with the aim of skilling the girls in programming while creating a Volunteer chain of girl students to sustain it

Eternal University
Presents
Girls High School Outreach program
by
Techshilla, Baru Sahib

WHERE GIRLS CODE HAPPINESS
TechShilla
Powered by Eternal university

Python Coding Bootcamp For Akal Academy Girls

Every Saturday

4 PM- 6:30 PM

By Invitation : Girl Students of Akal Academy , BaruSahib
www.eternaluniversity.edu.in

Arshita Maini
Volunteer Mentor, Techshilla
BTech (CSE)

Sukhjeet Kaur
Volunteer Mentor, Techshilla
BTech (CSE)

Mandeep Kaur
(Founder TechShilla.org)
Techshilla is 1st Startup incubated at Eternal University, BaruSahib By Alumni

Eternal University

Education Impact & New Initiatives

- Value Based Education with spiritual rejuvenation
- Promoting women empowerment
- Goal oriented course curriculum
- Drug/Smoking & ragging free environment
- Global alliances with international companies and universities
- Free Education & lodging aid to 500+ students annually under AIRWE
- Vibrant and productive academic environment
- Addition of new courses for upscaling Academic perspectives

SOUVENIR

NABARD

Organized by

University Corporate Resource Centre, Eternal University, Baru Sahib
Sirmour-173101, Himachal Pradesh

Disclaimer

The opinions expressed in this souvenir are personal views of individual author and in no way reflect the opinion of editor. The individual author (corresponding author) is solely responsible for the contents in his/her write-up and the Editor task no responsibility in this regards. The papers/abstracts in this souvenir are of the International Conference on "Water, Agriculture, Dairy and Food Processing for Sustainable Economy (WADFPSE-2022) held at Eternal; University, Baru Sahib, Sirmour, Himachal Pradesh on March 25-26, 2022.

Edited by

Ajar Nath Yadav
Ambika Sharma
Deep Chandra Suyal
Divjot Kour
Puneet Negi
Sunil Kumar

Published By

Eternal University, Baru Sahib

Sant Attar Singh ji
1866-1927

Sant Teja Singh ji
1877-1965

The great visionary of 20 century (Sant Attar Singh ji) had a vision that modern scientific education alone will not serve the humanity well, until and unless it is amalgamated with Braham Vidya (Spiritual Education). He was requested by Bharat Ratna Pt. Madan Mohan MalviyaJi to lay the foundation stone of Banaras Hindu University, Varanasi.

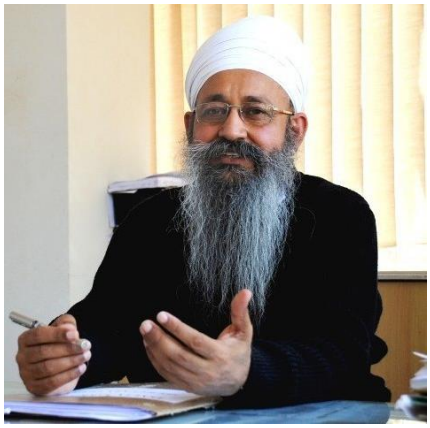
OUR MISSION

To Establish Permanent Peace in the World Through Value Based Scientific Education, Spiritual Rejuvenation and Women Empowerment.

Padma Shri Baba Iqbal Singh Ji
[1926-2022-Always]

Founder Chancellor, Eternal University
Founder President, Kalgidhar Trust, Baru Sahib, India
Shiromani Panth Rattan by Takhat Sri Harmandir Sahib, Patna
Vidya Martand Award by Sri Akal Takht Sahib
Sikh Lifetime Achievement Award (London) -2012
Former Director, Agriculture (Government of HP, INDIA)

Dr. Davinder Singh
Vice Chancellor
Eternal University
Baru Sahib, Himachal Pradesh



Message

I am glad to know that “University Corporate Resource Centre” of Eternal University, Baru Sahib is organising two days International Conference on “Water, Agriculture, Dairy and Food Processing for Sustainable Economy (WADFPSE-2022)” at Baru Sahib from March 25-26, 2022 with highly relevant themes to cover the latest advances in “Sustainable Economy” for agriculture, environment, natural resources, economic and human health security. Sustainability is the capacity to endure in a relatively ongoing way across various domains of life. In the 21st century, it refers generally to the capacity for Earth's biosphere and human civilization to co-exist. It is the process of people maintaining change in a homeostasis-balanced environment, in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. Sustainability is known through the interconnected domains or pillars like environmental, economic and social and sub-domains of sustainable development such as cultural, technological and political. This conference will provide a common platform and a golden opportunity to the distinguished scientists, economists, administrators, policy makers and research scholars to share their valuable experience, work and concern on the latest advances for harmonious use of natural resources for future sustainability. Faculty, staff and students of the Eternal University, Baru Sahib would be pleased to volunteer and extend their full support to the organizers of the conference and delegates for comfortable visit, stay and deliberations to make the conference a grand success.

March 19, 2022
Baru Sahib

Dr. Davinder Singh

Prof. Amrik Singh Ahluwalia
Pro-Vice Chancellor
Eternal University
Baru Sahib, Himachal Pradesh

Message

It's my pleasure that the “University Corporate Resource Centre” is organising an International Conference on “Water, Agriculture, Dairy and Food Processing for Sustainable Economy (WADFPSE-2022)” at Baru Sahib from March 25-26, 2022. The "sustainability" encompasses uses of natural, renewable resources that people can continue to rely on their yields in the long term. Sustainability can involve social challenges that entail international and national law, urban planning and transport, supply-chain management, local and individual lifestyles and ethical consumerism. The broad themes for sustainability is reorganizing living conditions; reappraising economic sectors (Green building, sustainable agriculture) or work practices (sustainable architecture); to develop new technologies (green technologies, renewable energy and sustainable fission and fusion power) and adjusting individual lifestyles to conserve natural resources. This conference will provide a common platform and a golden opportunity to the distinguished scientists, research scholars, scientists, academicians, and policy makers to share their valuable experience, work and concern on the current trends on sustainability, related to agro-environmental, biodiversity, climate change mitigation, renewable energy, social inclusion and urban sustainability issues. Organizing this conference (WADFPSE-2022) will help the scientists and researchers to gain new ideas and derive inspiration from the learned scientists, researchers and delegates.

I convey my best wishes to the organisers and the participants and wish this event a grand success.

March 19, 2021
Baru Sahib

Prof. Amrik Singh Ahluwalia

Department of Biophysics
ALL INDIA INSTITUTE OF MEDICAL SCIENCES
Ansari Nagar, New Delhi-110 029, India

PROF.T.P. Singh, Ph.D., D.Sc. (*hc*)
FTWAS, FNA, FASc, FNASc, FBRS
DST-SERB Distinguished Fellow
Honorary Distinguished Professor

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Mobile : 093122 49508

Message

I offer my heartiest congratulations to Eternal University, Baru Sahib, HP for organizing an International Conference on "Water, Agriculture, Dairy and Food Processing for Sustainable Economy (WADFPSE-2022)" in association with the IRMA Water Centre, IRMA on 25-26 March, 2022.

This is a great initiative by the University to indulge in such an academic pursuit as such pursuits are the need of the hour. I am sure that the deliberations of the Conference comprising of distinguished delegates as well as students and researchers will help in generating a stimulating thought process.

I take the opportunity to wish the organizers the very best and I hope that it turns out to be an intellectually rewarding experience for one and all.

Sincerely,

Professor T. P. Singh

INTERNATIONAL CENTRE FOR GENETIC ENGINEERING AND BIOTECHNOLOGY

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February 25, 2022

Message

It is very heartening to note that Eternal University, Baru Sahib is hosting an International Conference on “Water, Agriculture, Dairy and Food Processing for Sustainable Development” from March 25-26, 2022. The topic of the seminar is very important and of relevance in terms of meeting some of the UN development goals of providing water, food and nutrition security for the ever increasing population, especially in the developing world. Each of the key word in the topic, on one hand, is a subject of independent study and research yet on the other hand one can see an overlap and connectivity from the point of view of removing hunger and meeting the basic needs for the survival of the mankind. Agriculture is the main sector that utilizes over 70% of water for food production and the availability of this water is under constraint due to rapid urbanization and increase in population. The major water reservoirs in the form of glaciers are also melting due to global warming. Dairy animals are dependent on water as also on agriculture produce. Thus one finds a link between water, feed and food, and survival of animals. It has also been calculated that lot of fresh food and grains are lost due to post harvest mismanagement. Hence, food processing is essential to minimize the loss, as also important for value addition to meet the nutritional requirement in the target population.

I am sure experts will deliberate on various scientific and societal issues related to the theme of the conference and bring out the challenges before the Nation and simultaneously suggest solutions which will ensure sustainable development, even under the climate change scenario.

I wish the conference all the success and laud the organizers for bringing this important theme in focus for discussion.

Prof. Sudhir K Sopory
SERB Distinguished Scientist and Senior Emeritus Scientist
Former Vice-Chancellor, Jawaharlal Nehru University, New Delhi

Mathew Cherian
Chairperson

Message

I am glad to know that Baru Sahib Eternal University and Institute of Rural Management, Anand (IRMA) is organizing an International Conference on "Water, Agro, Diary & Food Processing for a Sustainable Economy " which is very relevant to the current crisis facing the world with climate change almost imminent. I have taught at Baru Sahib and I think the institution is so relevant with very good students who combine intellectual knowledge with passion. As an Alumnus of IRMA, I think the institution has built my career in the voluntary sector and has helped me achieve some major milestones working with marginalized elderly, women and children.

This conference will be a game changer for the nation and I am happy to convey to the organizers my good wishes and wish them all success.

Mathew Cherian

Address: CARE INDIA, NSIC Business Park, 411, 4th floor, OKHLA, New Delhi -110020

water for people
INDIA TRUST

Professor Balveer Arora (JNU Retd)
President
Water for People India Trust

Message

I am pleased to note that the E**ternal University** at Baru Saheb, Himachal Pradesh is organizing a two-day International Conference on **"Water, Agriculture, Dairy and Food Processing for a Sustainable Economy"** on 25th-26th March 2022 in Collaboration with IRMA, Anand. India is a vibrant federal democracy that is poised to assume its rightful place among the prominent economic forces of the world in the decades ahead. With our large population whose living conditions we are eager to ameliorate, the demand on our already stressed water resources is bound to grow. We need to look beyond the immediate horizons into questions of land and water productivity in agriculture, as well as more productive dairy and food processing sectors. The programme of sessions is very impressive and well thought out. I hope that the deliberations of the galaxy of eminent scholars and practitioners assembled will help in charting a viable and sustainable roadmap. Hopefully we will have, at the end of these deliberations, greater clarity on how we should approach our developmental goals, ever mindful of a sustainable path. In this context, the motto of Water for People, 'Everyone, Forever' may help draw our attention to the two intertwined dimensions: the need for an inclusive as well as a sustainable approach.

I wish the conference very successful deliberations and congratulate the organisers for taking such a timely initiative.

New Delhi, 21st March 2022

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Tel.: +91 6222 257321

www.india@waterforpeople.org

Basudev Mukherjee
Assistant Secretary General
ASSOCHAM

Message

I am delighted to learn that the University Corporate Resource Centre (UCRC), Eternal University, Baru Sahib in association with Institute of Rural Management, Anand (IRMA) is organising the International Conference on "Water, Agriculture, Dairy and Food Processing for Sustainable Economy" on March, 25- 26, 2022. The world, at present, is standing at the cusp of trepidation and equanimity both. At the second COP26 Climate Change Summit, at Glasgow, India Inc., stood tall with PM Modi in announcing its commitment towards climate change. It was a very proud moment for each one of us when the Hon'ble Prime Minister of India, Shri Narendra Modi pointed out to the world that India is the only major economy in the world to deliver its promise on the Paris Agreement on climate change. Sustainable agriculture can play an important role in ensuring responsible consumption and production, especially when around 30 percent of global biodiversity threats are due to consumption of food commodities. Developing sectors such as sustainable agroforestry, fishery and ecotourism sectors could provide alternative sources of employment and economic opportunities to various rural communities across the length and breadth of the country. In addition, we believe that with a large segment of the labour force in the country are in the agriculture sector, training them in sustainable agriculture practices, and empowering them through financial inclusion etc., will play an instrumental role in ensuring holistic development of the agrarian sector.

I am sure that the eminent speakers at the conference will help lay the roadmap towards a more sustainable development of the agriculture and allied sectors and I look forward to the deliberations of this conference.

भा.कृ.अनु.प.–भारतीय चरागाह एवं चारा अनुसंधान संस्थान
ICAR-Indian Grassland and Fodder Research Institute

डॉ. अमरेश चन्द्रा एफएनएएएस
निदेशक
Dr. Amaresh Chandra FNAAS
Director

Message

I offer my good wishes to the entire family of Eternal University, Baru Sahib, HP for organizing an International Conference on " Water , Agriculture, Dairy and Food Processing Industry " in association with the IRMA Water Centre, IRMA on 25-26th March , 2022.

It is a great endeavour on the part of the university. Hope it brings out the best in the field concerned with participation of questioning minds.

I take the opportunity to wish the organizers good luck and also extend my wishes to the scholarly minds that will be a part of this event.

Dated: 22.03.2022
ICAR-IGFRI

(Amaresh Chandra)

निकट पहूज बाँध, ग्वालियर मार्ग, झाँसी-284 003 (उत्तर प्रदेश) भारत/
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ई-मेल/E-mail : director.igfri@icar.gov.in, amaresh.chandra@icar.gov.in

Gujarat Co-Operative Milk Marketing Federation Limited

P.B. NO. 10, ANAND 388 001, INDIA • PHONES: (91) 2692 - 240180, 221202, 221212 • FAX: 240208

E-mail: sodhi@amul.coop

MANAGING DIRECTOR
Mdo:

21st March, 2022

It is my immense pleasure to know that Eternal University, Baru Sahib has organized two days international conference on "Water, Agriculture, Dairy and Food Processing for Sustainable Economy".

I personally feel that availability of "WATER", its effective utilization and intervention in water management technology for all filed is the key in current and next decades. Future of agriculture, animal husbandry, dairy and food processing depend on how effectively we can utilized the "WATER" – The most precious natural resources. Since all over the world demand of agriculture, dairy and processed food is increasing it is duty of all stakeholders to brainstorm and provide effective solutions.

I am sure all stakeholders have fruitful and healthy discussion during the two days conference and that will create path for future.

Thanking you,

Yours faithfully,

(Dr R S Sodhi)

Amul SAGAR

HARTEK®

Message

It is a pleasure to know that Eternal University, Baru Sahib, HP is organizing an International Conference on “Water, Agriculture, Dairy and Food Processing Industry” in association with the IRMA Water Centre, IRMA on 25-26th March, 2022. The theme of the conference is well picked as this area demands scholarly insights from time to time. I hope that this conference will provide an enriching experience to one and all, my heartfelt congratulation to the university and all the delegates for attending this event. This is going to be a very insightful and successful conference while having participation from pan India as well as from Bangladesh, Srilanka, USA, Canada, Denmark, Australia, South Korea etc.

I wish the speakers, organizers and the participants a very best of luck!

Warm Regards

Hartek Singh

Chairman & Managing Director

Hartek Power Pvt. Ltd.

About the Eternal University

The University came into existence with the visionary grace of Baba Iqbal Singh ji, former Director Agriculture, Himachal Pradesh, President Kalgidhar Trust and Hon'ble Chancellor of the Eternal University. According to him "...modern scientific education alone will not serve the humanity well, until and unless it is amalgamated with spiritual education". He has effectively translated the visions of Sant Baba Attar Singh Ji (Mastuana wale) and Sant Teja Singh Ji by establishing the first Akal Academy in 1986 at Baru Sahib. Later, it spread to a network of 130 CBSE affiliated Akal Academies over six states and two Universities to impart value-based education from nursery to Ph.D. As part of the vision, prophesy and prayers of the visionary Saints, the Eternal University was established under the Himachal Pradesh Government Act No. 3 of 2009 which has been recognized by UGC, AICTE, INC, NCTE, DSIR, DBT, DST and DRDO and accredited by NAAC. The graduates of this unique education system are not only outstanding in academics, but also carry high moral values. They have love for humanity, compassion for the weak and the poor and sense of selfless service for the community.

Eternal University is the first private university of Himachal Pradesh to start College of Agriculture, College of Nursing, and School of Public Health. The lush green and pollution free campus in Himachal Pradesh is fully residential for faculty and students with all the facilities for comfortable living, excellent academic career pursuit and participation in co-curricular and spiritual activities for their holistic development. It has now been transformed and recognized as a modern Gurukul exclusively for girls' education. The Eternal University has been regularly organizing conferences, symposia, workshops, Kisan Melas, Annual Sports meets, national and international days, faculty development and creating opportunities for student's awareness with the latest developments in the areas of their interest and confidence to share their knowledge with other faculty, students and stake holders. For the people of Sirmour', one of the most backward districts 'of Himachal Pradesh, the establishment of "Eternal University, Baru Sahib" is a boon with many hopes as well as expectations for addressing their problems related to education, health, nutrition, agricultural production, skill development and employment etc. for their inclusive development. After its establishment in the year 2009, with a mission and mandate of value- based education and women empowerment, the university has demonstrated its commitment to society through great impact in teaching, research and transfer of technology. It is continuously looking forward to set new dimensions in the research area of agriculture, food technology, biotechnology, public health, basic sciences and renewable energy with teams of world class scientists and external funding support by different funding agencies of Government of India and Himachal Pradesh.

The Eternal University has the following seven constituent colleges *viz*,

1. **Dr. Khem Singh Gill Akal College of Agriculture**
   - Department of Agronomy
   - Department of Agricultural Economics
   - Department of Entomology
   - Department of Plant Pathology
   - Department of Genetics, Plant Breeding and Biotechnology
   - Department of Horticulture (Vegetables, Fruits and Floriculture & Landscaping)
   - Department of Food Technology
   - Department of Soil Science and Agricultural Chemistry
   - Department of Agricultural Extension and Communication

2. **Akal College of Engineering and Technology**
   - Computer Science & Engineering

3. **Akal College of Basic Sciences**
   - Department of Botany
   - Department of Chemistry & Biochemistry
   - Department of Mathematics
   - Department of Microbiology
   - Department of Physics
   - Department of Zoology

4. **Akal College of Health and Allied Sciences**
   - Akal College of Nursing
   - Centre for Public Health and Healthcare Administration

5. **Akal College of Arts and Social Sciences**
   - Department of Economics
   - Department of Commerce
   - Department of Business Management

6. **Akal College of Education**

7. **Akal College of Economics, Commerce and Management**
   - Department of Music
   - Department of English and Communication Studies
   - Department of Psychology
   - Department of Punjabi
   - Department of Education
   - Department of Library & Information Science

Organizing Committee- Internal members

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Dr. Davinder Singh	-	Patron
Dr. A.S. Ahluwalia	-	Co-Patron
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Dr. Neelam Kaur	-	Member
Dr. B.S. Sohal	-	Member
Dr. S.K. Chauhan	-	Member
Dr. S.K. Sharma	-	Member
Dr. P.S. Cheema	-	Member
Dr. Purvi Luniyal	-	Member
Dr. Sandipan Gupta	-	Member
Dr. Yogeeta Thakur	-	Member
Dr. Raino Bhatia	-	Member
Mr. Balraj Singh	-	Member
Mr. S.C. Ghosh	-	Convener

Organizing Committee- External Members

Dr. MV Ashok- EX CGM, Nabard

Dr. U S Saha, EX CGM- Nabard, now RBI Chair Prof – IRMA, Anand

Dr. Kalyan Ballav Goswami, DG, Agro Chemical foundation Of India, New Delhi

Dr. Ashok Pandey, EX NABL, Mohali and distinguish scientist- Biotechnologist area, IITR- Lucknow

Dr. Debesh Roy, Ex Nabard, presently, Chairman, Institute for Pioneering Insightful Research and Edutech Pvt. Ltd., InsPIRE, Noida

Dr. J B Prajapati, Chairman, V J Kourien Centre of Excellence, IRMA, Anand

Dr. Dipankar Saha, Ex member, CGWB and Member Secretary, Central Ground Water Authority, Chair Prof, Manav Rachna University, Faridabad

Prof. Rajeev A, IRMA Anand

Dr. Saibal Paul, Associate Director, Membership, Policy, Strategic Initiative, Sa-Dhan, A leading NGO in the domain of micro finance

Mr. Sanjay Marwaha, Member, Haryana Water Resource Authority

National Advisory Committee

Dr. H. S. Dhaliwal, Ex Vice Chancellor, Eternal University and Now Trustee- The Kalgidhar Trust

Dr. N. Bhaskar, Advisor FSSAI, Minister of Health, Govt. of India

Dr. Suhas Wani, Ex-directory, ICRISAT, Govt. of India

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Mr. Vaibhav Kulkarni, Senior Director & Senior Leadership Team Member- Regulatory Affairs – Abbott Nutrition Regulatory Affairs, Abbott Healthcare Pvt.

Dr. Kalyan Goswami, Director General, Agro Chem Federation of India (ACFI), New Delhi

Dr. Ashok Panday, PhD, FBRS, FNASc, FRSB, FIOBB, FAMI, FISEES, FICT, FWSSET, BRSI Distinguished Fellow, HTBS National Innovation Chair, Distinguished Scientist- Centre for Innovation and Translational Research, CSIR Indian Institute of Toxicology Research, Lucknow

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Dr. Vikrant Tyagi	-	Member
Er. Rajeev Thakur	-	Member
Dr. Yogendra Singh	-	Member
Mr. Sukhwinder Singh	-	Member

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Schedule

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08:30-09:15 AM	REGISTRATION VENUE: University Reception Near Main Gate Entry
09:15-09:20 AM	Assembly of Delegates
09:15-09:20 AM	Lightening of The Lamp Ceremony
09:20-09:30 AM	Shabad by Students
09:30-09:40 AM	WELCOME ADDRESS BY: DR A S AHLUWALIA, Pro-Vice Chancellor, Eternal University, Baru Sahib
09:40-09:50 AM	ADDRESS BY HON'BLE PRESIDENT, KALGIDHAR TRUST & VC, ETERNAL UNIVERSITY BARU SAHIB (H.P): DR DEVENDER SINGH
09:50-10:05 AM	INTRODUCTION & TONE SETTING BY: DR ASHOK PANDEY, BRSI Distinguished Fellow, HTBS National Innovation Chair, Distinguished Scientist- Centre for Innovation and Translational Research, CSIR-Indian Institute of Toxicology Research, Lucknow
10:05-10:25 AM	KEY NOTE SPEAKER: MR. DIPANKAR SAHA, Ex member, CGWB and Member Secretary, Central Ground Water Authority, Chair Prof, Manav Rachna University, Faridabad
10:25-10:45 AM	GUEST OF HONOUR: DR SWARUP K CHAKRABARTI, Vice Chancellor Uttar Banga Krishi Vishwavidyalaya, Cooch Behar, West Bengal, Keynote Address (Online) TOPIC: Sustainable agriculture- Potential of Root and Tuber Crops
10:45-11:05 AM	SPECIAL GUEST: MR VIVEK VERMA, C & MD, SPRAY ENGINEERING DEVICES LTD, MOHALI, PUNJAB
11:05-11:30 AM	CHIEF GUEST: DR PUNJAB SINGH, Chancellor, Rani Laxmibai Central University; Former Secretary DARE & DG, ICAR, GOI, MoAFW
11:30-11:40 AM	VOTE OF THANKS BY: DR S K CHAUHAN, Dean & Addl Registrar, Eternal University, Baru Sahib
TEA BREAK (11:40-12:00 AM) VENUE: Bhai Gurdas Hall	
TECHNICAL SESSION ONE (12.00 AM – 1.30PM) THEME: Inclusive Water Management – Macro and Micro Perspectives MODE: PANEL/ PRESENTATION/ INTERACTION	
12:00-12:10 PM	MODERATOR: DR DIPANKAR SAHA, Former Member CGWB and former Member Secretary Central Ground Water Authority (10 minutes Deliberation) Rapporteur:
12:10-12:30 PM	DR MENU CHHABRA, Associate Professor, Department of Bioscience and Bioengineering, Indian Institute of Technology, Jodhpur Online AOD: Utility of Plant microbial fuel cells for Waste water treatment and power Generation (Online)
12:30-12:50 PM	MR LALIT SHARMA, Principal Scientist, Water Research and Training, Sehgal

	Foundation, Gurgaon AOD: Ground water development and Water Quality Management for better health (Online)
12:50-01:10 PM	MR SANJAY MARWAHA, Member, Haryana Water Resources Authority. TOPIC: Management and policy initiatives for sustaining ground water use in the state of Haryana
01:10-01:30 PM	DR MARCELLA D'SOUZA, Director of the WOTR Centre for Resilience Studies (W-ReS) and former Executive Director of Watershed Organization Trust (WOTR), India AOD: A Socio-Scientific Approach to Groundwater Management: Experiences from the Field
LUNCH (1.30-2:00 PM) VENUE: BHAI GURUDAS HALL	
TECHNICAL SESSION TWO (2.00.-3.30 PM) THEME: Diary Management- Different Dimensions Mode: Presentation/ Panel	
02:00-02:10 PM	MODERATOR: DR JB PRAJAPATI, Chairperson, VKCoE, IRMA (Online) RAPPORTEUR:
02:10-02:30 PM	SHRI PRANAV SHAH, Process Category Director, SPX Flow, Denmark Title: Water management in Dairy and Food processing
02:30-02:50 PM	SHRI ADITYA JAIN, Sr. Manager, PPD, NDDB, Anand Title: Dairy Development in India- role of NDDB and Amul in white revolution
02:50-03:10 PM	DR MANAB CHAKRABORTY, Advisor to Bangladesh Govt - Dairy Industry, Financial Inclusion, Microenterprise and Private Sector Consultant, New Delhi, India AOD: Dairy Value Chain in Bangladesh – How to Transform It
03:10-03:30 PM	DR. DHARMA HAGARE, Senior Lecturer, Sustainability Engineering, Leader, Nutrient Water and Materials Recycling Group (NeWMaRG), Associate Dean International (South Asia), School of Engineering, Design and Built Environment, Western Sydney University, Australia AOD: Sustainable nutrient management within dairy farms – An Australian experience
POSTER COMMPETION (2.00- 3.30 PM)- PARALLEL WITH TECHNICLA SESSION TWO	
TEA BREAK (3.30 PM – 3.45 PM) VENUE: BHAI GURUDAS HALL	
TECHNICAL SESSION THREE (3.45 –5.35PM) THEME: Agricultural and Horticultural Sustainability Practices- Different Perspectives MODE: Presentation/ questions / Interaction	
03:45-03:55 PM	MODERATOR: DR. AKHILESH KUMAR, (Postdoc-Israel), Founder & CEO- EDEN HORTICULTURE SERVICES AOD: Horticulture potential in HP & Hilly states
03:55-04:15 PM	DR UDAY S SAHA, RBI Chair Prof, IRMA, Anand TOPIC: Agricultural Infrastructure for Sustainable Income & Farmers' Prosperity
04:15-04:35 PM	DR ATUL KUMAR, Professor, Energy Studies Programme at Jawaharlal Nehru University, New Delhi AOD: Climate smart agriculture and Prospects

04:35-04:55 PM	**MR KALYAN GOSWAMI, DG - Agro Chem Federation of India (ACFI, New Delhi)** **AOD: Sustainable agriculture – Need to integrate 'Healthy Environment, Economic profitability and Socio-economic Equity**
04:55-05:15 PM	**MR NILOTPAL PATHAK, Partner, I-Farm Venture Advisors Private Limited, Gurugram, Haryana, National Capital Region, India** **AOD: Emerging investment opportunities in the Agritech and Agri infrastructure**
05:15-05:35 PM	**PROF VINAY NAGIA, Ph.D., Research Leader – Soil, Water, and Agronomy, Principal Water Scientist, International Centre for Agricultural Research in the Dry Areas (ICARDA), Texas, USA, online** **AOD: Climate-proofing smallholder agriculture for 2050**
CULTURAL PROGRAM BY ETERNAL UNIVERSITY PG/UGSTUDENTS, IF ANY (5:35-6:45 PM)	
DINNER (8.30- 9.20 PM)	
SECOND DAY, MARCH 26, 2022 (SATURDAY)	
08.30-09.15 AM	**UNIVERSITY TOUR**
TECHNICAL SESSION FOUR (9.15- 10.45 AM) **THEME: Food & Nutrition – Academics, Policy, Technology & Sustainability Issues- A critical Assessment** **MODE: Panel/ Presentation**	
09:15-09:25 AM	**MODERATOR: DR SUNIL PAREEK, Professor (Horticulture PHT), Director (IQAC), HOD, Department of Agriculture & Environmental Sciences, National Institute of Food Technology Entrepreneurship & Management (NIFTEM) (Deemed to be University under Ministry of Food Processing Industries)** **TOPIC: Current Trends in Processing and Next Generation of Future Food**
09:25-09:45 AM	**Dr J B PRAJAPATI, IRMA, Anand** **AOD: Functional Fermented Foods for Public Health and social Well being**
09:45-10:05 AM	**DR LATHA SABIKHI, Principal Scientist, NDRI, Karnal** **Title: Nutraceuticals and their Processing Aspects (online)**
10:05-10:25 AM	**DR DEEPTI GULATI, Industry Chair Professor: Nutraceuticals and Fortification, at NIFTEM, Sonepat, Haryana, India** **AOD: Food Fortification: Bridging the Nutrition Gap**
10:25-10:45 AM	**DR. VIVEK SRIVASTAV (MD, PhD, Dr. C.M.), Vice President – Research & Development and Operations, Esperer Onco Nutrition** **AOD: Nutraceutical- Imperative Component of Lifestyle and Wellness**
TEA BREAK (10.45- 11.00AM) **VENUE: Bhai Gurdas Hall**	
TECHNICAL SESSION FIVE (11.00-12.30 PM) **THEME: Water Management-Technological, Structural and Policy Issues** **MODE: Panel/ Presentation**	
11:00- 11:10 AM	**MODERATOR: SHRI SANJAY MARWAHA, Member, Haryana Water Resource Authority, Panchkula, Haryana**
11:10-11:30 AM	**DR ZHONGHUA CHEN, Western Sydney University** **AOD: Genetic and physiological improvement of potassium transport for water**

	use efficiency in barley.
11:30-11:50 AM	PROF BASANT MAHESHWARI, Western Sydney University AOD: Managing the invisible – Participatory Monitoring and Management of Groundwater at the Village Level'
11:50-12:10 PM 12.10- 12.30PM	AOD: MR VIVEK VERMA, C&MD, Spray Engineering Devices Ltd Mohali, Punjab AOD: Technological Break Through in Water Treatment for Strategic Advantage- SEDL.s Achievement QUESTIONS AND ANSWER
TECHNICAL SESSION SIX (12.30-2.00PM) THEME: Agricultural Development and Sustainability- Different Aspects MODE: Panel/ Presentation	
12:10-12:15 PM	MODERATOR: Dr U S SAHA, RBI Chair Prof, IRMA, Anand AOD: Agricultural and Sustainable Development- Different Aspects RAPPORTEUR:
12:15-12:35 PM	PROF. BRAHMA SINGH, PhD (Hort.) Padma Shri Awardee AOD: Vertical Horticulture Farming (online)
12:35-12:55 PM	DR JAI C. RANA, Ph. D AOD: Agro-Ecological Approaches Transforming Sustainable Food and Agriculture Systems
12:55-01:15 PM	DR RAJ BHANDARI + JOANNA KANEPOTAKA (From Australia), online from New York and Australia AOD: How to leverage the benefits of millets – Good for You, Good for the Planet and Good for the Farmer
01:15-01:35 PM	Dr. Vinod Kumar, Assistant Scientist, Department of Biochemistry, CoBS&H, CCS Haryana Agricultural University, Hisar, Haryana Topic: Plant Biotechnology for sustainable Agricultural development
LUNCH BREAK (1.35 PM -2.30 PM)	
TECHNICAL SESSION SEVEN (2.30-4.00 PM) SPECIAL SESSION: CROSS FUNCTIONAL NATURE	
02:30-02:40 PM	MODERATOR: Dr U S Saha, RBI Chair Prof, IRMA / PROF RAJEEV A FROM IRMA
02:40-03:00 PM	DR SAIBAL PAUL, Associate Director, Membership, Policy, Strategic Initiative, Sa-Dhan, New Delhi AOD: Indian Microfinance Sector - Outreach and impact on agriculture, dairy etc. of the Unreached
03:00-03:20 PM	MR TR KESAVAN, Group President, TAFE LIMITED, Chennai TOPIC: Integrated precision farming
03:20-03:45 PM 3.45- 4.00PM	DR J L N SHASTRI, Ex, CEO- National Medicinal Plants Board, Government of India (Online) TOPIC: Opportunities with the Food & Nutrition from Ayurved PROF RAJEEV A, Associate Professor, IRMA AOD: Sustainability and Analytics in the Agricultural / Dairy Supply chain
03:45-04:00 PM	QUESTIONS AND ANSWER SESSIONS
	VALECDICTORY SESSION (4.00- 5.20 PM)
04.00-04.10 PM	MODERATOR: PROF S C GHOSH, Director, University Corporate Resource Centre, EU, BS

04:10-04:25 PM	**CHIEF GUEST: DR SUBHASH DHIMAN, Ex Chairman, CGWB, GOI** **AOD: Rain water harvesting and artificial recharge**
04:25-04.50 PM	**DR S K SHARMA, Dean, Dr Khem Singh Gill Akal College of Agriculture for summing up the entire two days session**
04:50-05.10 PM	**DR DEVENDER SINGH, President, Kalgidhar Trust and VC- Eternal University, Baru Sahib**
05.10-05:20 PM	**VOTE OF THANKS: PROF A S AHLUWALIA, Pro-Vice Chancellor, Eternal University, Baru Sahib**
The announcement of formal closure of the Conference by the Convener	

Invited Lectures

1. **Prof Brahma Singh**, PhD (Hort.); Padma Shri Awardee; FNAAS, FNABS, FIAHS, FISVS, FAFST(I), FBVd, FISNS, Hon. FISAE; Founder Chairman, Prof Brahma Singh Horticulture Foundation, Delhi; Founder President, Indian Society for Protected Cultivation, New Delhi; Member, Planning Board, Ladakh UT; Vice President, ISVS, Varanasi
2. **Dr Jai C Rana**, PhD; Country Representative, India Office; National Coordinator, UN Environment-GEF Project, India; Alliance of Bio- Diversity International and CIAT Region -Asia, India Office
3. **Mr Joanna Kanepotaka**, from Australia, Director and Co-Founder of Food 2030, and Global leader of eminence on the crops grown in semi-arid tropics
4. **Dr Raj Bhandari**, from Mumbai, EX NITI Aayog, A world renounce scientists in Agro sector, especially Millets
5. **Prof JB Prajapati**, PhD, Chairperson Verghese Kurien Centre of Excellence (VKCoE) Institute of Rural Management Anand (IRMA) Anand 388001, Gujarat, INDIA
6. **Prof Ashok Pandey**, PhD, FBRS, FNASc, FRSB, FIOBB, FAMI, FISEES, FICT, FWSSET BRSI Distinguished Fellow, HTBS National Innovation Chair, Distinguished Scientist- Centre for Innovation and Translational Research, CSIR-Indian Institute of Toxicology, Research, Lucknow
7. **Dr KB Kathiria**, Vice Chancellor, Anand Agriculture University, Anand, Gujarat
8. **Dr Ashutosh**, Senior Scientist. Dairy Cattle Physiology Division, ICAR-NDRI, Karnal
9. **Dr Dipankar Saha**, Former Member (Head Quarters) CGWB, and former Member Secretary, CGWA. Presently he is Chair Professor at MRIIRS, Chairman of the Committee under NABET to accord accreditation to groundwater consultant organisation.
10. **Mr Kalyan Goswami**, (Policy, Government Affairs, Skill Development, Training (Agriculture , Agro-chemical, Healthcare) Director General Agro Chem Federation of India (ACFI) New Delhi
11. **Dr Manab Chakraborty**, PhD- Agro economist and Value Chain Expert Livestock and Dairy Development Project (LDDP), DOHS Mohakhali, Dhaka 1212, Bangladesh Ex CEO- Partners in Prosperity, New Delhi
12. **Mr Nilotpal Pathak**, Partner, I-Farm Venture Advisors Private Limited Gurugram, Haryana, National Capital Region, India Mailing Address: C-507, the Courtyard, Nirvana Country, South City DLF Golf Course Extension, Sector 50, Gurugram 122018
13. **Dr Menu Chhabra,** IIT- Jodhpur Associate Professor - Department of Bioscience and Bioengineering Indian Institute of Technology, Jodhpur
14. **Prof Basant Maheshwari,** Australia India Water Centre, Chief Convener, Western Sydney University, Australia
15. **Prof Dharma Hagare**, Western Sydney University, Australia
16. **Prof Zhonghua Chen**, Western Sydney University, Australia
17. **Prof Vijay Jayasena,** PhD, Professor of Nutrition and Food Science School of Science, Western Sydney University, Australia
18. **Prof Vinay Nangia,** PhD Research Leader – Soil, Water, and Agronomy, Principal Water Scientist International Center for Agricultural Research in the Dry Areas (ICARDA), P.O. Box 6299, Rabat Institutes, Rue Hafiane Cherkaoui, Rabat, Morocco

Dr. Uday Shankar Saha, currently the RBI Chair Professor at Institute of Rural Management Anand (IRMA), was in NABARD. He has excellent academic record in doing Masters (Hort.) and Ph.D in agriculture from the country's premier Institute, Indian Agricultural Research Institute (IARI), New Delhi and Post-doctoral Research on policy for Sustainable agriculture development in Agriculture from University of California, Berkeley. He has multi-disciplinary experiences in Policy, Planning, field experiences on water management, research and teaching as Faculty, Institution building in agriculture development and rural financing. He occupied various positions during his 32 years of illustrious services in NABARD and after superannuation as Chief General Manager (CGM), he joined as RBI Chair Professor in IRMA. He has rich experience in research, studies, policy, micro Institution building, and professional field experiences. He has contributed on water policy in irrigated and rainfed/dryland agriculture, towards sustainable development. He was involved in policy formulation for participatory watershed management in early ninety's and later involved in operations in field, impact studies etc. He had worked for judicious use of natural resources for sustainable development of livelihood of poorer section of society, a need-based multi-disciplinary action, land ownership, tenancy & sustainable development issues, water and livelihood development of poor with micro-institution, innovations on drinking water delivery, income enhancement with Dairy based Integrated Farming System, riverbed desilting for water availability for villagers, an experiment of participatory management. He was associated with several committees set up by the then Planning commission, Govt of India, RBI, NABARD from time to time since 1993 on policy and planning issues on country's agriculture, cooperation and strengthening of rural financial institutions and technology upgradation. He acted as state-charges of NABARD for two States (Maharashtra and Nagaland) and Head of Departments at Head Office. At present, he is involved in teaching & research at IRMA on Rural Development, Rural Finance, Microfinance, Financial Inclusion and MDPs (Management Development Programmes). He teaches on water issues and watershed management as part of rural development. He published several papers as part of book on natural resources (land, water) & poverty reduction for sustainable development, publish by WIDER, UNU, SAARC & Indian books. He is **instrumental in setting up Water Centre** at IRMA. Currently he is devoted on watershed management, water conservation, water education & water Institution building.

WADFPSE/IL/01

Water, Agriculture, Dairy and Food Processing Industry: Challenges and Opportunities for Sustainable Development

Ashok Pandey[1,2,3]

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Abstract

With the ever increasing world population and continuous depletion of natural resources due to over exploitation world-wide, there are serious concerns about the future of mankind on earth planet. A great emphasis has been laid by United Nations on sustainable development which has set 17 goals to be achieved by the national governments. These include sustainable use of water and wastewater, adopt modern ways of agriculture with specific need-based focus on regional requirement to feed the hungry population, and balanced approaches for the production, protection and processing of food, including dairy products (cattle management). In context to India, the issues are much more serious and need urgent attention and action. For example, while India contributes to 16% world population, it has only 4% of water availability. Current practices on water usage, especially in agriculture need major 'sustainable methods' to save water. There is over-exploitation of ground water, with decrease of water table almost one foot each year; the amount of water being replenished into ground is far less; the reasons are numerous, including poor river and lakes management, very poor wastewater treatment and management, etc. IN agriculture sector, while there is currently tremendous growth with annual increase of cereal grains production increasing at the rate of 3.5% and there is surplus production which is being exported to various countries, poor storage conditions lead to rotting of millions of tons. The fact in this regard is that a large percent of population remains hungry and does not get proper nutrition. In case of dairy industry, while India is current the largest producer of milk, considering the fact that the number of cattle is also the largest and that the average milk production per cattle is far less than other countries, there is need to pay attention on this in order to achieve sustainability in this sector. Waste-to-wealth (w-2-w) and waste-to-energy (w-2-e) concept has gained much momentum in recent years, as on one hand, it offers unique opportunity to handle and dispose solid wastes (municipal waste as well as agro-industrial wastes), and simultaneously provides alternative sources of renewable energy. Solid waste treatment and management is a major issue worldwide. Several countries lack proper basic waste management infrastructure and awareness. Thus, waste- to-energy could be an attractive solution for resource recovery, which eventually offers potential benefits for sustainable development.

WADFPSE/IL/02

Current trends in processing and next generation of future food

Sunil Pareek

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Abstract

India is known for the traditional and immune boosting foods since long. Various herbal, fruits and vegetable, millet and spice based products are included in daily life. However, in recent times, food choices are changed and shift towards ultra-processed and fast foods. World has experienced Covid-19 pandemic which again impacted the food industry 4.0 and many changes took place especially immune boosting natural food choice increased along with the food safety demand. Emerging food technology trends mark a shift towards sustainable and personalized food choices. These include alternative protein sources, local foods, nutraceuticals, and personalized nutrition. The concern over environmental impacts is causing FoodTech startups and brands to integrate waste reduction practices as well as zero-waste workflows. Food producers are digitizing their production floors with robotics, eCommerce, and digital food-management tools. Restaurants are also employing robots for hospitality and cooking, as well as promoting eCommerce. The food industry is tackling the continuing impact of the COVID-19 situation using all the above tools, towards efficient, transparent, and sustainable operations. Consumers shifting to alternative protein sources is the most significant trend in the food industry. This includes the meatless meat, plant based meat, texturized protein alternatives. Further, the increased awareness of nutrition and health concerns during the pandemic drives the demand for nutraceuticals and personalized nutrition. Now, like as medicine prescription, R_x diets, DNA based diets, life style diseases based diets are becoming popular among celebrities. Food eCommerce is another big trend that is fueled by the COVID-19 situation. Also, there is a substantial rise in food safety concerns directly impacting food transparency across the food value chain. With digitization being an integral part of the food & beverage industry, companies are adopting restaurant digitization, digital food management, and food robotics to improve operations. Plus, food brands are focussing on food waste reduction and are adopting zero-waste practices. 3D food printers are also a part of the food technology trends, enabling many other major trends such as meat alternatives and personalized nutrition.

WADFPSE/IL/03

Nutraceutical: Imperative component of Lifestyle and Wellness

Vivek Srivastav

Vice President – Research & Development and Operations, Esperer Onco Nutrition

Abstract

The nutraceutical market is currently a high-impact multi-billion-dollar industry, and it is anticipated to grow rapidly over the next decade. Nutraceuticals comprise diverse food-derived product categories that have become widespread due to increased consumer awareness of potential health benefits and the need for improved wellness. This targeted review is designed to identify the current global trends, market opportunities, and regulations that drive the nutraceutical industry. Safety and efficacy concerns are also explored with a view to highlighting areas that necessitate further research and oversight. Key drivers of the nutraceutical market include aging populations, consumer awareness, consumer lifestyle, increasing cost of healthcare, and marketing channels. Diet and lifestyle are considered essential to promote and maintain the well-being as well as to prevent the onset of diseases linked to wrong lifestyle and dietary habits that can both determine pathological conditions. Many of these require pharmacological therapy; nevertheless, some can be prevented and taken care of with the use of nutraceuticals in the daily diet. Nutraceuticals are pharmacologically active substances that can be extracted from vegetal or animal food, concentrated and administered in a suitable pharmaceutical form. A nutraceutical hence is a food or part of a food that produces health beneficial effects, including the prevention and/or treatment of a disease. The proper use of these food-drugs can help to reduce and/or to slow the onset of diseases, and, in particular, all the lifestyle related health conditions, e.g. the metabolic syndrome, which is strongly depending on the improper lifestyle and incorrect dietary habit. The effectiveness of nutraceuticals can be seen with their inclusion in the daily diet as a preventive agent against the onset of disease

Keywords: Food, Health, Hypercholesterolemia, Metabolic, Nutraceuticals, Prevention,

WADFPSE/IL/04

A Socio-Scientific Approach to Groundwater Management: Experiences from the Field

Marcella D'Souza

WOTR Centre for Resilience Studies (W-CReS)

Abstract

India is the highest user of groundwater, after the next two users, the US and China put together. Agriculture consumes approximately 80% of groundwater. Besides, being a hot-spot for climate change, our country has no option but to shift to the judicious use of groundwater. Demystifying science and technology with rural communities is a way of 'making the invisible, visible'. Villages in semi-arid Maharashtra show a way forward in the sustainable management of groundwater. A shared problem like water scarcity brings people together. However, sharing water is rarely possible, as water is considered a 'private good'. The 'Water Stewardship' approach is a way of addressing the 'shared problem'. It requires an understanding of - the surface topography and the watershed; of aquifers, that generally does not follow the village administrative boundary; of climate and varying weather conditions and of agriculture cultivated to meet farmers' food and income needs. The water scarcity problem knows no caste, creed or community. It requires that all living in a particular geography work together for a common solution. The Water Stewardship Approach therefore, is essentially a 'socio-scientific and technological' approach. The village or, a cluster of villages that share an aquifer, provides the environment to bring ALL households on a common platform. It brings women and marginalized to the fore in decision making roles. Water Stewardship demystifies science and helps the community to understand the causes of and the impacts of their action, and to set village rules. Visualizing the 'unseen' aquifers through constructing it together in a 3 D model, makes villages (that share a common aquifer) realize that, there is no option, but to use technology, budget water adapted to weather variability, and implement climate resilient agriculture, after prioritizing water for domestic and livestock needs and for nature.

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Water Stewardship in Rainfed Agrarian Maharashtra (Eshwer Kale and Marcella D'Souza, 2019); Book chapter in a publication 'Water conservation and saving in agriculture' by Government of Maharashtra; http://bit.ly/2X9I2OB

Making the Invisible, Visible: Manual for preparing Co-DriVE-Visual Integrator to overlay surface and sub-surface characteristics for Sustainable Groundwater Management (Sarita Chemburkar and Eshwer Kale; 2018), https://go.aws/3ceGREC

WADFPSE/IL/05

Functional Fermented Foods for Public Health and Social Well being

Jashbhai B. Prajapati

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Abstract

Food is essential for life. The basic role of the food is to provide nutrition to the body for sustenance and growth. Foods that provide something beyond nutrition are called as functional foods. Fermented foods are coming under the category of functional foods as the process of fermentation confers some functional attributes to the raw material that is fermented. Fermented foods are known since ages and are popular all over the world. People have learnt art of fermentation of every kind of food materials like cereals, pulses, milk, fruits, vegetables, fish, meat, tubers, etc. They are produced by employing simple, natural, less energy intensive and green processes. Fermented foods can be a very good tool to achieve United Nations sustainable development goal 2, as it offer a great potential to tackle the problem of malnutrition and food security, especially in developing countries of Asia, Latin America and Africa. As per FAO, 2004 estimate, fermented foods contribute to about one-third of the diet worldwide.

All types of fermented foods are made by the biological activity of healthy microorganisms. Among them lactic acid bacteria are the most widely used and studied. The constituent nutrients of raw material and action of microbes on them, makes wonders. This is an era of microbiota and metabolomics and our knowledge has given several insights for application of fermented foods in health and nutrition. Apart from traditional fermented foods, novel value added foods attract the industry and the society both. Nutraceuticals, probiotics, prebiotics, synbiotics, postbiotics, functional foods, dietary foods, medi foods, etc are the jargons being used by the researchers and the industry for similar kind of novel functional foods that give specific health benefits apart from the nutrition.

Fermented foods can be claimed for generic health benefits, but a specific health claim can only be made if the product is contain specific organism whose health effect is clinically proven. Hence, any health claim for the product, including immunomodulatory effect, has to be established clinically. The effects of consumption of fermented foods depend upon the starter cultures used in their manufacture apart from the ingredients used. Most of the health benefits are specific at the strain level, while certain benefits like improving gut functions, reducing lactose intolerance, improving digestibility of proteins, reducing anti-nutritionals, building immunity, good for health, etc are generic in nature.

Fermented Foods and Nutrition

The process of fermentation affects the quality and quantity of the nutrients present in the food. Quantitatively, major nutrients like protein, carbohydrate and fat may decrease slightly during the fermentation, but the metabolites like organic acids, fatty acids, peptides, increases. During fermentation, microbes may consume some vitamins and hence they may decrease, but at the same time, they may synthesize certain vitamins and hence it will increase. The process of fermentation improves the digestibility of proteins. This can be due to proteolysis and production of peptides and amino acids. Further, the digestibility further improves due to presence of lactic acid and other organic acids. The action of starter cultures produces acids that help in better absorption of minerals, especially calcium. Some cultures synthesise vitamins of B-complex which are essential for the body. Foods fermented by lactic acid bacteria possess the enzyme beta-galactosidase, which has been useful for the digestion of lactose. One major nutritional benefit of fermentation is that the process helps in removal of anti-nutritional factors like phytates, lectins, tannis, etc which unlocks the nutrients and make them available to the body.

Fermented Foods, Functionality and Health

The processing steps and the action of microbes in the fermented foods impart several functional properties to the food. One of the major changes is in body, texture, taste and aroma of the product. Several starter cultures produce exopolysaccharides, which act as natural stabilizers in products like yoghurt, butter milk, juices and gels apart from giving health benefits to the consumers. Fermentation is known to enhance the shelf-life of the product as the intrinsic conditions of lower pH, low Eh and presence of antimicrobial compounds produced by the cultures help in restricting the growth of spoilage organisms. The presence of healthy bacteria in fermented food helps in altering gut microflora that are healthy and helps in ameliorating several problems of gastro-intestinal tract. They are also known to control the growth of tumors and especially help in control of colon cancer. Their effects on cholesterol management are also known. The recent studies are proving their effects on life style diseases like hypertension, diabetes and obesity.

The present pandemic of Covid-19, helped the society to know the importance food and especially the value of foods that stimulate the body's immunity. Fermented foods with probiotics have remained in the front line in this regards. Literature survey indicates that fermented foods, especially added with probiotics have immunomodulatory effect on the body. There are several mechanisms for this action, which include immunostimulating metabolites and cell mediators. In a nut-shell, functional fermented foods are good to maintain your health status. They help in prevention of several diseases and thus reduce the pains and health care costs. They

can also take care of the problem of mal-nutrition. This paves the way for developing healthy society.

The Future

Current research in the area of fermented functional foods is focussing into the intestinal microbiome and obtaining genomic data from starter cultures and probiotics. Immunomodulation, effects on life style diseases, gut-brain axis are the emerging areas of research in fermented foods with probiotics. Nutrigenomics and metabolomics are rapidly developing new bodies of knowledge that will change future research and practice in human nutrition. This will require technologists who can develop food products for the personalized nutrition and taste. Thus entire field of functional foods for human well-being requires advanced research from many areas of expertise and that can be best done by developing networks and collaborative projects. SASNET-Fermented Foods is one of the networks, which promotes research and development work on fermented foods for health benefits and social well-being.

WADFPSE/IL/06

Sustainable Agriculture – Need to Integrate 'Healthy Environment, Economic Profitability and Socio-economic Equity'

Kalyan Goswami

Director General, Agro Chem Federation of India (ACFI)

Abstract

Agriculture has changed dramatically since the year 1950-60. Food and fiber productivity has increased due to new technologies, mechanization, increased chemical use and due to favorable government policies. Although these developments have had many positive effects and reduced many risks in farming, they also have significant costs. Prominent among these are soil depletion, groundwater contamination, air pollution, greenhouse gas emissions Etc. And also neglect of the living and working conditions of farm laborers, new threats to human health and safety due to the spread of new pathogens, economic concentration in food and agricultural industries, and disintegration of rural communities. A growing movement has emerged during the past 3 decades to question the necessity of these high costs and to offer innovative alternatives. Today this movement for sustainable agriculture is garnering increasing support and acceptance within our food production systems. Sustainable agriculture integrates three main goals – environmental health, economic profitability, and social equity. Although, Sustainable agriculture offers a much-needed alternative to conventional input-intensive agriculture, it is being practiced by only 4-5% of the Indian farmers presently. Sustainable Agriculture Practices are mostly knowledge intensive and successful adoption requires knowledge exchange and capacity building among farmers. But our Public Agriculture extension system remained ineffective to educate the farming community. While awareness & Skill development has to be extensive, the scale-up may start with rainfed areas, as they are already practicing low-resource agriculture. They have low productivities, and primarily stand to gain from the transition. Secondly, government support to farmers to be restructured by aligning incentives towards resource conservation and by rewarding outcomes such as total farm productivity or enhanced ecosystem services rather than just based on outputs such as yields. And also extend short-term transition support to individuals liable to be adversely impacted by a large-scale transition to sustainable agriculture.

WADFPSE/IL/07

Horticulture potential in Himanchal Pradesh and Hilly states

Akhilesh Kumar[1] and Satyender Yadav[2]

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Abstract

Himachal Pradesh (HP) has been endowed with a wide range of agro climatic conditions due to which a large number of horticulture commodities like fruit crops (from temperate to sub-tropical), flowers, vegetables, mushrooms, tea, medicinal & aromatic plants etc. are successfully grown here. HP has two distinct horticulture production systems – (i) temperate and sub-temperate horticulture; and (ii) sub-tropical horticulture. Temperate horticulture, which occurs in the high hills and valleys and cold/dry zones is dominated by apple cultivation on 107,686 ha, while sub temperate horticulture, which is predominantly in the mid-hills zone includes peach, plum and apricot, produced on 17,288 ha. Sub-tropical horticulture primarily occurs in the low hill and valley zone, areas near the plains, and includes mango, litchi, guava, loquat, citrus fig, ber, papaya, early varieties of grapes, jack fruit and banana production. While crop diversification is increasing in Himachal Pradesh, a significant increase in fruit and vegetable crop production is mostly concentrated in districts of the mid-hills and high hills and valleys zones, leaving a substantial income gap between temperate and sub-temperate horticulture producers and those farmers producing subtropical crops. Apart from above advantages horticulture sector in HP faces multiple challenges also. A key bottleneck is limited access to water sources and irrigation services. Nearly 75% of annual rainfall concentrates falls during the three-month monsoon season and this flow is lost as run-off without utilization or conservation. Only about 20% of cultivated area is irrigated and agriculture is largely dependent on rainfall. There is potential to increase irrigation services to about 60% of the cultivated area. Another key stress factor to crop production comes from monkey and wild animal menace, which affects about 156,000 ha of agriculture land. Apart from that access to modern Hi-Tech horticulture technologies, extension support, market infrastructure/information/linkage, skill development are major constraints where budding entrepreneurs may explore their future. In view of the immense potential of horticulture in Himanchal Pradesh, Shiva pilot project has been started in collaboration with the Asian Development Bank (ADB) for a total cost of Rs. 975 crores. The strategy of GoI and Government of Himachal Pradesh (GoHP) to address the constraints to the rapid and sustainable development of the horticulture sector in Himanchal Pradesh.

Extended Abstracts

WADFPSE/EA/01

Unexploited Fruit Crops of Himachal Pradesh for Harnessing the Natural Wealth to Support the Livelihood of Rural People

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Abstract
Himachal Pradesh state is blessed with diversity of fruit forms both in wild and cultivated species. Himachal Pradesh possesses diverse agro-climatic zones ranging from temperate to sub-tropical & wet temperate to dry arid zone with large variability of land in hilly topography. Diversified edible unexploited fruits and nut plant species types exist in wild form in their natural habitat under tropical and sub-tropical and temperate climatic condition. The unexploited fruits are valuable supplementary source of nutritious food for people living in inaccessible rural areas, difficult hill terrains in the vicinity of forests. Several wild edible fruit plants are nutritionally rich and can enrich the human diet with vitamins, essential amino acids/proteins, micronutrients, phyto-chemicals and antioxidants with specific medicinal importance. The nutritional importance of these unexploited fruit crops with vitamins, antioxidants, minerals and phytochemicals are under mined by local people living in remote and inaccessible areas. The fruits collected from their natural habitats are free from chemical, environmental pollutants and may provide healthy food with protective and curative phyto-chemicals to improve endurance of human system.

Keywords: Unexploited fruits, nutritious food, micronutrients, vitamins and environments

Introduction
The edible wild species including Asian gooseberry, Bael, Golden Himalayan raspberry, Hill raspberry, Indian raspberry, Hogberry, Black nightshade, Conker berry, Seabuckthorne, Opuntia pear and Wild persimmon were frequently cultivated but got naturalized as an escape mechanism in forests. Natures have blessed us with diverse sources of life forms and are serving the basic needs for our survival on this earth. Food is of main importance and primitive man ate various types of plants and their parts including fruits. The augments in area and production of these exploited fruit crops will not only provide nutritional security and save money on import but also export of fresh unexploited fruit crops and seed is further expected to boost region economy. These unexploited fruit crops also provide many fold employment opportunities in agro-based industries, packaging, storage, preservation, canning and transportation. Primitive people

collected these eatables in wild forms before adapting to cultivate them. Man identified those plants that were edible and acquired basic knowledge for their propagation and later domesticated some of these wild edible species as food. There is a necessity to create awareness by highlighting the value addition of these crops. The use and enhancement of these species is constrained by lack of knowledge of inheritance patterns with insufficient understanding of taxonomy, biology and multiplication of these species.

Therefore, keeping in view their usefulness and hardiness it becomes imperative to collect and document these plant species along with their distribution, ethnobotanical and medicinal importance for valuable germplasm encompassing nutrition profile, phytochemicals and unique value. Besides, the information on distribution of habitat of the wild edible fruits may lead to formulation of policies for in-situ and ex-situ conservation of genetic diversity of these unexploited fruit plant species in the form of botanical gardens, conservation grooves and biosphere reserves to provide protection from extinction. The utilization of waste and degraded lands for plantation of wild fruit species can be undertaken according to suitability of location and further popularization on commercial basis can be sought. Unexploited fruits are becoming more widely and effectively deployed to address malnutrition, poverty and economic prosperity. They constitute essential biological assets of the rural poor and offers scope to contribute by improving the well-being of millions of tribal population.

Unexploited fruit species are potential source of vitamins, minerals and other health promoting factors including high antioxidant activity. Furthermore, unexploited fruits possess resistance to several biotic and abiotic stresses by harnessing the nature's rhizosphere. The unexploited fruit crops can also provide mineral nutrition's to the poor by meeting the essential nutrient requirements of vulnerable groups too. Unexploited fruits play crucial role in the life of rural people; they form an integral part of food and nutritional aspect of local population as many of them are traditionally being esteemed for their utilization in terms of medicinal, therapeutic and nutritional values since time immemorial and are consumed in ripe form. Harnessing the potential of unexploited fruit crops can contribute to poverty elimination through generation of employment opportunities and risen income generation through sustainable livelihood improved efficiency and profitability of farm household labour use in both rural and urban environments.

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Role of *Apis mellifera* Honey Bees in Sustainable Farm Production

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Abstract
The findings of a study carried out in Himachal Pradesh, Punjab and Haryana reveals that the increase in crop productivity was recorded higher (20.66%) outside Himachal Pradesh than 18.37 per cent in the state. The average yields of guava grown without beekeeping was realized at 10.77 tonnes/ha and it was 11.40 tonnes/ha in Haryana where bee colonies were placed in the orchard, thus an increase of 5.85 per cent was noticed in this crop. Mango was grown in plain areas (Nurpur and Una) of Himachal Pradesh and in adjoining areas of Punjab and Haryana state. A significant increase in its average yield was noticed within and outside the state. The average yield of mango recorded an increase of 12.68 per cent and 14.14 per cent within Himachal Pradesh and outside states, respectively. Among field crops, maximum increase in the crop productivity was noticed in sunflower followed by mustard crop outside the state. In nutshell the study concludes that honey bees have a positive impact on the crop productivity of both field and horticultural crops. Therefore, it is suggested that beekeeping avocation be promoted among rural masses by extending suitable technologies and financial support for the production of honey and indirectly ensuring the sustainability of cropping system with reduced cost of production.

Keywords: Crop productivity, Cropping system, Horticultural crops, Sustainability

Introduction

Beekeeping on scientific lines was started way back in 1934 in Kullu and 1936 in Kangra valley of Himachal Pradesh. Besides, Himachal Pradesh took a lead in introducing *Apis mellifera* for the first time in India during 1962-63. The migratory system of beekeeping was put into practice way back in 1952 in the state and the beekeepers are still continuing with this practice and getting increased yield per bee colony per annum. This avocation has now attracted people all over the state to adopt migratory beekeeping with *Apis mellifera* as their full time activity (Chauhan & Sharma, 2000; Chauhan *et al*, 2018). Varied agro-climatic and topographical conditions in Himachal Pradesh are ideal for producing a wide variety of agricultural and horticultural crops besides growing seasonal off-seasonal vegetables and a wide range of flowers. Beekeeping is generally encouraged for production of honey. However, the honey bees can also be used as an important input for increasing the production and productivity of

agricultural as well as horticultural crops. The scientific studies have proved that honey bees through pollination increase the yield of various crops in the range of 20 per cent to cent per cent (Panda and Padhi, 1995).

In India over 80 per cent oilseeds, pulses, fodder, vegetables seed, fruit and commercial crops are benefited by bees. Thus the two most important gifts offered by honey bees to mankind are pollination service to crops and production of honey. However, in practice the main thrust in beekeeping research and development programme remained biased; mainly to honey production only and importance of honey bees as agents of pollination remained under- estimated and mostly ignored. Now it is realized that few farmers have become aware about the use of honeybees as an important input in enhancing the productivity of cross pollinated crops by placing the colonies in their fields or orchards. Therefore, in this article, an attempt has been made to bring in light the facts.about the pollination services of honey bees and their role in terms of diversification and improving agricultural and horticultural productivity.

Methodology

A study with 25 farmers cum orchardists selected within and outside the state formed a part of this study carried out in 2017. These farmers hired *Apis mellifera* bee colonies from the migratory beekeepers of Himachal Pradesh and placed on their crop specific fields for pollination purpose.

Results and Discussion

Crop diversification

According to an English proverb, a good farmer is one who diversifies- one who does not put all his eggs in one basket and one who rotates his crop. From this point of view it was expected that due to availability of efficient pollination in the form of bees, the farmers would think of diversifying the cropping pattern in favour of such crops where the productivity is largely determined by the availability of such pollinating agents. However, the investigation reveals that so far there has been no impact of apiculture on the crops diversification. The farmer are still sticking to all old cropping patterns and in the areas like Kullu, Solan, Sundernagar and Kangra where it has changed in favour of vegetables etc; was not as a result of apiculture rather due to infrastructure development in favour of the high value cash crops.

Impact on crops yield

The impact of honeybees on selected agricultural and horticultural crops yield is shown in Table 1. These results are based on data collected from 25 farmers situated in Una, Shimla, and Nurpur area of Himachal Pradesh; Hoshiarpur and Lalru of Punjab and Naraingarh and Ambala of Haryana who placed required number of bee colonies on their fields/orchards. It can be seen from Table 1 that the average yield of apple without beekeeping was 13.40 tonnes/ha which significantly increased to 16.50 tonnes/ha with beekeeping, this means that the productivity of apple increased by 23.13 per cent in Himachal Pradesh. Though the increase in yield is determined by many factors but the orchadists/farmers confidently claimed that the increase in yield was due to placing colonies in their fields as they have been conducting experiments as per availability of bee colonies. The farmers who kept bee

colonies in the apple orchards for pollination purpose could get on hire basis from the nearby government bee farms. However, the private beekeepers did not hire out colonies to orchadists due to: i) The erratic changes in the weather; ii) Fear psychosis of loss of colonies due to use of insecticides/pesticides; and iii) Chilly weather during winter season at the time of blossoming of apples.

Table 1: Impact of *Apis mellifera* Honeybees on Average Crops Yield (Tonnes/Ha)

S. N.	Crops	Within State (Himachal Pradesh)			Outside State (Punjab and Haryana)		
		Without honeybees	With honeybees	Percent change	Without honeybees	With honeybees	Percent change
1.	Apple (*Malus sylvestris*)	13.40	16.50	23.13	NA	NA	--
2.	Citrus (*Citrus* spp.)	9.80	11.60	18.37	12.10	14.60	20.66
3.	Guava (*Psidium guajava)*	NA	NA	--	10.77	11.40	5.85
4.	Mango (*Mangifera indica*)	7.10	8.00	12.66	8.06	9.20	14.14
5.	Mustard (*Brassica* sp.)	0.83	1.00	20.48	1.32	1.66	25.76
6.	Sunflower (*Hellanthus annus*)	0.21	0.25	19.05	0.40	0.51	27.50

As far as citrus fruits are concerned, the increase in productivity was recorded higher (20.66%) in outside states than 18.37 per cent within the state. Guava fruit crop was mostly grown by Haryana farmers in Saha, Sahazadpur and Naraingarh area. The average yields of guava grown without beekeeping was assessed at 10.77 tonnes/ha and it increased to 11.40 tonnes/ha while keeping bee colonies in the orchard, thus an increase of 5.85 per cent was noticed in this crop. Mango was equally grown in plane areas (Nurpur and Una) of Himachal Pradesh and in Punjab and Haryana. A significant increase in the average yield was noticed within and outside the state. The average yield of mango recorded an increase of 12.68 per cent and 14.14 per cent within Himachal Pradesh and outside states, respectively. As far as field crops are concerned; maximum increase in the crop productivity was noticed in sunflower followed by mustard crop outside the state.

Conclusion

From the analysis it can be concluded that honey bees has a positive impact on the crop productivity of both field and horticultural crops. Although, it has failed to establish its role in crops diversification as far as Himachal Pradesh is concerned, yet the hidden role played by the honey bees can't be overruled and needs further detailed investigation.

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Mineral Solubilizing Microbes for Plant Growth Promotion and Nutrient Uptake

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Abstract
The use of chemical fertilizers is increasing to meet the requirement of minerals and increase the yield but excessive use of agro-chemicals has left an undesirable effect on the ecosystem. There are diverse microbes including archaea, bacteria, and fungi in the soil have ability to solubilize minerals and make it available for plants which are referred as mineral solubilizing microbes (MSMs). Minerals are essential macro-micronutrients of the plant nutrition package that enhance crop quality and soil fertility. Despite adequate levels of minerals in the soil, its deficiency is mainly due to inefficient use of various available forms by plants. The presence of minerals in complex mineral forms hinders its usefulness for plant growth. Plants face many deficiency symptoms due to non-availability of sufficient minerals required for their metabolism, which checks the productivity of the crop. Mineral-soluble microbes act as biofertilizers and can provide a permanent solution to mineral deficiencies in plants. Plant growth-promoting (PGP) bacteria can help with phosphorus, potassium, zinc and selenium solubility in soils because of their multifaceted requirement for environmental and nutritional status.

Keywords Biofertilizers; Mineral solubilizing microbes; Sustainable agriculture

Introduction
Agriculture is the major economic sector representing a billion dollar industry worldwide. The region has been producing and provisioning a variety of crops for food, fodder and ornamental purposes for the past several years. This economic sector is expected to grow further in the coming years due to the rapidly increasing human population. It is expected that the human population will reach 10 billion by the year 2025. To achieve such unprecedented demand for food, an additional 2.7–4.9 Mha/year of agricultural land would be essential (Abhilash et al. 2016). By the year 2000, Green Revolution technologies such as genetic improvement, irrigation methods and the use of chemically employed fertilisers, herbicides and pesticides helped to increase and satisfy the desire for agricultural products. Green Revolution technology, the use of chemical-based products in agriculture, has given a boost to the farming system but its use has created many more serious problems for the environment and human health (Aktar et al. 2009).

To meet the food demand of a growing population, future agricultural production must be adequate and sustainable. Unfortunately, our current agricultural production is mostly dependent on the use of chemical fertilizers that are synthesized through an energy-intensive process and place a heavy burden on natural resources. Moreover, the widespread use of agrochemicals is known to cause serious health issues like pollution which adversely affects air, soil and water quality. Crop production related to environmental health has become a challenging and addressed issue of the present times. Across the world, there is an active debate on new agricultural strategies that can produce a greater amount of food in a sustainable manner (Wezel et al. 2014). Various alternatives to traditional agriculture are being practiced such as biodynamic agriculture, organic farming, permaculture and natural farming with little or no dependence on agrochemicals. These agricultural approaches use alternative inputs i.e. bio-inoculants because microbial inoculants have diverse properties to promote plant growth and protect soil health. Bio-inoculants, the formulation of beneficial microbes, are one of the best alternatives to agrochemical inputs that provide beneficial results on plant growth, health, stress tolerance, disease resistance and increased nutrient availability. Microbes (bacteria or fungi) are abundant communities that are present in the soil, water, and in association with plants and mineral solubilizing as well as other plant growth promoting (PGP) attributes could be used as bioinoculants (Hesham et al. 2021).

The use of mineral solubilizing potential microbes i.e., phosphorus (P), potassium (K), zinc (Zn), selenium (Se) and iron (Fe) that are used as bioinoculants for plant growth and development and also have several advantages over agrochemicals such as they are more secure to the ecosystem as well as human health. They play essential role in induces signaling, stimulated antioxidant system, increase accumulation of osmolytes, interact with hormones, photosynthesis, energy transfer, nitrogen fixation, plant respiration and plant metabolism, transformation of sugars and starches, nutrient movement within the plant, transfer of genetic characteristics from one generation to the next, activation of plant enzymes, maintenance of osmotic tension and turgor pressure, proteins synthesis, movement of water, necessary nutrients and carbohydrates. These minerals exist in soil in various forms; including soluble forms (available form for plant uptake) and insoluble form (cannot be used by the plants). Earlier sufficient amount of soluble were present in the soil which can be utilized by the plants but now the concentration of soluble form of nutrients is vanished from the soil due to anthropogenic activities of humans.

Therefore, use of beneficial microbes to promotes the plant growth *via* other PGP traits such as fixation of biological nitrogen; solubilization of several minerals like P, K, Zn and Se; production of siderophores, phytohormones (auxin, gibberellins, abscisic acid, cytokinin and ethylene), antibiotics, hydrogen cyanide and secondary metabolites (Kour et al. 2020). These mineral solubilizing and other PGP microbes could enhance the growth of plant either directly (providing requirement nutrients and supplements) or indirectly (killing and decreasing the effects of biotic and abiotic factors). The microbes exhibits direct plant growth promoting traits could

be use as biofertilizer and indirect plant growth promoting traits could be used as biopesticides for plant growth promotion and maintaining agriculture sustainability.

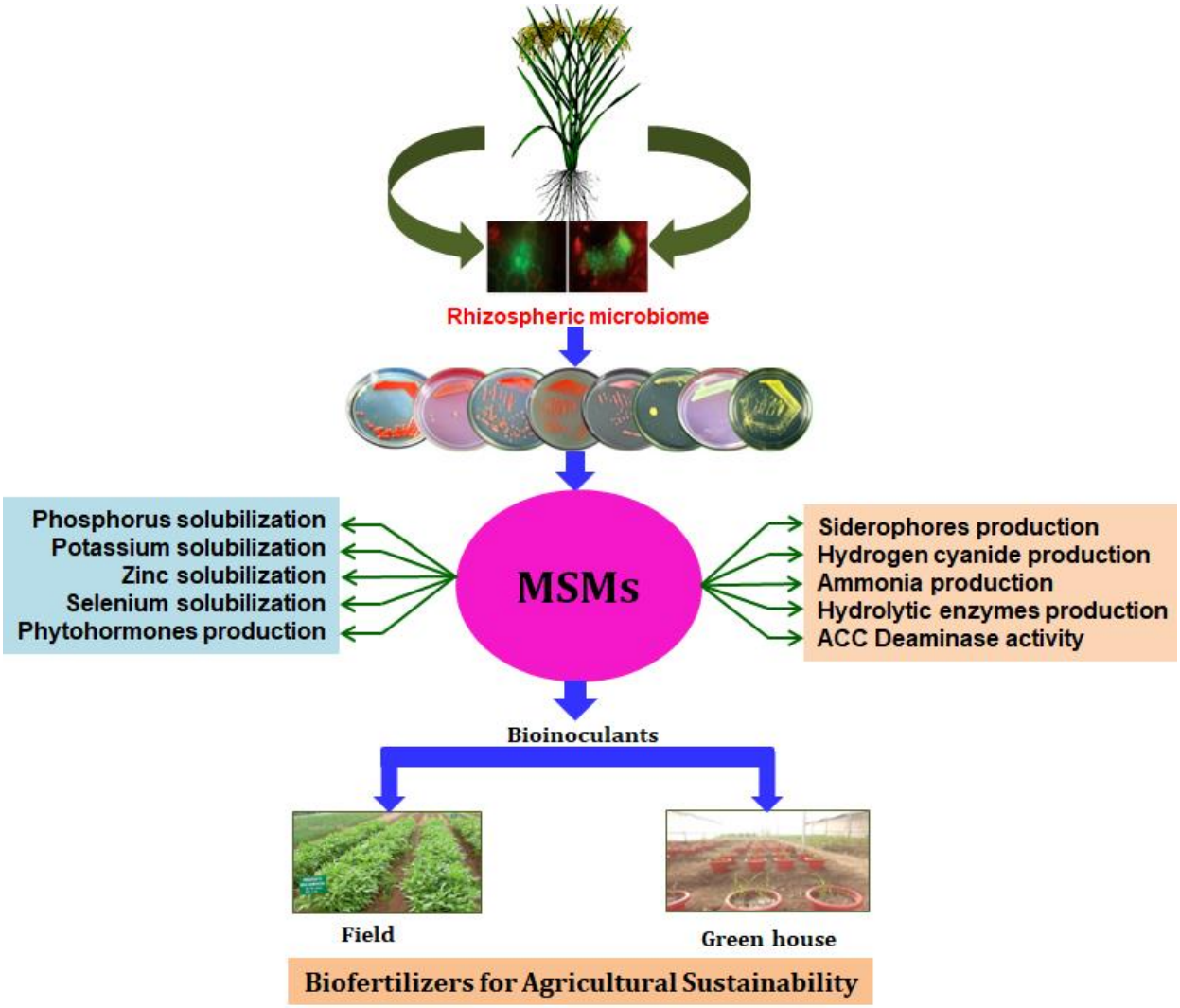

Figure 1 Rhizospheric mineral solubilizing microbes for agricultural sustainability

Mechanisms of mineral solubilization

A broad spectrum of mechanism exists in nature for mineral solubilization via bacteria, fungi and archaea. Among the main mechanisms of mineral solubilizing microbes like mineralization, solubilization, and mobilization. Processes of mineralization, organic form of minerals converted into inorganic form are known as mineralization. In the process of solubilization, microbes are converting into insoluble form of mineral nutrients to soluble form are known as solubilization, when plant uptake mineral into soluble form this phenomenon known as mobilization. The ability of microbes to transform insoluble forms of mineral nutrients into simple and absorbable from makes them very efficient for mineral deficient soil and it is referred as mineral

solubilization. There are two kinds of mineral (macronutrients and micronutrients), in which micronutrients group consist of Zn, Se, Fe, Mn, Al, Ni, B, Cu, Mb, and macronutrients consist of N, P, K required by plants. A number of theories explain the mechanism of mineral solubilization such as production of organic acids, lowering of pH, chealation, acidolysis, enzymolysis, capsule absorption and extracellular polysaccharides. Exopolysaccharides (EPSs) are carbohydrates polymers which are produced by microorganisms like bacteria, fungi, and blue-green algae (Trabelsi et al. 2018). It is a complex mixture of biopolymers consisting mainly of polysaccharides, with proteins, nucleic acids, lipids and humic substances that vary in molecular mass and structural properties. In the case of organic acids, derived from microbes in the plant rhizosphere may also be involved in mineral solubility, like white lupine (Hocking 2001).

Several organic acid were reported such as acetic acid, gluconic acid, citric acid, 2-ketogluconic acid, fumaric acid, lactic acid, malic acid, butyric acid, propionic acid, succinic acid, formic acid, carboxylic acid, pyruvic acid, glyoxalic acid and tartaric acid to be produced by microbes. The chelation of bivalent and trivalent cations such as Ca_2^+, Fe_3^+ and Al_3^+, commonly associated with precipitated form of soil P, may increases the availability of P from these mineral types, via comparison, adding potassium salt from the organic acid appears to cause soil solution pH to increase, but the chealation properties of the acid anion can be exercised even when adding salts. Acidolysis is the processes where a reaction in which a chemical bond is broken via an acid and the hydrogen and anion of the acid become independently attached to the two secreted parts; the decomposition of a compound in this ways. It is help to shift K+ form the insoluble parts in the soil by cation exchange methods. Therefore, the microbes, synthesized and discharge of organic acid into the surrounding environment acidify the cell of the microbes and their surrounding environment, which eventually leads to the release of K ions from the mineral by protonation and acidification. The main process of acidolysis and complexolysis exchange reaction involve in minerals of K mobilization (Uroz et al. 2009).

Mineral solubilizing microbes as biofertilizers

Mineral solubilizing microbes with plant growth promoting attributes can be used as bio-inoculants and microbial consortium to dissolve minerals from poorly available sources in soil to reduce the use of agricultural chemicals. Several studies are available on the effect of inoculating crops with MSM isolated from different crop. Similarly, *Acinetobacter* sp., *Klebsiella* sp., and *Bacillus* sp. were separated from selenium-supplemented wheat and exposed potential develop to plant-growth abilities (production of siderophores, auxin, phytate mineralization, and solubilization of phosphorus) and it is also utilized for the growth of plant, and biofortification (Durán et al. 2014). *Bacillus* sp., *Burkholderia* sp., and *Flavobacterium* sp. were inoculated in the crop of maize, shows significantly increases in plant height, biomass, root length, and grain yield, compared to the uninoculated control (Iqbal Hussain et al. 2013).

Conclusion

The scientific community is focusing on greater use of mineral solubilizers with diverse PGP characteristics. Mineral solubilizing microbes are efficient bio-fertilizers that promote plant growth. They can be applied to crops to promote growth or to increase minerals availability, to reduce chemical fertilizers and to restore soil fertility. Further understanding and study of the genetics behind mineral solubility would also be of great benefit. Mineral solubilizing microbes and transfer their knowledge into bio-based inoculants that could be made easily available to farmers; awareness must also be created among farmers to use inoculants that make sustainable agriculture possible.

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Apiculture as the Most Viable Entrepreneurship for Sustainable Livelihood and Poverty Alleviation

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Abstract
Beekeeping is practice over a greater area of earth's surface than perhaps any other single branch of agriculture and on it depend the success of many other branches of agriculture. The average honey production with *Apis mellifera* is 20 to 30 kg/year/ colony but through migration beekeepers are getting the higher average of 60 to 70 kg. The livelihoods of communities living in hilly areas are normally dependent on agriculture and smallholder farming. The livelihoods requirements of rural small marginal farmers' of hilly regions are not fulfilled without providing them alternative income within available resources. At the same time beekeeping is the best alternative available to provide the potential financial security to small and marginal farmers living in the rural hilly areas. Himachal Pradesh offers very rich possibilities for the development of bee keeping because of its larger area are under horticulture, agriculture and forest. Honey produced by the honeybees, has huge demand in the country and also provides good export potential. The farming communities can adopt bee keeping on commercial basis as a part of cottage industries which will aid their economic development. Honey bees play a vital role in enhancing the productivity of the horticulture and agricultural crops by acting as pollinating agent. The apiculture cultivation is a way forward to double farmer's income with the latest technological intervention.

Keywords: Beekeeping, Entrepreneur, Honey, Livelihood, Sustainability

Introduction
The human population is growing rapidly which is in disproportion to the production of food supplies. Human population has reached 7 billion already (Smith, 2011) and is expected to increase over 8 billion by 2025 (Hinrichsen and Robey, 2000), thereby compelling the need for more food production. While agriculture came into existence around10, 000 years ago, the need for food for the increasing population was met by expanding the cultivatable territory. However, during the last century, the focus was shifted on increasing productivity per unit of land, as due to human intervention the available land required is decreasing day by day. The mediation of several factors such as use of fertilisers, the genetic potential of the crop, water availability and organisms such as arthropods (insects and mites), nematodes, fungi, bacteria, viruses, birds, rodents, and other vertebrates associated

with the crops limit the enhancement of food productivity per unit of land. According to Hall (1995), more than 10,000 species of insects, 30,000 species of weeds, 100,000 plant diseases caused by fungi, virus, bacteria and other microorganisms, and 1000 species of nematodes damage food plants. The yield losses from different categories of pests have been estimated to be US$500 billion worldwide. The application of chemicals on fields causes several problems as environmental pollution, insecticide resistance in over 500 insect pests (Georghiou, 1986), pest resurgence and health problems. These damages to the crop and monetary losses annually certainly affect the small hold and marginal farmers up to a great extent. Therefore an alternative means of livelihood in these unprecedented times is essential and beekeeping arises as a best economically viable solution for the farmers.

How is entrepreneurship good for economic growth?

Entrepreneurship has been termed as the fuel of economic progress and the prime mover of economic growth and development. Entrepreneurs create new businesses, which in turn create jobs, intensify competition and may even increase productivity through technological change. Entrepreneurship in agriculture is an important issue in India. With the upsurge in unemployment, policy makers, researchers and farmers are all working on the development of entrepreneurship in agriculture. In order to draw more entrepreneurs it is vital to give more subsidies in the agriculture, horticulture, sericulture, handloom and handicraft sector. Beekeeping helps to create sustainable livelihood and therefore the decreasing the exposure of masses to poverty. Entrepreneurship development training in beekeeping has been imparted to more new beekeeper in the state. The unemployed youth can start this business with minimal funds and this in return helps in rural development by promoting small village industries. This can be only achieved by supporting capacity building programs such as beekeeping and providing wider help range access to convert the assets into successful means of income.

Why beekeeping?

In Himachal Pradesh farmers have very small land holdings in hilly areas. Beekeeping does not require more land therefore; small farmers and even the landless people can undertake beekeeping. This field does not compete with other branch of agriculture and does not need continuous labour. Managing bee colonies does not require heavy physical work therefore even children and women can maintain apiary. Heavy investment is not compulsory for beekeeping and at the same time this particular sector requires less equipment. Bees also pollinate flowering plants and this activity of this living creature is vital for life on earth. Adequate pollination leads to the good quality fruits and seeds and is essential for maintaining the biodiversity (Pratap and Pratap, 2001). Honey a useful product is valued by the societies as a medicine and healthy food. Propolis and pollen may be also harvested from the bees. Beeswax is used in many cosmetics, candles and has other uses. This sector is sustainable as beekeepers are the friends of the natural environment, willing to conserve forest and vegetation where their bees live and forage. Where there are beekeeping

activities, many people in the community also generate income by making equipments through selling bee products. Bees visit flowers anywhere wild, cultivated and also protected areas all have value for beekeeping. They do not use upland that could be used for crops and bees not depend upon the beekeeper for food.

Beekeeping as a source of income

Beekeeping can occupy an important place in the economy of the farmers. Income from honey supplements the main income from crops and farmer can get a higher income from the beekeeping than from all other work. Beeswax is the second crop that we get from beekeeping. The wax has both commercial and industrial values, especially in cosmetic industry. Sale of the colonies by division is one more source of income. Beekeepers can sell superior queens raised up from better-performing bee colonies. Production of different hive products like bee venom, royal jelly, pollen and propolis can further be the source of income to the farmers. During pollen and nectar gathering the honeybees also effect pollination and improve the quality and quantity of the crop produce. It is estimated that the value of increase in crop yields through pollination is 15-20 times more than the value of honey produced by them. Benefits through pollination are derived by a community rather than only by the beekeeper. Beekeeper himself can increase his income through renting out his bee colonies for pollination services. This practice is well established in many countries and is picking up even in India. Thus the farmer can also earn money through pollination rental.

Beekeeping unit at EU, Baru Sahib

We have established beekeeping “Apiary Unit” in 2017-2018 at Eternal University Baru Sahib, Tehsil Pachhad, District Sirmour of Himachal Pradesh with 10 bee hives boxes of European honey bee (*Apis mellifera*).It is mainly focused on socio-economic upliftment of rural farmers as well as maintained the environmental sustainability. Due to quality production, our honey is in huge demand but production cannot meet the demand thus we expanded this unit. The nearby areas of Eternal University have large proportion of unapproachable lands for agriculture and are covered with various types of medicinal plants and wild flowers that make this part of the region a high potential area for beekeeping. During on campus beekeeping training programmes, local farmers were also made aware about the production of high quality wax and honey using local technology. When beekeepers were taught about the value of 'bee-loving' trees and the bees’ pollination activities, they were more willing to preserve forest habitat intact thus reducing erosion and landslides which are common in this steeply mountainous area. Information on different aspects of bee forage is essential for the efficient management of honey bee colonies. The most serious problem for Indian beekeeping has been the decline in flora due to deforestation and clearing of wastes land for extensive agriculture. Management scheme for each apiculture region is closely correlated with the flowering of local honey and pollen producing plants as also the climatic conditions. A basic research in the area of forage ecology has been done and floral calendars for different regions are prepared.

Table1 List of some flora available at Lana Machher

Sr. No.	Common Name	Scientific Name	Family	Flowering Time	Source of N-Nectar P-Pollen	Plant type and economic importance
1.	Sarson	*Brassica campestris* L.	Brassicaceae	Nov-March	N+P	Herb, Oilseed
2.	Marigold	*Tageteserrecta* L.	Asteraceae	Sept- Nov	N	Herb, Ornamental plant
3.	Pajja	*Prunuspuddum*Franch.	Rosaceae	Nov- Dec	N+P	Tree, horticultural plant
4.	Chichri	*Plectranthusrugosus* Wall.	Lamiaceae	Aug-Oct	N+P	Shrub, wild plant
5.	Khair	*Acacia catechu* Willd.	Mimosaceae	May-July	N	Tree, Wild plant
6.	Bottle brush	*Callistemon citrinus*	Myrtaceae	March-May	N+P	Tree, ornamental plant
7.	Eucalyptus	*Eucalyptus hybrid* L.	Myrtaceae	March-May	N+P	Tree, wild plant
8.	Cauliflower	*Brassica oleracea*var*botrytis* L.	Brassicaceae	March-May	N+P	Herb, Vegetable
9.	Kainth	*Pyruspashia L.*	Rosaceae	Feb-March	N+P	Tree, horticultural plant
10.	Peach	*Prunuspersica*Batsch	Rosaceae	Feb-March	N+P	Tree, horticultural plant
11.	Pear	*Pyruscommunis*L.	Rosaceae	Feb-March	N+P	Tree, horticultural plant
12.	Simbal	*Bombaxceiba*L.	Malvaceae	Feb-March	N+P	Tree, wild plant
13.	Kachnar	*Bauhinia variegata*	Fabaceae	March - April	N+P	Tree, wild plant

Figure 1: Apiary unit (learning facility availed by students from apiary unit established with *Apis mellifera* bee colonies at Lana Machher).

Figure 2: Extracted honey from established apiary unit of Eternal University Baru Sahib

Role of Beekeeping in improving food security and livelihood

There are a number of specialist industries which supply requisites to the beekeeping industry. This supply industry includes:

Packer's equipments- Bottles and bottling equipment are required by packers. In addition, drum manufactures provide the special galvanized drum, made with side bung that is not generally available from other sources for producers and packers.

Extractor/ uncapping machinery- Any company skilled in the production of stainless steel equipment for the food industry would be capable of manufacturing the machinery required to "uncap" combs and extract honey.

Beehive manufacturer- While only small in number, companies manufacturing hives for the industry tend to specialize in this activity.

Heat source- Every honey producer requires a steam or hot water boiler to generate steam and hot water for processing honey and wax. While not required a specialized manufacturing activity, the beekeeping industry generate a demand for such equipment.

Transport/ handling equipment- All commercial beekeepers must purchase trucks and utilities for transporting and servicing hives.

Other equipment- Beekeepers also have a need for additional equipments such as electric generators and mobile extracting units.

Industries that depend on apiculture

Honey is the prime output of commercial beekeepers and produced by bees from plant nectar. The major produces are Russia, USA, China, Argentina, Canada, Mexico, Brazil and Australia. The major exporters are China, Argentina and Mexico and the highest colony yields are recorded in Australia and Canada which have a favourable environment as well as highly developed colony management. The increased consumptions over the last few years can be due to increase in the living standards and a higher interest in natural and health products. Wax is a material secreted by the worker bees. It is collected from honey comp and also from the wax pieces and is used in various pharmaceutical and cosmetic preparations. Marketing and prices for the products made from beeswax vary extensively from country to country. It is used in skin creams, candles making, grafting wax for the horticultural crops, polishes and varnishes, liquid furniture polishes, paste furniture polishes, floor polishes, spray polishes and shoe polishes. The production of queen bees and the entire colonies is the main diversification accessible to the beekeepers. Live bee export is a potential growth area in beekeeping industry. A milky white smooth jelly secreted by the nurse bees used to developqueen larvae and the young worker bee larvae. The production of royal jelly is a specialized procedure and flora conditions must be ideal. Royal jellycan be sold in its fresh state and also mixed with other products.

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Mighty Microbes: A Potential Link to Agricultural Sustainability

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Abstract
Sustainable agriculture and sustainable environment are the two world most important need because the growing population of the world and human activities has ruined the environment. Growing population of the word leaves behind the big threat to the food security. Therefore, scientists have emerged a new tool for the sustainable environment and agriculture i.e. microbes. Microbes are the minute forms of life that have hidden talent to work for the environment. Microbes exist in the different environment like soil, water, air from which microbes present in soil have many advantages for environment and the agriculture. Naturally soil microbes are involved in the geological cycles like nitrogen and carbon. In agricultural soil microbes plays a significant role in reclamation of soil fertility, alleviation of stresses, and nutrients stress so that the growth and development of plants is well.

Keywords: Agriculture Sustainability, Bioformulations, Microbiomes, Soil fertility

Introduction
Food production is one of the major challenges for every nation particularly with the accelerated rate of industrialization and urbanization as they have deteriorated soil fertility. According to the Global Land Assessment of Soil Degradation (GLASOD) mapping system, estimated 8.7 billion hectare and 2 billion hectare of agriculture land, pasture, forest and woodland, respectively has been degraded since mid-century. The mapping system has also reveals that Asia has a third most degraded i.e. 38% land after Africa (65%) and Latin America (51%), thus crop production with concerning the environmental health have become a challenging and addressing issues of current time. The scientific community worldwide rethink the age-old and some new practices i.e. biodynamic agriculture, organic farming, permaculture and natural farming which have low or no dependence on agrochemicals. Microbial use in the agriculture fields are increasing at tremendous rate and the productivity of agriculture product has boosted from stagnant level. Bioinoculants, the formulation of beneficial microbes are one of the best alternatives of agrochemicals inputs which provide beneficial consequences on enhancement of plant growth, health, stress tolerance, disease

resistance and nutrient availability. The advantageous effects of microbes as biofertilizer in agriculture have boosted many researches around the globe. Microbes (bacteria or fungi) are the plentiful community which are present in the soil, water, and in association with plants (endophytic, epiphytic and rhizospheric) with plant growth promoting (PGP) attributes could be used as bioinoculants (Kour et al. 2020b).

Beneficial microbes promotes the plant growth *via* different PGP traits such as fixation of biological nitrogen; solubilization of several minerals like phosphorus, potassium and zinc; production of siderophores, phytohormones (auxin, gibberellins, abscisic acid, cytokinin and ethylene), antibiotics, hydrogen cyanide and secondary metabolites. These PGP traits of microbes could enhance the growth of plant either directly (providing requirement nutrients and supplements) or indirectly (killing and decreasing the effects of biotic and abiotic factors). The microbes exhibits direct plant growth promoting traits could be use as biofertilizer and indirect plant growth promoting traits could be used as biopesticides (Yadav 2021; Yadav et al. 2020).

Biological nitrogen fixation

Nitrogen is the most abundant element on the earth and the main reservoir of this element is biosphere where it is present in form of stable nitrogen gas N_2. This element is important for every living organism as it is a structural component of biomolecules like nucleic acids, proteins and some other biological molecules. In plants also nitrogen is the most important factor that forms nearly 4% of its dry weight and its deficiency decreases the protein level, yield and water use which ultimately stunts the plant growth. Plant absorbs nitrogen in the inorganic form i.e. ammonia, which is further used for manufacturing all necessary nitrogen-containing components. Microbes helps in the provide nitrogen through the process biological nitrogen fixation. Several studies have reported nitrogen fixing bacteria. *Sphingomonas trueperi, Psychrobacillus psychrodurans* and *Enterobacter oryzae*.

Phosphorus solubilization

Phosphorus is the second most required element of the plants. It is the 11th most abundant element on the earth and the of P largest reservoir is lithosphere i.e. soil (400-1200 mg/kg). Phosphorus the integral part of its chemical structures (coenzymes, nucleic acids, phosphorproteins and phospholipids) and make up 0.2% of plant's dry weight. In plants, this macronutrient plays a significant role in respiration, photosynthesis, membrane formation, carbon metabolism and energy transfer. Phosphorus also helps in root elongation and proliferation for the acquisition of more nutrients and water from the soil. Microbes avail this particular through the process of solubilization and microbes such as *Pantoea agglomerans*, *Enterobacter asburiae*, *Acinetobacter* sp., *Bacillus cereus*, *Streptomyces laurentii*, and *Penicillium* sp. have been reported for solubilizing P mineral (Kour et al. 2020a).

Potassium solubilization

The third essential macronutrient which is solubilized by the microbes for plants growth development is potassium (K). Plant uptake K from the soil through the

root systems and this mineral is transported to every inner cells of the plant tissue through xylem and phloem for several plant functioning. This mineral itself is not a part of the plant chemical structures like of nitrogen and phosphorus, but still it is a crucial macronutrient. It particularly helps in the activation of plant enzymes, maintenance of osmotic tension and turgor, synthesis of proteins, regulation of

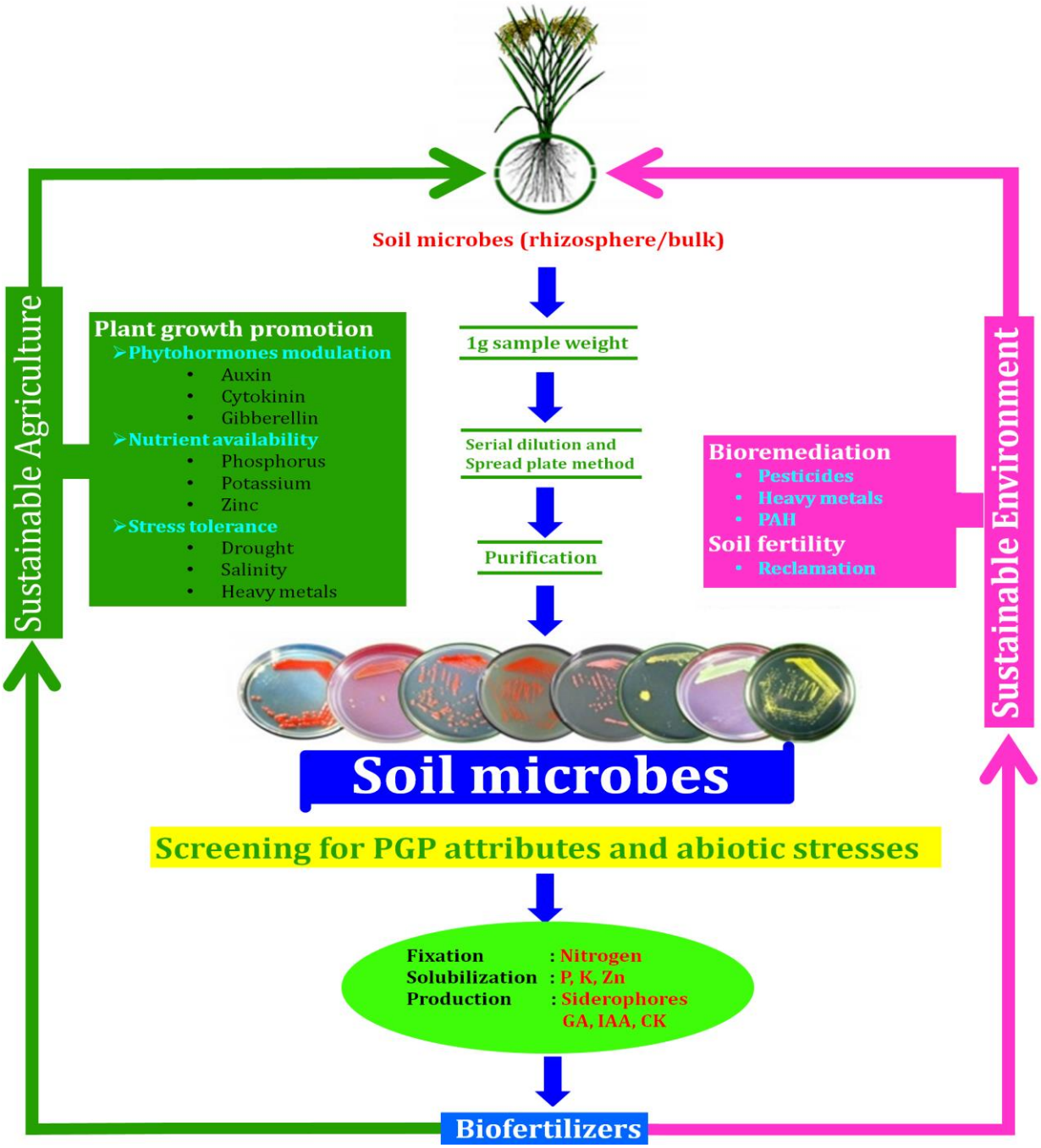

Figure 1 Mighty Microbes for sustainability

stomata cells activity to prevent loss of water by transpiration, photosynthesis (conversion of carbon dioxide and hydrogen into sugars, for sugars translocation and for the formation of starch), movement of water, necessary nutrients and carbohydrates in various parts of plant tissue and it imparts the plant resistance against pathogens like bacteria and fungi. Various studies have been conducted for the investigation of potassium solubilizing microbes that further can be used as potassium biofertilizer instead of chemically synthesized fertilizer (potash). *Bacillus subtilis*, *Burkholderia cepacia*, *Pantoea agglomerans*, *Pseudomonas orientalis*, *Rahnella aquatilis* are the few potassium solubilizing microbes that have been reported.

Microbial consortium

Bioformulations of beneficial PGP microbes as biofertilizer and biopesticides are known from many years. The microbial based first formulation was developed in 80s in USA, since then, different types of microbial bioformulations were made and applied in the fields that contain different carrier, and microbes. Beneficial microbes exhibiting multifarious plant growth promoting traits as bioinoculants could be used as singly or as consortium (mixture of two or more microbes). The majority of available bioformulations developed ever since was of single species. Particularly from the last decade, microbial bioformulations were also developed containing two or more microbial species as combining the microbes gives combined benefits. Thus, the conglomeration of beneficial microbes is an efficient bioinoculants over the single microbe containing bioformulations. According to a report by Rana et al. (2015), the combined inoculation of *Anabaena oscillarioides*, *Brevundimonas diminuta*, and *Ochrobactrum anthropi* on rice, significantly enhanced the crop content of macronutrients nitrogen, phosphorus and potassium and micronutrients iron, zinc, copper and manganese. The study concluded that the combined inoculation in crop favoured the development and yield performance in comparison with the single inoculation and uninoculated control (Gavilanes et al. 2020). Similarly, the combination of PGP bacteria, *Burkholderia* sp. *Mesorhizobium* sp., and *Pseudomonas* sp. and AMF, *Claroideoglomus claroideum, Funneliformis geosporum* and *Rhizophagus irregularis* on chickpea was reported for increasing growth, grain yield and protein content under the rainfed condition (Laranjeira et al. 2021)

Conclusion

Plant growth and development is key factor for higher productivity and it is mainly depends on the required nutrients fulfilment. Earlier sufficient amount of soluble nutrients form were present in the soil which can be utilized by the plants but now the concentration of soluble form of nutrients is vanished from the soil due to anthropogenic activities of humans. Since the beginning of green revolution plant requirement was fulfilled by using the chemical synthesized fertilizer. These agrochemicals are known to enhance the growth and yield of the plants but other

the hand they have depleted the health of the environment by causing different types of pollution. The replacement or reduced application of the deleterious effect of agrochemicals, biofertilizers could be used for the sustainable crop development. Biofertilizer demand is increasing day by day and different biofertilizers were being launched in the market. They are mostly developed from the single culture and microbial mixtures are less especially for the hilly regions. The microbial mixture or microbial consortium has been more advantageous over the singly cultured biofertilizer and they could be used in future as an alternative of chemical fertilizers.

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Drought-Adaptive Phosphorus Solubilizing Microbes for Agricultural Sustainability

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Abstract
Drought is among one of the major abiotic stress factor responsible for the decrease in the yield of the crops in the world with the increasing population day by day. Further, problems are caused by the limitations of the nutrients particularly the phosphorus due to which the dependency on the phosphatic fertilizers is increasing. The availability of phosphorus is further decreased under stress conditions. Mitigating the adverse effects of drought and making the availability of phosphorus by use of stress adaptive and P-solubilizing plant growth promoting microbes is an effective strategy. Many studies have reported diverse microbial genera which exhibit ability to solubilize phosphorus as well as are drought tolerant including *Acinetobacter, Bacillus, Delftia, Paenibacillus, Pseudomonas,* and *Stenotrophomonas*.

Keywords: Biodiversity, Drought, Phosphorus, Plant growth promotion

Introduction
The global climate is changing as a consequence of industrialization and exponential growth of world population. Each year, the world loses more and more agricultural land to drought and increased salinity. Drought stress result in the inhibition of plant growth compared to the level that it might attain in their absence. The negative impact of the drought stress on the plants occurs due to various factors such as low rainfall, low and high air temperatures, lack of irrigation water and salinity. Drought stress effects biochemical, morphological and physiological characteristics as a result decreasing the crop growth and yield. Phosphorus (P) is one of the vital elements in the nutrition of plants, after nitrogen (N). It plays major role in almost all metabolic processes of plants including photosynthesis, energy transfer, macromolecular biosynthesis and respiration. Most soils contain large reserves of total P, but due to fixation and precipitation of P with soil constituents cause a major P-deficiency and restrict the growth and yield of plants. Phosphorus limitations under drought stress further reduces growth of the plants. The negative impacts of the drought stress and phosphorus deficiency can be overcome by drought stress adaptive and P-solubilizing microbes (PSMs).

These stresses adaptive PSMs are precious bioresources to promote growth and fulfill the P requirements of the plants under drought stress. Drought stress adaptive PSMs confer drought resistance and promote plant growth through the production of various plant growth regulators, siderophores, solubilization of other insoluble nutrients, accumulation of different osmolytes, scavenging reactive oxygen species, reducing the inhibitory concentration of ethylene and decreasing lipid peroxidation (Yadav et al. 2020a; Yadav et al. 2020b). Stress adaptive microbes with P-solubilizing capability could be used as bioinoculants for increasing phosphate uptake and combating drought stress for agricultural sustainability.

Stress adaptive P-solubilizing microbes-mediated drought tolerance

Sustainable agricultural systems employ natural processes so as to achieve acceptable levels of productivity as well as the food quality simultaneously minimizing the adverse environmental impacts. Greater emphasis has been placed on the indigenous soil microbes which contribute to the fertility of the soil, increased plant growth as well as the plant protection. There are numbers of different mechanisms by which stress adaptive P-solubilizing microbes with different plant growth promoting attributes directly or indirectly affect the growth of the plants under normal as well as the stress conditions (Figure 1).

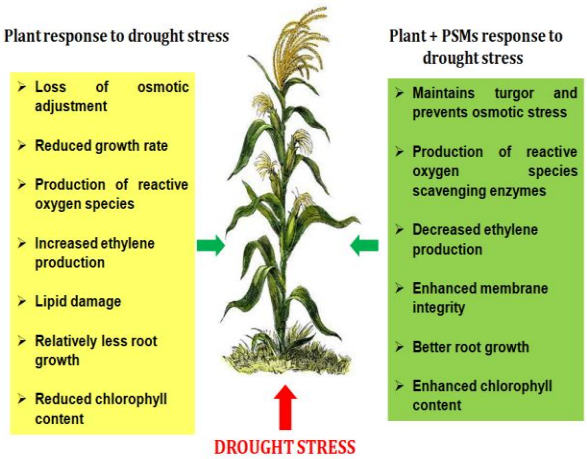

Fig. 1 A schematic representation of impact of PGPMs on plants exposed to drought stress

Phytohormones production

Indole acetic acid (IAA) is one of the most active auxins and it positively affects the growth of the roots. IAA affects cell division, extension and differentiation, seed and tuber germination, controls various processes of vegetative growth, increases the rate of xylem and root development, pigment formation, resistance to various stressful conditions (Miransari and Smith 2014). There is vast diversity of PGP microbes reported to produce IAA including *Acinetobacter calcoaceticus Curvularia geniculata, Lecanicillium psalliotae, Penicillium menonorum, Ralstonia* sp., and *Stenotrophomonas maltophilia* (Rastegari et al. 2020). Gibberellins regulate and influence the growth, developmental process, flowering, stem elongation, seed germination and enzyme induction. The production of the gibberellins has been confirmed in *Acetobacter diazotrophicus, Herbaspirillum seropedicae* (Bastián et al. 1998) and *Bacillus* sp. (Gutiérrez-Mañero et al. 2001). Auxins and cytokinins interact with each other and control many of the important developmental processes in plants such as apical dominance, and root and shoot development. Some strains of *Bacillus subtilis, Paenibacillus polymyxa, Pantoea agglomerans*, *Pseudomonas fluorescens,* and *Rhodospirillum rubrum*

have been detected with the synthesis of cytokinins (Yadav et al. 2020b). . Cytokinin-producing *Bacillus subtilis* has been demonstrated to enhance the shoot growth and confer drought stress tolerance in *Platycladus orientalis* (Liu et al. 2013).

Production of siderophores

Iron (Fe) is known to be the fourth most abundant element on earth's crust and is vital for the growth and developmental processes of living organism. It regulates the biosynthesis of antibiotics, aromatic compounds, nucleic acid synthesis, pigments, porphyrins, toxins and vitamins (Saha et al. 2016). Siderophores are low molecular weight, high affinity ferric ion chelators that are excreted under iron starvation by diverse microbes such as archaea, bacteria and fungi and have also been known to be excreted by plants. Siderophores means the iron (Fe^{3+}) carrier. There are various studies which show the siderophores producing rhizospheric bacteria mainly belongs to the genera *Bradyrhizobium, Pseudomonas, Rhizobium, Serratia* and *Streptomyces* (Mehnaz 2013).

Solubilization of potassium and zinc

Potassium together with nitrogen and phosphorus, is one of the most important essential nutrient for plants and is the third element in the classical chemical fertilizers NPK (Velázquez et al. 2016). Many potassium solubilizing microbes (KSMs) have been reported from different sources and hosts such as *Aspergillus niger, Bacillus circulans, Fomitopsis meliae,* and *Paenibacillus glucanolyticus* (Yadav et al. 2020a). Zinc is another vital micronutrient for growth and development of plants. It is an important constituent of a variety of metabolic enzymes. There are several genera of PGPMs that have been reported to be Zn solubilizers including *Bacillus* sp. and *Pseudomonas* sp. (Goteti et al. 2013), *Abisidia cylindrospora, Abisidia glauca, Abisidia spinosa, Aspergillus niger* and *Penicillium simplicissimum* (Franz et al. 1993; Saravanan et al. 2011), *Aspergillus niger* and Phomopsis sp. (Sutjaritvorakul et al. 2013).

ACC deaminase activity

Ethylene (C_2H_4) is an endogenously produced gaseous hormone which basically acts at very low concentrations and participates in regulating various plant growth processes and development Ethylene is also synthesized in response to various stresses which is known as "stress ethylene". Ethylene when present at high concentration proves to be inhibitory for the growth of the plants. The levels of stress ethylene in plants can be reduced by the activity of microbial ACC deaminase (Kour and Yadav 2020). There are many reports on ACC deaminase activity by microbial strains belonging to diverse genera.

Conclusion

The efficient strains well adapted to stress environments can be isolated and screened for diverse plant growth promoting attributes for developing bioinoculants for stressed environments. Thus, utilizing these bioinoculants will make a breakthrough in growing crops as well as enhancing the yield of the crops under stress conditions.

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Poster Presentations

WADFPSE/PP/01

Sustained subculture influences indirect organogenesis from mature leaf explants of *Swertia chirayita* Buch.- Hams. ex Wall

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Abstract
In case of *Swertia chirayita* Buch.-Hams. ex Wall propagation through seeds is restricted because of long gestation period, seed dormancy, poor seed germination rate and low seed viability. While vegetative propagation is slow and time consuming, therefore, micro- propagation is an alternative for sustainable production of uniform quality of bioactive compounds present in *Swertia chirayita.* In present study, it may be observed that the regeneration potential of callus increased with an increase in subculture passage. Highest per cent noticed upto 99.15% after third sub culturing. Similar trend noted for average number of shoots per explants and average shoot length. An increase in number of micro shoots per explants with increase in number of sub culturing was obtained with highest number of shoot frequency but up to fourth sub culturing. After that there was a decrease in both average number of shoots per explants and average shoot length. But rejuvenation overall influences various parameters of growth during indirect organogenesis from mature leaf explants with an enhancement in callus and shoot induction up to certain stage as observed in present study.

Keywords: Rejuvenation, Seed dormancy, *Swertia chirayita*

WADFPSE/PP/02

Biochemical characterization of rice straw cultivars for alternative industrial uses

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Abstract
Every year, Haryana (India) produces about 6 million metric tons of rice straw due to rice cultivation. Generally, rice straw is either burned or ploughed onto the field without being turned into a functional product. This can affect the regional environment, as well as anthropogenic climate change.Burning pollutes the air resulting in considerable losses on the properties of the soil, the soil nutrients, organic matter, productivity and biodiversity, and on & off-farm humans and animals' health. Rice straw is the most prevalent farm waste, and as feedback for the production of value-added products, it has a lot of promise. The biochemically and functionally specified potential for optimal alternative use of the rice straw of 13 most widely produced rice varieties from Haryana's eastern and western agro-climate zones was undertaken. For the biochemical characterization, the contents of cellulose, hemicellulose, lignin, silica, nitrogen, phosphorus and potassium were determined. The existence of functional groups in rice straw was identified with Fourier Infrared Transform Spectroscopy. Pusa-1401 variety had the highest cellulose (46.55%) and silica content (13.70%), while Pusa-1718 hadhemicellulose (28.25%) and lignin (11.60%), respectively. The highest nitrogen (0.81%), phosphorus (0.32%) and potassium (2.78 %) were found in rice variety Pusa-1509, Pusa-1401 and Rice-6129. The findings seemed to be statistically significant ($p<0.05$). The biochemical profiles of rice straw cultivars were classified into distinct structural groups (C-H alkalanes, O-H alcohol, C=O, C–H alkanes) based on the FTIR spectrum in order to find the best alternative possibilities for bioethanol and compost production.

Keywords: Rice straw, Characterization, Straw burning, Alternative uses, Compost

WADFPSE/PP/03

Bacterial Remediation of Paper Mill Effluent

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Abstract
Remediation is defined as the elimination or transformation of polluting substances. Now a days it is too important to adopt some means of remediation to degrade or reduce the amount of contaminants from environment. To achieve this goal several methods like high-temperature, incineration and oxidation have come into play but due to some limitations, these methods didn't get much attention. This is where bioremediation comes into play. Waste disposal has environmental and financial cost, which can be reduced by using bio remediating agents. As we know, one of the major causes of environmental pollution is increase in industrialization and urbanization. The waste so produced contains a number of chemical and toxic residues that can harm biotic factors also. To decrease levels of such contaminants several chemical, physical and biological factors are being used. The effluent from various industries contains lots of coloring agents (dyes, inorganic pigments, tannins, lignin etc), chemicals that are not suitable for environment, heavy metals and some other causative compounds. Paper mill industries also produces large amount of dark colored effluent with high BOD and COD. In present study, bacteria were isolated from the paper mill effluent contaminated soil samples. Isolated bacteria were accessed for reduction in COD of treated effluent. Bacterial isolate YPM_{22} was able to reduce COD of paper mill effluent nearly 14-18% after 5 days of incubation. The isolated bacteria can represent promising application in treatment of wastewater from paper mill.

Keywords: Paper mill, Bioremediation, Effluent, Bacteria

WADFPSE/PP/04

Protein Enhancement in Pearl-millet by Fermentation with *Lactobacillus plantarum*

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Abstract
Nutritional value of cereals and pseudocereals can be enhanced by fermenting withprobiotic bacteria, it will also help in improving stability and flavour in food also. Most widely grown type of millet is Pearl millet (*Pennisetumtyphoideum*) throughout the world, which is superior to major cereals nutritionally *viz*. high quality proteins, fat and minerals such as calcium, iron, zinc. Moreover, it is also a rich source of dietary fiber and micro nutrients (Malik, Singh, &Dahiya, 2002).It is gluten free, so can be used as food for people having gluten allergy (Galante*et al*. 2020). Probiotic bacteria such as *Lactobacillus plantarum*, *L. fermentans* and *L. rhamnosus* has ability to produce extracellular enzymes such as protease which help in release of smaller molecules such as peptides, amino acids, and other nitrogenous compounds having physiological functions. In this study, submerged fermentation of defatted pearl-millet flour was performed using *Lactobacillus plantarum* for 72h. Samples were collected after every 24h to check pH, titrable acidity and protein concentration. Decrease in pH was observed after 48h (3.5) as compare to control (7.0) indicating ability of bacteria to ferment millet.Increase in soluble protein was observed on fermenting pearl-millet with *Lactobacillus plantarum which indicates* significant level of protein hydrolysis occurred as compare to control. Peptides produced after fermentation has more nutritional attributes such as anti-microbial, anti-oxidative and anti-diabetic activities which can be used for production of fermentative nutraceuticals.

Keywords: Anti-diabetic, protein, peptide, Pearl-millet, Fermentation

WADFPSE/PP/05

Synergistic effect of microbial consortium of mineral solubilizing microbes on plant growth of oats (*Avena sativa*) growing in hilly region of Himachal Pradesh

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Abstract

Bioinoculants provide a better opportunity for ecological farming practices to enhance plant crop productivity. Different types of bio-inoculants containing single microbial strain or multiple strains as consortium could be used for agriculture sustainability. The purpose of this study is the isolation of plant associated microbes from rhizospheric soil and root internal tissues from different crop and evaluation on oats plants. The present investigation deals with isolation of mineral solubilizing microbes from the rhizosphere of crops growing in hilly regions in Himachal Pradesh and their role in plant growth promotion of oats. A total of 169 bacterial strains were isolated from different cereal crops i.e. foxtail millet, finger millet, maize, oats and, wheat, and screened for the mineral solubilizing attributes including solubilization of phosphorus, potassium, zinc, selenium and iron. The selected mineral solubilizing bacteria were further screened for other plant growth-promoting attributes like nitrogen fixation, and production of ammonia, indole acetic acid, and hydrogen production cyanide. Five efficient strains were identified using 16S rRNA gene sequencing as *Serratia surfactantfaciens* EU-C3SY2 (P-solubilizer), *Serratia marcescens* EU-D1RNL1 (K- solubilizers), *Serratia nematodiphila* EU- D2SRY4 (Zn-solubilizer), *Serratia* sp. EU-C1RK1, and (Fe-solubilizer), *Erwinia persicina* EU-B1RT3.1 (Se-solubilizer). The inoculation of these bacterial strains on oats as single strain and as microbial consortium enhanced the growth and physiological parameters of oats including; root/shoot length, fresh and dry weight of plants, content of chlorophyll, carotenoids, phenolics, flavonoids, and sugar in comparison with untreated control. The results suggested that the microbial consortium is a good source to reduce chemical input in traditional agricultural practices and to increase nutrients uptake and help in better plant growth. Effective microbial consortium could be used as bioinoculants for cereal crops growing in hilly regions.

Keywords: Agricultural sustainability; Mineral solubilizing microbes; Microbial consortium; Oates; Plant growth promotion

WADFPSE/PP/06

Plant Breeding a Proven Tool to Guard Food and Nutritional Deficiency in the Current Era of Climate Change

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Abstract
By 2050, the world population is likely to grow by 9 billion people, making food availability a critical concern now and in the future in the current era of climate change. Plant breeding will continue to play a crucial role to safeguard the food and nutritional security of the rising population as well as to combat the climate change. The conventional breeding methods like selection, hybridization, line breeding etc. usually can take up 10 years to develop a new variety. In the new era of science and technology, plant breeding is equipped with novel tools such as marker assisted selection, rapid generation advance, double haploid method, shuttle breeding, marker assisted pyramiding, and so on, which enable breeders to breed new varieties with higher yield, biotic stress resistance/abiotic stress tolerance and enrich with nutritional value(Bio-fortification) in time efficient manner. These advanced techniques supplemented the conventional breeding methods and proven to be have great potential in enhancing the crop yield in short period of time and cost-effective manner under high resource use efficiency. There is an urgent need to direct more funds toward the development and adoption of these innovative techniques in underdeveloped/ developing nations. Plant breeding is still under dynamic progression and firmly founded on inter-disciplinary science, yet more innovative technologies are expected to emerge and existing ones will have to find new applications within them.

Keywords: Hybridization, marker assisted selection, double haploid, rapid generation advance.

WADFPSE/PP/07

Statistical Optimization of Steam Blanching Time and Temperature for the Production of Onion Puree

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Abstract
In the agro-food sector, blanching is a heat treatment that is commonly used as a pre-treatment before the processing of fresh vegetables. Essentially, its main purpose is to inactivate the enzymes responsible for causing fresh vegetables to decay. Furthermore, it reduces the bulk and microbial activity, allows faster cooking times, and eliminates intracellular air so that oxidation does not occur. Therefore, this study aims to optimize the steam blanching time and temperature for the production of enhanced quality onion puree. The process was optimized using Response Surface Methodology with a Miscellaneous 3-Level Factorial design ($R^2 \geq 0.75$; $p < 0.05$). There were two independent variables studied: blanching time (1-5 minutes) and temperature (100-110°C), for onion (cv. Punjab Naroya), which was peeled, washed, cut into quarters, and then steam blanched. These blanched samples were then pureed with a grinder. The samples were analysed for the colour change, whiteness index, total solids, and pyruvic content. The contour maps generated using the response surface methodology indicated that the experimental variables significantly influenced the response. Moreover, blanching temperature was found to be significantly influencing colour change, whiteness index total solids, and pyruvic content. The optimum processing conditions that yielded products with minimum colour change and maximum whiteness index, total soluble solids and pyruvic content: steam blanching time of 5minutes, and steam temperature of 110°C.

Keywords: Onion Puree, Optimization, Quality, Steam Blanching

WADFPSE/PP/08

Response of Seed Germination and Seedling Growth of Mung Bean to Ozone Gas Treatment

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Abstract
Germination of seeds plays a critical role in the adaptation of mung bean, as it controls the growth of the plant. More commonly, ozone is used to enhance the shelf life of agricultural products, protect crops from diseases and pests, and irrigate agricultural fields. In the present study, the effects of ozone doses and exposure time on the germination and growth of mung bean seeds (*Vigna radiate* and SML-668) were assessed through two different experiments. For the first experiment, seeds were pre-treated with ozone gas at 0, 500, 750, 1000, and 1250 ppm for two hours. Based on the results of the first experiment, the second experiment was undertaken for different exposure period (1, 2, 4 and 6h) in order to determine an appropriate exposure time for the optimal dose of ozone gas treatment. As a result of applications, shoot length, root length, germination rate, and vigour index, were evaluated. The results showed that ozone treatments positively affected seed germination and seedling growth (p<0.05), and exposing the seed to ozone gas at 1000 ppm for two hours had the most stimulating effect as compared to other doses and control samples. Besides, it was observed that the highest dose of 1250ppm ozone gas, negatively affected the same parameters. The ozone exposure time also had a significant influence on the length and germination percentage of the seedlings and the vigour index of the plants (p< 0.05).Seed growth indices and germination were observed to increase with ozone treatment when mung bean seedlings were exposed for 2 hours, but growth slowed with longer exposure times (4 h or 6 h). Consequently, ozone gas treatment at 1000ppm dose for 2h exposure period can be used to increase rate of seed germination and seedling growth in mung bean plants**.**

Keywords: Germination, Mungbean, Ozone, Vigour index

WADFPSE/PP/09

Recent Trends in the Area, Production, and Productivity of Rapeseed, Mustard and Chickpea in Haryana, India

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Abstract
The present study was carried out with the objectives to analyze the trend in area, production and productivity of rapeseed & mustard and chickpea. The outcomes of study revealed an increasing trend in the area, production and productivity of rapeseed & mustard at the national level with CAGR values of 0.14, 2.17 and 1.92 per cent, respectively. Whereas, in Haryana, the trend in area indicated decreasing trend 0.05 per cent, while production and productivity illustrated increasing trend with CAGR values of 2.37 and 3.67 per cent, respectively. In this study, an increasing trend was shown in the area, production and productivity of chickpea at the national level with CAGR values of 1.87, 3.30 and 1.41 per cent, respectively. Whereas, in Haryana, the trend in area and production indicated decreasing trend -8.14 per cent and -6.88 per cent while productivity illustrated increasing trend with CAGR values of 1.32 per cent, respectively. In case production, the maximum production of rapeseed and mustard was 9256 thousand tones during 2018-19 in India, while in case of chickpea, the production was maximum in 2017-18 *i.e.* 11379 thousand tones.

Keywords: Chickpea, Growth rate, Productivity, Rapeseed, Mustard

WADFPSE/PP/10

Psychrotrophic Phosphorus Solubilizing Bacteria of Himalayan Regions: Biodiversity and Role in Plant Growth Promotion of Cereal Crops

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Abstract

Phosphorus is an important nutrient for plant growth and development, which plays a vital role in the different metabolic activities. Phosphorus is the major yield limiting plant nutrient in arid and semi-arid soils. Phosphorus is abundant in soils in both organic and inorganic forms. The use of chemical P-fertilizers is obviously the best means to circumvent phosphorus deficiency, but their use is always limited due to its spiraling cost. To circumvent P-deficiency, phosphate-solubilizing microorganisms (PSMs) could play an important role in supplying phosphate to plants in a more environmentally-friendly and sustainable manner. The present study was conducted to analyze the plant growth promotion effects of PSMs under low temperature stress conditions. In the present investigation, the bacteria were isolated from the rhizospheric soil of wheat crop of Keylong, Himachal Pradesh. A total of 191 bacterial isolates were isolated on different growth media such as nutrient agar, King's B agar, and trypticase soya agar. These isolates were screened for P-solubilization using three different insoluble form phosphorus i.e. rock phosphate, apatite and tricalcium phosphate. Ten efficient isolates solubilizing all the three insoluble sources of P were then further characterised for other attributes of plant growth promotion including the solubilization of Zn and K; production of IAA, siderophores, HCN and ammonia. All ten isolates with multiple PGP attributes were used as bioinoculants in green house experiment on wheat crop. The isolates efficiently improved the physiological and growth parameters of wheat crop under low temperature conditions. PSMs could be widely utilized as biofertilizers in agronomic practices in order to increase the productivity of crops while maintaining the health of soils.

Keywords: Diversity, Plant growth promotion, P-solubilization, Sustainable agriculture

WADFPSE/PP/11

Plant growth promotion of foxtail millet (*Setaria italica* L.) by novel and potential microbial consortium with multifunctional attributes

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Abstract
Plant growth promoting microbes as bio-inoculants provide better opportunity for ecological farming practices to improve the crop productivity of the crops. It could promote growth of plant either directly by aiding resource acquisition and controlling the levels of plant hormones or indirectly by reducing the phytopathogens inhibitory effects. It could be achieved by inoculating single microbial strain or multiple microbial strains in single formulation as consortium. In the present investigation, a microbial bioformulation was used to evaluate the growth of foxtail millet (*Setaria italica* L.) under the controlled and natural conditions. The diverse groups of plant growth promoting microbes were isolated from rhizospheric and endophytic region of different cereal crops growing in Indian Himalayan regions. A total of 147 isolates were obtained which included 53 endophytic and 94 rhizospheric isolates, which were screened for plant growth attributes and found that 11 were having potential to fixed nitrogen, 56, and 26 were having capability to solubilize the phosphorus, and potassium, respectively. Efficient microbes with multifunctional attributes were identified as *Stenotrophomonas rhizophila* EUA1SN1*, Pseudomonas panacis* EU- LWNA-38 and *Bacillus* sp. EU-FTK-6 by 16S rRNA gene sequencing. The selected bacterial were formulated as consortium and was evaluated for growth of foxtail millet and results showed the significant changes in physiological parameters, photosynthetic pigment, total soluble sugar content and flavonoid content as compared to control. This efficient microbial consortium could be used as bioinoculants for crops growing in hilly region for agricultural sustainability.

Keywords: Agricultural sustainability; Biofertilizer; Consortium; PGP attributes; *Setaria italica*.

WADFPSE/PP/12

Increase in Water Use Efficiency is Need of Present Age

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Abstract
The growing water demand has raised serious concern to the future of irrigated agriculture in many parts of the country. Therefore, the knowledge of crop water demand is an important practical consideration to improve the water use efficiency in irrigation practices. The traditional irrigation systems provide unnecessary irrigation to one part of a field while leading to a lack of irrigation in other parts. Changing environmental conditions and shortage of water have led to the need for a system which efficiently manages irrigation of fields. One of the major problems in agriculture is non-optimal usage of water. Most of the fresh-water used for agriculture in developing countries is lost, either by evaporation, spills, or absorption by the deeper layers of the soil, beyond the reach of plants roots. Therefore a new approach of collecting real time data from the field by using soil moisture sensor offers real potential for reliably monitoring soil water status in agriculture fields. There are a number of sensor systems now available that provide valuable information on when a field is ready to be irrigated. Wireless data transmission and improved software interfaces are now making these sensors practical for farm use. An affordable way to gain experience with sensor-based scheduling is to monitor a field for a season and review the data over the winter to see how your irrigation decisions matched the sensor readings. There are three main methods of irrigation scheduling: 1) Soil-based methods 2) Plant-based methods 3) Climate-based methods. Thus, sensors based technology for an automatic irrigation system which can be used for optimum use of water, saving money, electricity and time of the farmer.

Keywords: Agriculture, Climate-based, Irrigation system

WADFPSE/PP/13

Trends of Milk Production in India

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Abstract
Before and even after few decades of independence, India was not having high productivity in different sectors due to the use of traditional tools and techniques in different fields of the economy. During 1964-66, India was facing the problem of feeding sufficient food to the population. Apart from agriculture sector, dairy industry was also suffering from losses. To improve the overall situation of the country different schemes and projects were developed under different authorities. After the huge success of green revolution, white revolution was taken in account by Dr. Verghese Kurein who is known as the father of white revolution in India. Revolution was developed under National Dairy Development Board which also known as Operation Flood aimed to become independent in milk production and to reduce its imports. The study was based on secondary data for the year 1991-2019 related to production and per capita availability of milk of India as well state-wise. The study has shown that per annum growth rate of the production and per capita availability of milk of India were 8.49 and 4.33% respectively. Punjab is the state with highest per capita availability of milk during the last two decade. The study concluded that increasing demand for milk can lead to more production of milk to increase global share in milk production.

Keywords: Dairy Industry, Per Capita Availability, Livestock, White Revolution, Milk Production

WADFPSE/PP/14

Isolation and Screening of Rhizobia for Plant Growth Promoting Activity from Root Nodules of *Albizia lebbeck* and *Leucaena leucocephala*

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Abstract
A total of 38 rhizobial isolates were isolated from root nodules of *Albizia lebbeck* and *Leucaena leucocephala* from two districts of Himachal Pradesh i.e., Solan and Bilaspur. Enumeration of rhizobial was higher in Solan district compared to Bilaspur on YEMA medium. The isolates were able to grow at an optimum temperature of 28ºC for 72 h incubation. Five isolates from *A.lebbeck* (AL 2, AL 5, AL 6, AL8, AL 13,) and 4 isolates from *L. leucocephala* (LL 08, LL 9, LL 10 and LL 13) showed higher plant growth promoting activity i.e., P-solubilization, siderophore production, HCN production, IAA production and antifungal activity against *Fusarium oxysporium* and *Rhizoctonia solani* and growth on nitrogen-free medium. Isolates from *A. lebbeck* (AL 2, AL 5, AL8) showed higher activity for P-solubilization (204 µg/ml, 198 µg/ml, 201 µg/ml), siderophore production (47.56%, 44.34%, 48.21%), IAA production (39 µg/ml, 32 µg/ml, 37µg/ml), antagonistic activity against *Fusarium oxysporium* (66.46%, 63.27%, 65.79%) and *Rhizoctonia solani* (64.12%, 59.52%, 62.82%) and positive growth on nitrogen free media. Isolates from *L. leucocephala* (LL 08, LL 10 and LL 13) showed higher activity for P-solubilization (201 µg/ml, 207 µg/ml, 193 µg/ml), siderophore production (43.64%, 45.21%, 39.78%), IAA production (28 µg/ml, 36 µg/ml, 31µg/ml), antagonistic activity against *Fusarium oxysporium* (62.58%, 66.46%, 57.23%) and *Rhizoctonia solani* (61.29%, 65.41%, 58.47%) and positive growth on nitrogen free media.

Keywords: *Albizia lebbeck*, *Leucaena leucocephala,* Plant Growth Promotion,

WADFPSE/PP/15

Efficacy of Microbial Pesticides against Tobacco Caterpillar

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Abstract
Our study aimed to determine the pathogenicity of different microbial pesticides against *Spodoptera litura. S. litura* is an important polyphagous pest, which developed resistance to some of the commonly used insecticides because of which management of this pest has became a challenge to entomologists both in India and abroad. The over dependence on chemical pesticides and eventual uninhibited use of them has necessitated for alternatives mainly for environmental concerns. Biopesticides or biological pesticides based on pathogenic microorganisms specific to a target pest offer an ecologically sound and effective solution to pest problems. They pose less threat to the environment and to human health. Due to popularization and increased usage of microbial pesticides across the crops for pest and disease management the issues is pertaining to their efficacy gains importance. A total of 3 different treatments *B. bassiana, M. anisopliae,* and *L. lecanii* were evaluated for their levels of virulency against the target pest *Spodoptera litura*.The amount of 5g of powder formulations of different test cultures were individually weighed and dissolved in 1000 ml of water by thoroughly mixing. The leaf discs of cotton were dipped in all the culture concentrations of the test biopesticides, allowed to dry and then kept in petriplates. The third instar larvae of *S. litura* were released in petriplates and allowed to feed on treated leaves for one day and on fresh untreated leaves from next day onwards. Observations were taken for larval mortality at 7, 10 and 12 days after treatment. All treatments were found significantly superior over control in reducing the pest population. Among the test microbial pesticides, *B. bassiana* has recorded maximum per cent mortality of 96.00 per cent followed by *M. anisopliae* and *L. lecanii* with 80.00, 60.00 per cent mortality respectively.

Keywords: Environment**,** Microbial Pesticides, Tobacco Caterpillar

WADFPSE/PP/16

First Report on Nitrogen-Fixing Endophytic Bacteria from Wild Wheat Relative *Aegilops kotschyi* and their Role in Plant Growth Promotion

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Abstract
Endophyte biology is an emerging field due to their wide range of application in various sectors including agriculture and industries. The endophytic phytomicrobiome residing inside the tissue of the plant have gained the momentum for promoting the plant growth and production along with sustaining the environmental health. Considering the importance of sustainability and endophytic microbes, the present study aimed to characterize and evaluate the plant growth promoting endophytic microbes. In the present investigation, a total of 52 endophytic bacteria were been isolated from wild wheat relative *Aegilops kotschyi* growing Himalayan regions. All the isolates were screened for nitrogen-fixing attributes. Efficient microbes having capability to fix nitrogen was identified as *Rahnella sp.* EU-B2SN1 using 16S rRNA gene sequencing and BLASTn analysis. The selected bacterial strain were further evaluated for growth of *Aegilops kotschyi* and results showed the significant improvement in the physiological parameters, chlorophyll, total soluble sugar, phenolics and flavonoid content as compared to chemical control and untreated control. This efficient bacterial strain could be used as bioinoculant for wild wheat relative and other cereal crops growing in hilly region for agricultural sustainability.

Keywords: *Aegilops kotschyi*; Agricultural sustainability; Biofertilizer; Biological Nitrogen Fixation; Endophytic Bacteria

WADFPSE/PP/17

Nutritional Importance of Millets, Pseudo-Cereals and Underutilized Cereals

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Abstract
Consumers nowadays are becoming more aware to adapt healthy lifestyles and richer nutritional habits. Recent studies found that there is a need to improve nutritional quality of gluten free products by incorporating millets, pseudocereals and underutilized cereals as they contain high contents of beta-glucan, functional proteins, essential fatty acids, vitamins and minerals. Currently, researchers are more interested in making the use of underutilized cereals, millets, and pseudocereals. These underutilized grains have attained the great attention in few years because of their outstanding nutritional, phenolic, phytochemical profile as well as biological value which are considerably higher as in contrast to other traditional cereals. Underutilized cereals such as oats and barley contain β- Glucan, phenolics, carotenoids, vitamin E, phytic acid, sterols, and antioxidants such as tocols. Millets are reserve of fiber, phytochemicals such as phenolics, insulin, lignans, β- glucan, resistant starch, phytates, sterols, minerals and vitamins. Pseudo-cereals such as amaranth are a rich source of flavonoids, phenolics, carotenoids, antioxidants and polyphenols such as rutin, isoquercitrin, nicotiflorin. Quinoa contains phytosterols such as beta-sitosterol, campesterol, stigmasterol, phenolic acids, and flavonoids. Similarly, buckwheat is a rich source of fagopyrin, flavonoids, and fatty acid contents. They promote health benefits by acting as antioxidant, anti-cancer, anti-diabetic, anti-inflammatory, anti-hypertensive, antimicrobial, anti-tumerogenic, and helps in reduction of oxidative stress. These grains can also be employed for consumption after several processed treatments like popping, roasting, flaking, cooking or extrusion. Varieties of food products like pasta, noodles, bread, cookies and beverage are produced from underutilized cereals, pseudocereals, and millets which contain higher bioactive compounds than other cereals.

Keywords: Bioactives, Millets, Nutrients, Pseudocereals, Processed products

WADFPSE/PP/18

Antibiotic-resistant *Acinetobacter baumannii*: A Global Public Health Threat

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Antimicrobial resistance in pathogenic bacteria is a serious health challenge in both developed and developing countries. Various factors responsible for emergence of antibiotic resistance include misuse/overuse of antibiotics and incomplete treatment schedule whereas the dissemination of antibiotic resistance is facilitated by mobile genetic elements and horizontal gene transfer pathways. Among different Gram-negative pathogens, multidrug-resistant *Acinetobacter baumannii*, an opportunistic nosocomial pathogen, is commonly associated with ventilator-associated pneumonia, bloodstream infections, urinary tract infections and wound infections in intensive care units and immunocompromised patients. Multidrug-resistant *A. baumannii* is included in the global priority list of antibiotic-resistant bacteria published by World Health Organization. *A. baumannii* isolates are reported to exhibit several folds higher antibiotic resistance levels compared to other nosocomial pathogens and emergence of multi-, extreme- and pan-drug-resistant *A. baumannii* strains is widespread in healthcare settings. These isolates exhibited resistance to beta-lactams, tigecycline, carbapenems and colistin. The rapid rise in its incidence and without adequate therapeutic intervention, *A. baumannii* poses a significant threat to human health and is considered a major challenge for public health agencies and healthcare providers. The present alarming situation necessitates an urgent attention towards development of new chemotherapeutics, complementary therapy, newer combination drug treatment regimen, antibiotics use awareness, continuous antibiotic-resistance screening at community level and vaccine-based interventions.

Keywords: *Acinetobacter baumannii, Bacterial pathogens, Nosocomial infections, Antibiotics*

WADFPSE/PP/19

Genome Wide Association Study of Powdery Mildew Resistance in the Panel of Common Wheat

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Abstract
Wheat (*Triticumaestivum* L. emThell) is one of the most essential staple food crops of the world. *The population of developing and under-developed countries depends on wheat for their survival*.The objective of this study was the genome-wide association analysis to dissect genomic regions in spring wheat germplasm harboring powdery mildew disease resistance loci. A spring wheat panel including 294 divers'germplasm accessions with a high level of geographic diversity was created by CIMMYT, Mexico. This panel was evaluated phenotypically using 0 to 9 scale for the severity of powdery mildew disease. This panel was later mapped with 17,937 polymorphic SNPs of 90K SNP array. The association mapping panel was structured using a model-based cluster analysis tool called as STRUCTURE. Genome-wide association analysis of one year data revealed that 9SNPs were highly significantly associated with powdery mildew disease resistance at the significant level of P<0.0001.The mapping panel was structured and divided into four subpopulations viz. *G1, G2 G3* and*G4*. The four sub-populations were included *40(G1), 21 (G2), 35 (G3)* and *129 (G4*; admixture) genotypes, respectively. The results from these studies provide an opportunity to the breeders for the selection of spring wheat genotypes to the development of high yielding and powdery mildew disease resistance varieties.

Keywords: Wheat, GWAS, Powdery mildew, Disease resistance

WADFPSE/PP/20

Entomopathogenic Nematodes: A Sustainable Option against Insect Pests of Tomato

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Abstract
Tomato (*Solanum lycopersicum* L.) belonging to the family Solanaceae, is an important cash crop grown worldwide with estimated world production about 177 million tonnes .This crop is mainly attacked by pests including borer, tomato leaf miner; tomato cut worm, aphid and whitefly. The persistent attack of these pests pertains to heavy monetary losses to the farmers annually. The application of biological control agents can serve the purpose of safeguard from both pests and aftermath of excessive sprayed chemicals. Therefore it is essential to encourage the farmers for adapting the biological control methods to reduce the excessive use of toxic chemical pesticides and fertilizers. Entomopathogenic nematodes (EPNs) are well known for their potential as bio control agents to control the emergence and development of insect pests. Biological control using entomopathogenic nematodes is an effective alternative strategy against pests of tomato because these pests have developed resistance to most insecticides. In present investigation, the bio efficacy of indigenous EPNs is tested against the major insect pests of tomato. EPNs were isolated from the rhizosphere soils which were collected from the different fruit trees. *In vivo* culturing of EPNs, mass multiplication was done using *Corcyra cephalonica* and *Galleria mellonella* as bait. The infective juvenile (IJs)of EPNs were applied on 3rd and 4th instar larvae with different concentrations along with control; larval mortality was checked after 24h, 48h, 72h and 96h of infection in green house condition. For field trials the assessment were made after 15days of spray. At the highest concentration maximum mortality were observed in 3rd and 4th instar larvae which are quite effective in managing the larval population in field as well as greenhouse condition. The demonstration of field trials showcasing the utilization of EPNs against the major pests of tomato was given to the local farmers of the area. The study concluded that indigenous EPNs can serve as an alternative of chemical insecticides for pests management program in future.

Keywords: Bio-efficacy; Biological control; Chemical pesticides; Entomopathogenic nematodes; Insect pests

WADFPSE/PP/21

Weed fungus control during the growth of *Pleurotus sajor-caju* (Fr.) Singer

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Abstract
The investigations were carried out to document the frequency of contamination encountered during the growth of *Pleurotus sajor-caju* (Fr.) Singer in mushroom farming sites throughout Punjab. Contaminants were identified in several mushroom producing locations of Punjab in moderate to severe concentrations. The survey confirmed the presence of four contaminants in compost beds, with *Trichoderma harzianum*, *Aspergillus flavus*, *Coprinus comatus*, and Penicillium being the most common. Their incidence was high from October to January, ranging from 8% to 25%, producing the greatest loss in mushroom output. The influence of several substrates on spawn run, fruiting body induction, yield performance, and biological efficiency of *Pleurotus sajor-caju* was investigated using wheat straw, rice straw, Ashoka leaves (*Saraca asoca*), waste paper, and sugarcane bagasse. Among the five plant extracts studied *in vitro*, garlic leaf extracts (*Allium sativum*) were shown to be the most effective against *Aspergillus flavus*, with 41.6 percent mycelial growth suppression, while lantana had the highest mycelial growth inhibition of 26.1 percent against *Trichoderma harzianum*. *In vitro*, formalin inhibited mycelial growth by 20.7 percent against *Aspergillus flavus*, whereas *Trichoderma harzianum* inhibited mycelial growth by 27.4 percent. Formalin inhibited mycelial growth by 20.7 percent against *Aspergillus flavus in vitro*, whereas thiophanate methyl and formalin inhibited mycelial growth by 27.4 percent against *Trichoderma harzianum*.

Keywords: *Trichoderma harzianum, Pleurotus sajor-caju,* Weed fungus

WADFPSE/PP/22

Meta-QTL Analysis for the Identification of Spot Blotch Resistance Loci in Bread Wheat

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Abstract
Wheat (*Triticum aestivum*) is a global food crop cultivated for its high nutritious value and food grain. However, wheat production faces multiple threats via rapidly evolving pathogen variants. Spot blotch caused by *Bipolaris sorokiniana* is a destructive disease of wheat in warm and humid wheat growing regions of the world including India. Development of resistant cultivars through MAS is a cost-effective and environment friendly approach to mitigate negative effects of the disease. Meta-QTL (M-QTL) analysis may identify redundant QTL among various studies and reveal major QTL for targeting in MAS applications. The QTL data of 17 mapping populations were used for the identification of M-QTLs in the present study. In this study, 72 spot blotch resistant QTLs were found and utilised in the projection of Meta-QTLs using a freely available software Biomercator v4.2. A consensus map was also prepared for the projection of M-QTLs using the software LPmerge. For this purpose, five individual genetic linkage maps each from different studies were used as reference maps. The dense consensus map comprising 61,678 markers and 72 previously identified QTLs with the required information could be utilised leading to the identification of 29 M-QTLs spread over 15 chromosomes out of the 21 chromosomes. Three M-QTL out of 15 were found on the chromosome 2A, 2B, 3B, 5B and others are on 1A, 1B, 2D, 3A, 4B, 4D, 5A, 6A, 7A, 7B and 7D. These race non-specific M-QTL is a promising strategy to provide high and stable resistance to spot blotch in wheat.

Key words: Wheat, Spot blotch, QTL, Meta-QTL, Consensus map.

WADFPSE/PP/23

Apricot kernel: Utilization and Its Benefits

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Abstract
According to Statista, the total production of apricot in India was 16,150 metric ton in 2019 which produced 4,845 metric ton apricot stone as a waste. Apricot stone consists of 27% kernels. Apricot kernel consists of an appreciable concentration of oil, protein, minerals (Ca, K, Mg, Na and P), vitamins (Vitamin E) and dietary fibers. The amount of protein, oil and dietary fiber content in apricot kernels are varied from 14.1- 45.3%, 40.23-53.19% and 12-15% respectively. Apricot kernel protein consists of well-balanced amino acid profile similar to almond kernel protein which plays an important role in its potential utility in health, antioxidant properties and used as a value-added ingredient in many food formulations. Protein hydrolysates exhibit several pharmacological activities such as antioxidant, anti-inflammatory, anti-microbial and ACE inhibitory activities. Apricot kernel oil consists of unsaturated fatty acids (oleic acid and linoleic acid), phospholipids, glycolipids and antioxidants like phenolic compounds, tocopherols. Its fatty acid profile is similar to the almond oil. It also contains omega-6 and omega-3 fatty acids. Due to the presence of these components, it shows the antimicrobial, antioxidant, analgesic, anticancer, anti-asthmatic, anti-inflammatory and antimutagenic activity. Whereas apricot kernel is not directly consumed due to the presence of toxic cyanogenic glycosides which are mainly present in the bitter variety of apricot and are responsible for its bitterness. But it's utilization cannot be disregarded and it can be used as an alternative and potential source of high quality and inexpensive protein and oil which can be solve the high demand of nutritive food products.

Key words: Apricot, Nutritive food products, Pharmacological activities

WADFPSE/PP/24

Comparative morphological study of leaf and stem samples of *Zanthoxylum armatum* DC collected from different geographical regions of Himachal Pradesh

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Abstract
Zanthoxylum armatum DC plays an important role in the history of Indian medicine. The plant is widely dispersed in the warmer Himalayan regions, ranging in altitude from 1000 to 2100 meters above sea level and used in Ayurvedic herbal compositions to treat a variety of ailments. Alkaloids, phenolics, flavonoids, lignans, terpenoids, coumarins, glycosides, steroids and aminoacids are among the major phytochemical found in *Z*. *armatum*. The population of *Z*. *armatum* in its natural habitats is decreasing day by day due to its dioecious nature and a lack of awareness among the local people. The unlimited cutting and exploitation of diverse species for various uses leads to the risk of their extinction which necessitated research about their genetic diversity and conservation. In present study, before doing genetic diversity analysis the morphological parameters were compared for various samples. For this first the samples were collected in replicates from three different sites in four different districts in Himachal Pradesh (Hamirpur, Mandi, Bilaspur and Sirmour).The plants from every site were selected and investigated for qualitative (leaf color, leaf shape, leaf margin, leaf orientation, stem width etc.) And quantitative morphological parameters (number of leaves and leaf length etc.).

Key words: *Zanthoxylumarmatum,* Phytochemical, medicine, Quantitative, Qualitative.

WADFPSE/PP/25

Isolation and Characterization of Sunflower Protein Isolates

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Abstract
The majority of people in India and other developing countries suffer from the deficiency of protein intake in their diets due to scarcity and high cost of animal or dairy based sources of protein. This problem demands consumption of plant based protein with low cost and good quality. The rapidly growing world protein requirement has directed major attention to plant proteins. Oilseeds are valuable sources of lipid and basically processed for their edible oils leaving behind a lot of protein-rich meal. Proteins are usually recovered from the meals and marketed as food ingredients in developed countries. The most produced oilseeds worldwide are, in decreasing order, soybean, rapeseed, cotton, groundnut and sunflowers, amongst others. Over the last decade, the food industry has been searching for protein ingredients to replace those derived from animals, wheat and soy because of shifting consumer trends toward dietary choices based on health as well as toward more environmentally sustainable options. Sunflower (*Helianthus annus* L.) protein is one such protein that has garnered a great deal of interest based on its low allergenicity, high nutritional value and availability. One of the byproducts of the oil extraction process is sunflower meal, which has high protein content (40-50%), making sunflower meal an attractive protein source. Sunflower protein isolate was more comparable to soybean meal protein in having a narrow pH range of insolubility at pH 4-5. While sunflower proteins may appear, therefore, to have limited application in beverage products, but have wide application in foods as protein fortifier.

Keywords: Sunflower, Sunflower protein isolate, food, solubility

WADFPSE/PP/26

1AS.1DL and 1BS.1DL Translocations in Durum Wheat to Improve its End-Use Quality

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Abstract

Durum wheat is tetraploid (2n=4x=28) with genomic constitution (AABB) and it is highly nutritional cereal crops. Durum wheat is a great source of pro-vitamin A, antioxidants, carbohydrates, and non-starch polysaccharides. It is mainly consumed in the form of pasta, macroni, spaghetti, vermicelli, noodle products, halva, upma, idli and dosa. It is usually preferred for the production of pasta due to the sufficient amount of yellow pigment and protein content. Durum wheat possesses poor gluten strength and bread making quality as compared to the hexaploid wheat due to the absence of D genome, silencing of *Glu-A1* locus, lack of suitable high molecular weight (HMW-GS) gluten subunit and low molecular weight (LMW-GS) gluten subunit. The 1D genome of bread wheat possesses seed storage protein for high molecular weight (5+10), (2+12) and (2t+t2) subunits for better use of bread making quality. Our strategy to overcome this limitation is through the introduction of *Glu-D1* allele from the D genome of *Aegilops squorosa* possessing seed storage protein from HMW-GS gluten subunit (2t+t2) for improvement of bread making quality through translocation. In our material two substitution lines are used one for substitution of 1A chromosomes for 1D chromosome (26''-1A''+1D'') and 2nd line having substitution of chromosome of 1B for 1D (26''-1B''+1D''). One line (26''-1A''+1D'') lines have been crossed with the elite durum cultivar to produce two monosomic 1A and 1D and the second line (26''-1B''+1D'') are crossed with the elite durum cultivar to produce two monosomic 1B and 1D. The F_1 lines are self to form chromosomal misdivision to translocate *Glu-D1* allele into durum background for enhancement of bread making quality of durum.

Key words: Durum wheat, Translocation and substitution lines, SDS-PAGE, HMW-GS

WADFPSE/PP/27

Characterization of Hydrothermally Synthesized TiO_2 Nanoparticles and its Toxicological Evaluation against HEK293 Cell Line

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Abstract
The low-temperature synthesis method was used to form the titanium dioxide (TiO_2) nanoparticles. TiO_2 nanoparticles synthesized by hydrothermal method successfully exhibited its anatase phase as confirmed by X-ray diffraction (XRD) data. Its elemental and morphological parameters were analyzed by various analytical techniques. Fourier Transform Infrared Spectroscopy (FTIR) indicates Ti-O-Ti peak at around 456nm and the bands at 1410 and 1581cm^{-1}indicates its C–H group in-plane vibrations and stretching of imidazolium ring. Scanning electron microscope (SEM) images showed the TiO_2 nanoparticles were almost spherical in shape and their data revealed the average diameters of TiO_2 nanoparticles was in the range of 60nm. TiO_2 nanoparticles were found to be non toxic against normal human embryonic kidney (HEK) cell lines and showed 75% cell viability up to the range of 800µg/ml. The application of TiO_2 is widespread due to its low toxicity. Due to its different properties it found applicable in every field of science such as medical, food, industrial, and environmental.

Keywords: TiO_2 nanoparticles, HEK293, XRD, FTIR, and SEM.

WADFPSE/PP/28

Storage Study of Tomato Using Hydrothermally Synthesized ZnONPs; Characterization, Antimycotic, And Toxicological Evaluation

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Abstract
The hydrothermally synthesized zinc oxide nanoparticles (ZnONPs) evaluated for its antimycotic property and used for studied the extending storage span of tomato (*Solanum lycopersicum*) variety Solan Lalima. The low temperature synthesis method used for synthesizing ZnONPs; its crystalline structure was characterized by X-rays diffraction (XRD) and morphological properties were studied by Scanning electron microscope (SEM). The disc shaped ZnONPs were confirmed by SEM analysis. The Fourier Transform Infrared Spectroscopy (FTIR) of ZnONPs and Zinc acetate hydrate was done to see the chemical bonds. ZnONPs along with biodegradable polymer used to coat the perishable tomato crop at different concentrations; A (13µg/ml), B (11µg/ml), C (9µg/ml) and uncoated control. These coated and uncoated samples were studied for physical, proximate, and biochemical parameters on day 4, 8, 12, 16 at ambient temperature. The ZnONPs showed great antimycotic activity against opportunistic fungal pathogen. The toxicological evaluation of ZnONPs was done on HEK293 cell line and showed 85% cell viability which accounts the safe use of ZnONPs. The nano coating maintains the quality aspects and decreases the microbial infestation of tomato as compare to uncoated control. The research concludes that the ZnONPs@biodegradable polymer prevent the post harvest loss in tomato by retarding microbial spoilage and maintaining its quality perspectives.

Keywords: Zinc oxide, Tomato, Antimycotic, Toxicological evaluation

WADFPSE/PP/29

Role of Probiotics in Food and Economic Sustainability

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Abstract
The food economy is booming with new issues such as sustainability, safety and quality standards, consumer health, and industry concentration. While population growth is an important driver of increasing food demand, its impact is magnified by changes in the types and quantities of food demands per capita. Further, the diets are also moving towards diversified and calorie-intended foods. In this respect, probiotics have become increasingly popular now days due to their beneficial health effects on human beings. They are live microorganisms that provide health benefits when consumed or applied to the body. Several studies have been done to evaluate and identify the mechanism of probiotics on an animal model system. They have shown that the probiotics affected adiposity, inflammation, energy expenditure, glucose metabolism, and satiety in those animals. Moreover, few clinical trials have also been done on humans that have proven these results. *Lactobacillus, Bifidobacterium bifidum*, and *Bifidobacterium breve* have been identified to possess the ability to transform linoleic acid into its conjugate, which can suppress carcinoma. Similarly, *Bifidobacterium longum* and *Lactobacillus helveticus* have been reported to enhance mammalian serotonin metabolism and thus, can modulate behavioral patterns. Probiotics are also recommended for maintaining oral health, especially against candidiasis (mucous membrane diseases), dental caries (tooth decay), and periodontitis (gum disease). Moreover, they are known to produce antioxidants that neutralize the free electrons in the oral cavity which are required by the pathogens to form a biofilm. The growing demand for probiotics can be justified with the rapid growth of the health care industries including probiotics as an important market. The value of the global probiotic market is projected to reach USD 61.1 billion in 2021 and USD91.1 billion by 2026 with a CAGR of 8.3%. In the Indian scenario, the probiotic market reached INR 2.6 billion in 2021. Looking ahead, the IMARC group expects the market to reach INR 7.7 billion by 2027 with a CAGR of 20.50%during 2022- 2027. However, this increasing demand can only be fulfilled by isolating and screening the potential probiotic strains. Therefore, there is an immense need for probiotic research and development.

Keywords: Probiotics, Health benefits, Market

WADFPSE/PP/30

Antimicrobial Resistance Mechanisms in Extended-Spectrum β-lactamase Producing Gram-negative Bacterial Pathogens

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Abstract
Extended-spectrum β-lactamase (ESBL) production is recognized as the most important antibiotic resistance mechanisms in members of *Enterobacterales* from water resources, wastewaters and healthcare facilities where these are associated with bacteraemia and septic shock. ESBLs are widely reported from *Escherichia coli, Klebsiella, Enterobacter, Citrobacter* and *Pseudomonas*. ESBLs are plasmid-encoded and constitutively expressed antibiotic-degradative enzymes comprising of various categories viz. cefotaxime β-lactamase (CTX-M), TEM and sulfhydryl variable (SHV) β-lactamases. ESBLs can hydrolyze penicillins, aztreonam and most of cephalosporins. CTX-M type enzymes are the most prevalent with the CTX-M-14, CTX-M-14, and CTX-M-27 are the main types. In addition, other ESBL families such as OXA, PER, VEB, BES, GES, SFO, TLA, and IBC are also reported from several countries. ESBLs encoding genes are carried by mobile genetic elements (plasmids, insertion sequences, integrons, transposons and bacteriophages) which have facilitated their wide dissemination to other bacterial species through transformation, conjugation and transduction. Today, many diagnostic tools, genotypic methods and phenotypic methods are available for detection of ESBLs. Genotypic methods relies on the detection of ESBL-associated genes such as *bla*$_{\text{CTX-M}}$, *bla*$_{\text{TEM}}$ and *bla*$_{\text{SHV}}$ using conventional PCR whereas phenotypic methods involved double-disc synergy test. Future studies on molecular characteristics of ESBL-producing strains and their relationship with clinical outcomes are warranted.

Keywords: Antimicrobials, ESBLs, Resistance

WADFPSE/PP/31

Development and Evaluation of Ready-to-eat (RTE) Extruded Snacks from Pearl Millet (*Pennisetum glaucum* L.)

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The present study entitled “Development and evaluation of ready-to-eat (RTE) extruded snacks from pearl millet (*Pennisetum glaucum* l.)” was carried out in the laboratories of Department of Food Science, DKSG Akal College of Agriculture, Eternal University, Baru Sahib, HP. The study was conducted with the objectives to isolate/prepare pearl millet starch and to use pearl millet starch for development of fortified extruded snacks. These developed products were evaluated for physico-chemical properties and functional characteristics of pearl millet. Various proportions of pearl millet starch and pearl millet flour were blended. The control and pearl millet starch fortified extruded snacks were packed and preserved for 60 days at ambient temperature (30+2^{o}C) for determining its quality and sensory characters at 30 days intervals. During storage the moisture content increased, decrease in crude fat, crude protein, ash and crude fiber, pearl millet starch fortified extruded snacks during storage. The pearl millet starch fortified extruded snacks scored greater as compared to control in organoleptic evaluation. It was observed that acceptable characteristics of pearl millet starch incorporated extruded snacks and can be prepared with 15 % PMS, 85% PMF. Acceptable ready to eat pearl millet starch incorporated snacks can be developed by incorporating 15 percent PMS in formulation of pearl millet flour. Pearl millet grains can be processed for PMF and PMS, utilized for preparation of ready to eat pearl millet starch incorporated extruded snacks with improved sensory attribute. Thus, processing of pearlmillet into PMS can be used as a replacement of corn starch and can also be used for development of PMF and PMS based ready to eat pearl millet starch incorporated snacks.

Keywords: Pearl millet, Isolation, Starch, Ready–to–eat, Extruded

WADFPSE/PP/32

Evaluation of Biparental Mapping Population for Southern Corn Leaf Blight (SCLB) in Maize

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Maize (Zea mays L.) is the third most widely grown cereal crop after rice and wheat belongs to family *Poaceae* (grass family). Southern corn leaf blight (SCLB) is an important foliar disease of maize caused by fungi *Cochliobolus heterostrophus* also known as *Bipolaris maydis* (ascomycetes). It is reported from most of the maize growing regions but most devastating in hot and humid tropical and temperate areas of the world. Almost 70% yield loss is recorded due to SCLB. A set of 300 maize recombinant inbred lines (RILs), derived from a cross between the popcorn inbred line (susceptible) as the female parent and Teosinte (wild relative) as male parent (resistance) planted during Kharif season, 2021 along with parents in the last week of May. Each genotype represented by a plot of two rows of 1m length and row spacing will be maintained at 40 cm. The disease data were recorded in the six week old plants in the natural field conditions in two replicates, average of both the replications were used for further analysis. Leaf lesions scale of 0–5 (0 highly resistance and 5 highly susceptible) was used as disease severity ratings. Out of 300 RILs, five lines showed resistance to SCLB scoring near to 1, thirteen lines showed moderately resistance scoring near to 3, 227 lines showed moderately susceptible scoring near to 4 and 93 lines showed highly susceptible as the score was 5. Screening of RIL population for SCLB revealed that Teosinte conferring resistance is fairly abundant in the populations and it may be used as the good source of SCLB resistance in future maize breeding program.

Key words: Maize, Teosinte, SCLB, Resistance, RIL

WADFPSE/PP/33

Effect of Soaking and Germination Processing Treatments on Nutritional Characteristics of Millets and Pseudocereals

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Millets and pseudocereals have attracted the attention of nutritionists and food technologists due to their high nutritional value. These are rich sources of dietary fibers, proteins, minerals, and bioactive components such as phenolic compounds, flavonoids, and other antioxidants. Besides their nutritional potential, these are deficient in gluten content and can serve as foods of great concern for persons suffering from celiac disease or gluten allergy. Processing treatments such as soaking and germination are considered an effective way to enhance the nutritional quality of food grains. Soaking and germination are traditional and most effective treatments for enhancing the nutritional and bioactive potential as well as reducing the anti-nutritional components in food grains. This study reflects the effect of soaking and germination treatments on nutritional, bioactive, and anti-nutritional characteristics of millets i.e. finger millet (*Eleusine coracana* L.) and pearl millet (*Pennisetum glaucum* L.) and pseudocereals i.e. amaranth (*Amaranthus hypochondriacus* L.), buckwheat (*Fagopyrum esculentum* L.) and quinoa (*Chenopodium quinoa* L.). There was a significant ($p \leq 0.05$) increase in nutritional and bioactive components such as crude fiber, crude protein, phenolic components, antioxidant activity, and mineral content but the reduction in anti-nutritional components such as tannins and phytic acid. In amaranth, there was a significant ($p \leq 0.05$) increase of 7.01, 74.67, 126.62, and 87.47% in crude protein, crude fiber, phenolic content, and antioxidant activity, respectively. Similar changes in crude proteins, crude fiber, phenolic content, and antioxidant activity were observed in buckwheat, quinoa, finger millet, and pearl millet. While the anti-nutritional components such as tannin and phytic acids decreased significantly by 32.30 and 29.57% in amaranth, 59.91 and 17.42%, in buckwheat and 27.08% and 47.57%, in quinoa, respectively. Similar changes in anti-nutritional components have been observed in finger millet and pearl millet. Therefore, soaking and germination proved to be excellent techniques to minimize the anti-nutritional component and enhance the nutritional, bioactive, and antioxidant potential of these underutilized grains.

Keywords: Bioactives, Germination, Millets, Nutrients, Pseudocereals, Soaking

WADFPSE/PP/34

Status and Scope of Exotic Vegetable Production In India

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Abstract
Exotic vegetable are the plant species that have been introduced from another country to a location or country where it does not belongs to and are grown commercially in net houses or poly houses. Farmers are profited from demand-driven exotic vegetable production because they have a guaranteed market through customer contracts. Currently, there are various exotic vegetables available in India like broccoli, asparagus, cherry tomato, coloured capsicum, zucchini, red cabbage, Chinese cabbage, Pak Choy etc. Maharashtra alone can account for half of India's exotic vegetable production with some of its districts like Pune, Nasik and Satara growing asparagus and broccoli. In Himachal Pradesh, their cultivation has started picking up in Theog, Narkanda, Matyana, Saproon Valley, Nauradhar in Sirmaur, Katrain, Sainj Valley and Manali. They are a major source of cash income for smallholders in Asia on a global scale. They are highly nutritious and have medicinal values. They contain a variety of health-promoting phytochemicals, especially antioxidants, in addition to essential micronutrients which will help to avoid dietary deficiencies as well as obesity and chronic diseases like diabetes, heart disease, and cancer. Commercial production and marketing require knowledge about their time of planting and availability in various regions. Exotic vegetable cultivation is a more lucrative sector than conventional Indian vegetable cultivation. 75 percent of the proposed polyhouses would be used for exotic vegetable cultivation due to rapid increase in the demand. A lot of opportunity exists for exotic vegetable in India due to increasing urban population, changing life style, food habit and increasing numbers of foreign tourist day by day.

Keywords: Anti-oxidant, Commercial, Exotic, Micronutrient, Phytochemicals

Oral Presentations

WADFPSE/OP/01

Phenolics and Antioxidant Activity of Turmeric Powder as Affected by Grinding Temperature

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Abstract

The turmeric was grinded in jacketed hammer mill. The temperature inside the grinding mill increases during grinding operation. The bioactive compounds along with their biological activity and stability depends on the grinding temperature. The water at atmospheric temperature, chilled water and coolant were circulated through jacket to lower down the grinding temperature. The turmeric rhizome was fed at ambient temperature and at low temperature (~10 ºC). The effects of grinding temperature and feed temperature on the phenolics, antioxidant activity and curcumin content of turmeric powder were studied. Antioxidant activity, curcumin content and phenolic content increased with decrease in grinding temperature. The temperature inside the grinding chamber at the end of grinding of 3 kg sample of turmeric reached to 43 ºC for traditional grinding, and this was reduced to 18.33 ºC for coolant circulation with low temperature feed. Reduction in grinding temperature resulted highest phenol content (3.13%), flavonoid content (1.43%), antioxidant activity (59.31%) for coolant circulation with low feed temperature. Chilled water circulation with low temperature feed resulted highest curcumin content (2.48%). These bioactive compounds were significantly differed with grinding method as well as feed temperature.

Keywords: Turmeric Powder, Low Temperature Grinding, Curcumin, Phenoic, Antioxidant Acitivity

WADFPSE/OP/02

Role of Bees in Pollination of Tomato under Protected Conditions

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Abstract
Experiment was conducted during the years 2020 and 2021 on tomato grown under protected and open field conditions. A total of 16 major insect visitors were recorded on flowers of tomato.The Shannon-Wiener diversity Index of tomato insect pollinator wascalculated. Honeybee and stingless bee populations were abundant on tomato flowers alongwith major portions of *Xylocopa*, Halictidae, *Amegilla* and Megachilids. The maximum diurnal abundance of pollinators recorded between 0800-1200 h. The maximum foraging rate was found with honeybees but relative abundance was higher of stingless bees. In open pollination of crop, *Amegilla*, *Xylocopa*and Halictids have important contribution in tomato. The calculated pollination index was almost similar for*Apisceranaa*nd stingless bees (*T. iridipennis*). Floral biology of tomato disclosed complex structure of flowers with stigma receptivity and pollen dehiscence periods. Stigma become receptive before1-2 days of pollen dehiscence and maximum pollen dehiscence was recorded at 0800-1200 h. Total 4 treatments were taken i.e. Open field pollination, no pollination, stingless bee pollination and *Apiscerana* pollination. Data on yield (% fruit set, fruit weight, fruit yield) and quality parameters (healthy fruits, deformed fruits, TSS, seed weight and seed number) under different modes of pollination revealed bee pollination was superior over open field pollination and withoutpollination. Without pollinationthe yield and quality were low in tomato. The bees of genus *Apis*and *Tetragonula* were major true pollinators of tomato. Out of these,*Apiscerana* and*Tetragonulairidipennis* were key pollinators in tomato crop under the climatic conditions of Dimapur in Nagaland.

Keywords: Bees, Pollination, Tomato

WADFPSE/OP/03

Millets as Functional Ingredients in Probiotic Food Formulations

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Abstract

In recent years, global communities have faced deep turbulence through the outbreak of diseases, antibiotic resistance among bacteria, climate changes from global warming, increase in the world population, and malnutrition. All these issues at their core impact food security and human health. One promising approach in food formulations is the use of probiotic supplements incorporated within nutritionally rich natural substrates. The addition of selected substrate sources with high nutritional composition can add to the organoleptic properties such as taste, smell, texture, colour, consistency, and good market value. Millets are regarded as the oldest known noble food grains to mankind and rampant in Indian kitchens since ancient times but still were neglected due to the western notion of perceiving millet as “bird feed and poor people’s food”. The green revolution movement also pushed them back and promoted wheat and rice production which led to the declined consumption of millets. Recently, millets also labeled as ‘nutricereals’ have gotten attention because of their superiority in terms of rich nutritional and phytochemical profile over other cereal grains such as rice and wheat. This work focusses on millet grains which compared to rice and wheat contains more crude fiber, protein, vitamins, mineral content, micronutrients, mild digestibility and are ‘gluten free’ making them convenient for individuals suffering from celiac disease, allergy, sensitivity, and enteropathy due to the presence of gluten in wheat. This work also shows how the high iron, zinc concentration, and lower glycemic index of millets are beneficial for anemic and diabetic patients. Several millet varieties like foxtail, Kodo millet, barnyard, pearl millet, and sorghum are used in traditional food cuisines and drinks. Food processing technologies such as soaking, germination, decortication, debranning, and fermentation of millets can enhance their functionality and consumer acceptance. In addition to the nutritional composition, millets are also ‘climate smart’ grains as they are drought resilient, heat tolerant, pest and disease resistant in addition, water shortage doesn’t affect their growth and production rate. Millet enrichment through probiotic cultures and utilization in food formulations can be a boon for national and global food security and malnutrition. Probiotic millet-based food formulations will boost immunity while exerting health benefits to consumers and provide millets deserved recognition at the global platform. Additionally, an effort has been made to show how coarse grains from yesterday are today’s nutricereals. As consumers find a lack of diversity in dietary foods, they need promising solutions to their changing lifestyles.

Keywords: Millets; Nutricereals; Probiotics; Probiotic food; Micronutrients

WADFPSE/OP/04

Paddy Residue Recycling for Economic and Environmental Sustainability

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Abstract
Agriculture has a major share in the overall economy of India. After China, India is the world's largest producer of paddy. Paddy residues are parts of the plants left in the field after crops have been harvested and threshed. Approximately 130 million tones of paddy residue is generated on-farm annually from its production. Multipurpose use of paddy residues are animal feeding, soil-mulching, bio-manure, thatching for rural homes, fuel for domestic and factory use. The present study was conducted in two paddy growing districts of Haryana state i.e. Karnal and Kurukshetra with objective: (i) to explore the awareness about utilization of paddy residue by farmers, two blocks from each district was randomly selected. Further, one village from each block was selected randomly. Thus, total 4 villages were selected to conduct the study. From each selected village, 75 male paddy growing farmers having more than 5 acres of land were selected purposively through snowball technique. Thus, the total numbers of respondents were 300 for objective. A well structured and pretested interview schedule was developed according to the objectives of the study. It was found that 'lack of awareness about environmental issues among farmers' got rank XIII (WMS -1.35). Half of the respondents (52.00%) were aware about utilization of paddy residue helpful in reduce environment pollution. Paddy residue recycle is the emerging challenge for sustainable growth in agriculture and environmental protection mainly in Haryana and Punjab state. Paddy residue recycling offers the advantage of transforming surplus farm waste into a usable product for satisfying crop fertilizer requirements. Recycling of paddy residue provides around a third of the nitrogen, between a fifth and a third of the phosphorus, and more than 100 percent of the potassium applied via inorganic fertilizers. In-situ management is also more sustainable and practical method for recycling of residues. In-situ retention of paddy residues is beneficial for crop and also can improve the water retention of soils.

Keywords: Paddy residue, Utilization, Environmental sustainability

WADFPSE/OP/05

Influence of Ozone Treatment on Wheat Germination during Bulk Storage

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Abstract
In this research article, the ozone gas treatment given to the wheat grain during bulk storage and evaluated its impact on seed germination. Ozone is a green alternative which used to control insects in grain storage. Ozone is the acceptable and economically viable technique for treating grains during storage for its residue-free and environment-friendly nature. A pilot-scale ozone disinfestation system for wheat grains was developed. The two-factorial experimental design on the influence of the parameters of the technological process of ozone treatment on the sowing qualities of wheat seeds was carried out. Based on the experimental data, the effect of ozone treatment time and the frequent ozone cycle on the germination percentage of wheat grain was determined. Wheat grains were treated by gaseous ozone with various time durations (0 min, 30 min, 60 min, 90 min and 120 min) and at various frequency cycles (7 days, 14 days, 21 days). The data demonstrated that ozone used in bulk storage enhances seed germination percentage. On the other hand, excess ozone can also cause some negative effects on germination. This study provided new insights into how wheat grain responds to ozone treatment and highlighted the role of treatment time and cycle in seed germination.

Keywords: Ozone, Seed germination, Wheat

WADFPSE/OP/06

Enhancing the chickpea (*Cicer Arietinum* L.) Yield through Various Water Saving Strategies under Rainfed Conditions

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Abstract
Chickpea (*Cicer arietinum*, L.) is a popular food legume, typically grown under arid and semi-arid region as rainfed crop. The crop productivity is limited under rainfed conditions due to bio-physical and socio-economic restrictions. Rainfed agriculture accounts for 67 % of net sown area in India, providing 44 % of food grains and supporting 40 % of the population. In practice, about 90 % chickpea is cultivated under rainfed conditionss without the use of irrigation. The most promising plant qualities that enable chickpea for rainfed agriculture are early maturing cultivars with vigorous root characteristics such as root-depth and -biomass by escaping terminal drought. Under rainfed conditions, early sowing, around 20 days earlier than normal, has also observed to greatly boost chickpea production. Furthermore, conservation agriculture by water management interventions is regarded as suitable adoption strategy to enhance crop production, productivity and revenue by 20-120 %. Natural hydrogel technology has recently been shown to enhance the chickpea yield due to its enormous capacity to absorb the soil moisture via osmosis and conserving significant amounts of water by enhancing the soil's water holding capacity. Natural gums like tragacanth (Gond Katira), sterculia (Gond Karaya), and xantham are nontoxic and even edible which have a water absorption capacity of around 100 times to their dry weight and help to make agriculture more sustainable and resilient to climate change. Tragacanth, commonly known as goat's thorn and locoweed, is a natural gum obtained from the dried sap of Middle Eastern legumes such as *Astragalus adscendens, A. gummifer, A. brachycalyx*, and *A. tragacantha*. Seed germination and seedling establishment are critical stages in chickpea growth and development under rainfed environment. Seed treatment with 0.2 % hydrogel level improves seed germination, seedling establishment and plant growth in chickpea as compared to control condition.

Keywords: Chickpea, Rainfed, Hydrogel, Tragacanth, Conservation agriculture

WADFPSE/OP/07

Physicochemical Properties of Turmeric (var. *Salem*) Powder as Affected by the Different Grinding Methods

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Abstract
Spices are integral parts of different cuisines from different region of India, it is generally ground from the size reduction process by ambient grinding. Turmeric (*Curcuma longa*) rhizome (var. Salem) samples were procured from local market and ground according to eight different treatments from four grinding methods and two feed temperatures. The effect of grinding methods viz., ambient grinding without water circulation around chamber, ambient grinding with water circulation, grinding with chilled water circulation and grinding with coolant circulation and two feed temperatures viz., ambient and refrigerated on some physicochemical properties was evaluated. The average values of particle size distribution were decreased and varied as the temperature of grinding was decreased. The biochemical properties such as moisture content, total carbohydrate, true protein, total fat and volatile oil was also affected by the grinding method and feed temperature. There was a positive effect of low temperature grinding with the chilled water and coolant circulation on the retention of the losses of volatile oil. The ground sample by the coolant circulation method with the low temperature feed (L3T1) was found the most suitable with better retention of biochemical properties and physical properties.

Keywords: Turmeric, Grinding methods, Biochemical properties

WADFPSE/OP/08

Public Distribution System: A Study of Sirmour District in Himachal Pradesh

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Abstract
The present study focused on allocation and distribution of the Public Distribution System in the Sirmour district of Himachal Pradesh. It is an important initiative of the government of India to ensure food safety, especially useful for economically and socially backwards classes. PDS is one of the major food security schemes of India which plays crucial role to reduce poverty, food insecurity and malnutrition. The scheme is imparting in achieving the second Sustainable Development Goal. The study is based on secondary data regarding allocation & distribution of food items and number of ration card holders. The data were analyzed through percentages and presented through tabular form and bar graph. The results of the study shown that total allocation of food items like sugar, rice, salt, wheat flour and pulses tends to increase from 2016 to 2020 except 2017.Whereas, total distribution of food items declined in 2016 to 2018 and increased from 2019 to 2020. The total numbers of card holders under the different categories have shown increasing trend from 2018 to 2021. The fluctuation in the allocation and distribution of food items is caused by the variability in the number of card holders, migration of the people from and to other place and the size of the family. The study concluded that the allocation of food items is directly proportional to the number of beneficiaries. The distribution of food items is less to the beneficiaries due to the demonetization during 2017- 2018.

Keywords: Allocation, Distribution, Food Items, Malnutrition, Poverty

WADFPSE/OP/09

Effect of PGPR from organic sources of nutrients and their effects on growth and yield of Turmeric (*Curcuma longa* L.)

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Abstract

In order to avoid the excessive use of chemical fertilizers, various traditional inputs such as Panchagavya, Jeevamrit, Farm Yard Manure and Shady soil of banyan tree are available which acts as richest source of the microbial diversity and beneficial for soil health and quality. Due to increase in utilization there may be the scarcity of these organic sources near future. Therefore microorganism (PGPR) from these resources can act as alternative way of fertilizers. Nowadays, PGPR established a efficient and commercial role in sustainable agriculture development around the globe and can reduce chemical input upto 25-30%. Beside this PGPR also provides a cost effective, eco-friendly way of detoxification and bioremediation of soil. The samples of organic sources of nutrient (FYM, Panchgavya, Jeevamrit and Organic soil) were collected from different location of Himachal Pradesh (Una, Hamirpur and Nauni) and Punjab (Jalandhar, Hosiarpur and Sangrur). Out of 60 bacterial isolates (14 from FYM, 5 from panchgavya, 8 from jeevamrit and 33 from organic soil) 49 were P-solubilizer, 53 were nitrogen fixers, 28 were HCN producers, 37 were siderophore producers, 42 showed inhibition against *Pythium aphanidematum* and 43 showed inhibiton against *Collectotrichum capsici*. Only three bacterial isolates (PGPR1, PGPR2 and PGPR3) were selected on the basis of maximum plant growth promoting traits for net house study. Plants bacterized with isolate PGPR3 (JS6) showed significant increase in rhizome germination (54.67 %), number of leaf per plant (76.89 %), shoot length (46.29 %), shoot fresh weight (30.38 %), shoot dry weight (114.66 %), rhizome length (67.43 %) and in rhizome weight (75.99 %) over T_1 (Uninoculated control). Under field conditions the selected bacterial isolate PGPR3 along with 70 per cent dose of chemical fertilizer (NPK) as well as FYM registered significant increase in rhizome germination (21.99 %), number of leaf per plant (56 %), shoot length (37.47 %), shoot fresh weight (65.30 %), shoot dry weight (44.43 %), rhizome length (75 %) and rhizome weight (42.52 %) over T1 (control full RDF and FYM). Biofertilization and bioprotactant characters of the selected bacterial isolate PGPR3 (*Bacillus megaterium*) paved the way of its use at commercial level may be recommended to the farmers which can significantly reduce the dependence on organic as well as chemical fertilizers coupled with eco-friendly approaches for quality production of turmeric in the state.

Keywords: PGPR, Turmeric, Plant growth promotion

WADFPSE/OP/10

Effect of Different Blanching Methods on the Peroxidase Activity and Ascorbic Acid Content of Baby Corn

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Abstract
Baby corn is popular around the globe due to its distinct taste, nutritional value and economic importance. Blanching is considered as most efficient method that helps in inactivation of enzymes hence three blanching methods (hot water, steam and microwave blanching) were employed with different time temperature/power combinations. Treated samples were evaluated for peroxidase activity and ascorbic acid degradation to examine the effectiveness of blanching. Different time temperature combination of blanching methods used were hot water blanching (70°C, 80°C, 90°C for 60,120 180 and 240 secs) , steam blanching (1000C for 60,120 180 and 240 sec) and microwave blanching (360-900W, 10-300 secs). It was found that for microwave, hot water and steam blanched samples, the 90% inactivation of peroxidase enzyme was achieved at 540W, 90 °C and 100°C for 30, 60 and 60 secs respectively. Moreover, higher retention of ascorbic acid was found in microwave blanched samples, as compared to conventional methods. The retention % of ascorbic acid was found to be 94.15, 83.5 and 94 % for microwave, hot water and steam blanched samples respectively.

Keywords: Ascorbic acid, Baby corn, Blanching methods, Peroxidase activity,

WADFPSE/OP/11

Role of Diatomaceous Members for Sustainability in Forensic Limnology

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Abstract
Diatoms are golden brown microscopic algal organisms, composed mainly of siliceous cell walls. They are photosynthetic in nature and are cosmopolitan in distribution, in all aquatic and moist habitats. They serve as major environmental indicators to denote the water quality and inferpast environmental conditions. For the last few years, these members have occupied a special position as a tool in solving drowning cases. Forensic Limnology is a branch of science where drowning related investigations are performed by using diatoms as important evidence. Drowning holds third position in causing unnatural death of persons worldwide as per World Health Organization. Diagnosis of death due to drowning remained a challenging issue for the forensic community. In the present study, two cases of drowned victims have been solved by merging evidence from pathophysiology and limnology. The case study was carried out in the State Forensic Laboratory, Junga, Himachal Pradesh. The biological samples from the two corpses (sternum) and water samples from the suspected drowning sites, along with the autopsy reports, were sent for denoting the exact cause of death. Reverse aqua regia solution was used for the cleaning of diatom cells. The results obtained after the diatom test showed a number of diatoms namely, species of *Navicula, Synedra, Pinnularia, Fragilaria, Diatoma* and *Cocconeis.* The cause of death and site of incident was detected successfully with the help of diatomtest. Thus, the outcome of our study strongly supports the sustainability of these organisms in forensic limnology.

Keywords: Diatoms, Forensic Limnology, Sustainability,

WADFPSE/OP/12

Ultrasonic Extraction of total Phenolic Content and Antioxidant Assay of Wood Apple (*Limonia acidissima* L.) Fruit Pulp

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Abstract
Wood apple (*Limonia acidissima* L.) is an underutilized fruit that is native to India and Sri Lanka. This fruit belongs to Rutaceae and contains bioactive compounds such as phenolics, flavonoids, sterols, fatty acids, vitamins and minerals. These compounds show bioactivity in the human body and are responsible for the prevention of coronary heart disease, cancer, mental health. Ultrasonic extraction is considered a modern extraction method for effective or efficient extractability as compared with conventional methods and has been applied for phytochemical extraction at a short time during, less solvent consumption, minimising temperature degradation with low energy input and simplified manipulation. Ultrasonic extraction with ethanol solvents of phenolic extract yield, total phenolic content and antioxidant (DPPH) assay from wood apple fruit pulp was presented. The results show that the optimized extraction conditions were 50% ethanol solvent at 30°C temperature and 0.63 kHz ultrasonic frequency for 40 min. Extraction yield of phenolics obtained on these optimized condtion was in range of 9.17-28.19%, similiary phenolic content obtained in range of 133.02-414.24 µg GAE/g and DPPH assay was 75.89-96.16%. On the basis on desirability, the optimized values were 27% extraction yield, 352.13 µg GAE/g phenolic content and 94.04% DPPH assay. The ultrasonic extraction can be carried out at lower temperatures (30°C) and time (40 min) with minimum solvent consumption for maximum recovery of phenolic extract and recovery was also affected by the polarity of the solvent.

Keywords: Antioxidant, Phenolics, Wood apple

WADFPSE/OP/13

Portraying Mechanics of Plant Growth Promoting Rhizobacteria as Beneficial on Growth and Quality Production of Carnation

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Abstract

Use of plant growth promoting rhizobacteria (PGPR) has shown potentials to be used as a promising technique in the practice of sustainable agriculture. PGPR are free-living bacteria colonizing plant roots and exert beneficial effects on overall development of plant. The PGPR promote plant growth either by nutrient acquisition like nitrogen fixation, phosphate solubilization and producing hormones or may promote the plant growth by suppressing plant pathogens. These abilities are of great agriculture importance in terms of improving soil fertility and crop yield, thus reducing the negative impact of chemical fertilizers on the environment. The sustainability of ornamental crop production is of increasing concern to both producers and consumers. Carnation being one of the important commercial floriculture crop require large amount of fertilizer applications. Therefore in the present study, *in vitro* experiments were conducted to screen different PGPR strains and their mechanisms for their ability to promote growth and quality of carnation. Two PGPR strains were found most effective for plant growth promoting mechanisms i.e., *Psychrobacillus psychrodurans* strain SSR7 and *Bacillus subtilis* strain SRR29.After selection of these potential PGPR strains different treatments in combination with chemical fertilizers were used for evaluation studies under polyhouse conditions. Interestingly all the parameters such as flower size, plant height, stem length, cut flower grades and weight of cut flower stem was observed highest in treatment containing (70% NP + SSR7) and treatment T10 containing (70% NP+ SRR29). Treatments T9 and T10 showed results at par with each other and also showed promising results for its application as inoculant for carnation cultivation over uninoculated control and RDN.

Keywords: Carnation, Nutrient acquisition, PGPR, Phosphate solubilization, Plant growth

WADFPSE/OP/14

Is Plastic Really Non-Degradable?

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Abstract
Over last decade, pollution of plastic has become a reason of concern because of its low degradability and poor recycling. Plastic is one of the resilient materials as at normal environmental conditions they resist degradation, have disruptive and threatening effects on the ecosystem.Current methods used for eliminating the plastics include landfilling, recycling and incineration which are unsustainable and even puts burden on the environment. For such kind of havoc, single remediation approach is often found as baseless and requires multidisciplinary strategies that involves both physicochemical and biological approaches.Critical turning pointsoccurredinto plastic degradation after the introduction of bacteria (*Brevibacillus borstelensis, Comamonas acidovorans*, *Pseudomonas* sp., and *Staphylococcus* sp.), fungi (*Aspergillus niger*, and *A. glaucus)* and some insects (*Zophobas atratus*, and *Z. morio)*.These can ingest the plastic and then convert it to compounds that are environment friendly. For many microbial communities' (*Pseudomonas flourescens,* and *Penicilliums implicissimum*) plastics can act as the source of carbon.

Keywords: Microbial communities, Non-Degradable, Plastic

WADFPSE/OP/15

Productivity Assessment of Intercrops under Agroforestry System

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Abstract
The growing demand for food, fuel and fodder due to burgeoning human and animal population and shrinkage of available land resources necessitate to increase the production per unit area. Therefore, it is not appropriate to depend completely on traditional agriculture which is uncertain and extremely risky but to develop alternate land use system such as 'agroforestry' which is more sustainable and stabilize the income, besides simultaneously helps in food security and to protect the environment. A field experiment was carried out to evaluate the performance of the intercrops under Melia dubia during kharif, 2018 at agroforestry block, College of agriculture, Rajendranagar, Hyderabad. . The yield among the two clones of Melia dubia has shown decreased over the sole crop. Between the two clones (MTP-I, MTP-II) clone II has recorded significantly higher yield. The results of the present study indicated that between the two clones MTP-II superior over the MTP-I and among the intercrops foxtail millet has shown less decrease in the percentage over the sole crop compared to other intercrop combinations.

Keywords: Intercrops, Grain yield, Stover yield, Harvest index

WADFPSE/OP/16

Applicability of SCoT Markers for Genetic Diversity Assessment in Capsicum (*Capsicum Annuum* L.) Genotypes Associated with Phytophthora Resistance

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Abstract
Capsicum (*Capsicum annuum* L.) is an economical and nutritional crop, grown worldwide for its vital uses as vegetables, spices, ornaments and medicines. The present study was aimed to assess the genetic diversity among three capsicum genotypes namely Solan Bharpur (tolerant to *Phytophthora* blight), California Wonder (susceptible to *Phytophthora* blight) and DKC-8 (Resistant to Phytophthora blight) using 36 SCoT markers. Out of 36, thirtyfour markers showed successful amplification profile yielding 182 fragments, of these 27 primers (75%) gave a total of 85 polymorphic bands with 2.5 average bands per primer. Average percent polymorphism was 41.96 within the size range of 100-2500 bp. The similarity coefficient ranged from 0.67-0.73 which assembled Solan Bharpur and California Wonder in one group and partitioned DKC-8 from these two genotypes. The average polymorphic information content value (PIC), average effective multiplex ratio (EMR), average marker index (MI) and average resolving power (RP) was calculated as 0.20, 1.58, 0.53 and 2.45, respectively which indicated the high efficiency of SCoT primers for capsicum variability study. SCoT12 primer produced maximum ten bands with PIC value of 0.44, EMR of 10, MI of 4.44 and RP of 9.90. Other differentiation genetic parameters such as effective number of alleles (1.52±0.34), Nei's genetic diversity (0.30±0.17) and Shannon's information index (0.45±0.24) elucidated the allelic richness, rich genetic diversity among the genotypes and informative nature of the markers. The findings of the present study have the potential applications in future breeding programmes for genetic improvement of *Capsicum*. The *Phytophthora* blight resistant genotypes can be exploited in breeding after some further experimentation.

Keywords: *Capsicum*, *Phytophthora*, Genotypes, Diversity, Markers

WADFPSE/OP/17

Effect of Hydrothermal Treatment on Oil Absorption of Wheat Starches

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Abstract

Wheat (*Triticum aestivum* L.) starch was isolated from three wheat varieties (DBW-16, WH-147, and WH-542) and was fractionated according to the size of the granules, large granules (A), and small granules (B). Starches were subjected to hydrothermal treatment at 100℃ and 30% moisture content for modification. Native starches and hydrothermally treated starches were hydrated to optimum moisture level and fried at 180℃. Oil content measurements showed that native starches absorbed more oil than fractionated starch granules. The oil content of the modified starches was comparatively lower than native starches. There was about a 10% reduction in oil content in modified starches. The results were also correlated with the amylose content of the starch granules. The promoting effect of oil absorption on the interactions of starch composition and structure was confirmed by FTIR spectra peaks at (1793-1693 cm-1, 2880-2990 cm-1). Hydrothermal treatment of wheat starches modified surface morphology of the granules that's why the peaks of surface oil confirmation were not seen in modified starches. A better understanding of the relationship between starch granules size and oil absorption obtained in the course of the present research will facilitate the development of fried foods with lesser oil uptake.

Keywords: Hydrothermal treatment; Oil Absorption; Morphological Properties; FTIR Spectroscopy

WADFPSE/OP/18

Role of Arbuscular Mycorrhizal Fungi (AMF) in antimicrobial and radical scavenging activity in *Vinca minor* Linn. Growing under Himalayan conditions

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Abstract

A mycorrhizal fungus infects the plant roots to form symbiotic associations whereby the fungi give nutrients, water and protection to the plant in exchange for food in the form of carbon. Mycorrhizal diversity is important to maintaining the crop vigor and soil fertility. They play a crucial role in plant nutrient uptake, water relations, ecosystem establishment, plant diversity, and the productivity of plants. Antibacterial activity of isolated methanolic leaf extract of AMF inoculated *V. minor* was performed against various pathogenic bacteria such as *Staphylococcus aureus*, *Escherichia coli, Staphylococcus aureus*, and *Salmonella typhi* by agar well diffusion method. The zone of inhibition of every plate was measured. Natural antimicrobial compounds derived from *Vinca minor* L. plant contain a wide variety of secondary metabolites, which are useful for “brain health” (increasing blood circulation in the brain, supporting brain metabolism, increasing mental productivity, preventing memory and concentration problems and preventing early aging of brain cells). The best antibacterial activity was shown for ethanolic extract from *V. minor* plants growing in Turkey. The main phenolic compounds were isolated from the leaves of *V. minor* as kaempferol -3 -O (6- O - rhamnosyl glucoside)- 7- O- glucoside, vincoside, chlorogenic acid. 2. 3- Dihydroxybenzoic acid showed a potent radical scavenging activity. The leaves of *V. minor* contain valuable source of antibacterial substances. Tested extracts obtained from this plant showed different degree of antimicrobial activity in relation to different microorganisms. *V. minor* species, suggesting its use in processed food preservation, including raw, pharmaceuticals, alternative medicine and natural therapies. The phenolic compounds are known for their antimicrobial properties. Since the strains of bacteria used resisted the convectional antibiotics such as chloram phenicol, ampicillin and cotrom oxazole, we decided to use a ciprofloxacin (fluoroquinolone) abroad spectrum antibiotic for both gram positive and gram negative bacteria as control. As the concentration of extract increases, the activity also increases and thus the zone of inhibition too increases. Significant results were shown by *Escherichia coli* and non significant by *Staphylococcus aureus*. As an important medicinal plant, it has a good antioxidant potential throughout its parts under drought stress. Ethanol as used for the extraction of phytochemicals because it has the ability to dissolve the phytochemical compounds like tannins, polyphenols, flavonols, terpenoids and alkaloids It has been demonstrated that extracts prepared using dried plant material is much more trustworthy than the fresh plant materials.

WADFPSE/OP/19

Optimization of Sprouting Conditions for Development of Enhanced Quality Soybean Sprouts

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Abstract
Soybean sprouts may provide a significant amount of the necessary requirement of vitamins and minerals in our daily diet. Sprout quality is influenced by total length and weight of hypocotyl, length of root and their germination ratio. This study was designed to optimize the sprouting condition variables comprising steeping temperature, germination temperature, relative humidity and time to investigate their relative effects on the morphological quality parameters such as sprout length and weight including germination percentage. To analyze the results and finally to optimize the relationship of sprouting conditions, the statistical tool namely, response surface methodology (RSM) was utilized. Sprouting condition variables were found to play a decisive role in determining quality of sprouted soybean. The analysis showed the optimized values for sprouting condition variables at steeping temperature (26°C), germination temperature (24°C), relative humidity (83%), and germination time (3.5 days). The results are indicator parameters for better production, handling, management, storage and marketing of soybean sprouts for the maintenance of good health through natural unprocessed products.

Keywords: Germination, Health, Soybean Sprouts

WADFPSE/OP/20

Carbon Nanotubes- An Emerging Tool towards Remediation of Contaminated Environment

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Abstract
The release of dangerous contaminants into the environment has grown because of industrialization and technological advancements. Even though various remediation strategies have been developed, the persistence and concentration of pollutants continues to rise. In recent years, carbon nanotube (CNT) – polymer composites have attracted a lot of attention. Carbon nanotubes have unique material qualities that make them excellent filler for reinforcing polymer matrices to produce light-weight advanced nanocomposites with excellent mechanical, electrical, thermal, and multi-functional capabilities. The most promising and challenging areas of carbon nanotube-based nanocomposites research is the development of lightweight, high-strength structural composites for the revival of contaminated environment. These have sparked a lot of attention in wastewater treatment in recent years due to their diverse features. The solution for revival of polluted environment are some methods such as solvent casting, drop casting and spin casting, melt-processing also melt blending, shear mixing, in-situ polymerization, coagulation method etc. Carbon nanotubes and their composites have significantly improved adsorption efficiency for the removal of single and combined contaminants. The treatment properties of carbon nanotubes for various organic and inorganic contaminants are described with an emphasis on improving treatment efficiency by various surface modifications and nano-composite preparation. This illuminates the path towards the development of more advanced materials for the treatment of different types of contaminants.

Keywords: Carbon nanotubes, Environment, Remediation

WADFPSE/OP/21

Defense Priming by Plant Activating Proteins *flg*22 towards Sustained Plant Immunity

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Abstract

Many Gram-negative phytopathogenic bacteria use a type III secretion system (T3SS) encoded by a hypersensitive response and pathogenicity (*hrp*) gene cluster to manipulate the metabolism of their host and trigger susceptibility. Harpins also trigger diverse beneficial responses when sprayed or expressed in plants. Pathogen – associated microbial patterns leads to the activation of PAMP-triggered immunity (PTI), which wards off the pathogens. In this study, we isolated flg22 epitope region of fliC and the effector *hpa*G, *hrp*N and *hrp*Z from *Xanthomonas axonopodis* pv. dieffenbachiae (Xad), *Erwinia* sp. and *Ralstonia* sp., respectively. Proteomic analysis of Gram negative bacterial secretes yielded a plant activating proteins (PAPM) (*flg*22) for disease resistance and plant health. PAPM for defense priming was identified as flic by MALDI-TOF. The 22 aminoacid of *flg*22 epitope region (ASMSTSIQRLSSGLRINSAKDDAAGLAISER) of fliC from Xad was synthesized and its effect on tobacco plants was tested and showed hypersensitivity reaction suggesting that this peptide could be a potential elicitor of plant defense priming. In *flg*22 infiltrated leaf, the expression of PR1 and NPR1 genes were up-regulated indicating the capability of f*lg*22 as elicitor of HR response in non-host plant tobacco. The results showed that in response to a harpin protein, the salicylic acid signaling pathway is activated to confer induced resistance against pathogens while abscisic acid signaling is triggered to regulate the induction of drought tolerance. Hence, PAPM *flg*22 can be tailored into a newer formulation for sustainable site specific plant health as well as immunity in crop plants against bacterial diseases.

Keywords: Defense Priming, Drought, Harpins

WADFPSE/OP/22

Mass Production Strategies to Elevate the Number of Indigenious Entomopathogenic Nematodes and Their Associated Bacteria Isolated from Mid-Hill Region of Himachal Pradesh

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Abstract
The over-reliance on chemicals in agricultural practises led the world in a quandary. The upsurge in difficulties such as pesticide residue, soil degradation and pest resistance acted as pacesetter for research on biological control with prime focus on entomopathogens. In recent times insect parasitic nematodes (EPNs) have emerged as the best alternative to the menacing situation created worldwide by the misuse of chemical pesticides. This approach yields maximum profit and minimum hindrance to the ecological balance resulting in array of new opportunities towards sustainable crop protection. This study utilization of different mass production strategies on indigenous entomopathogenic nematode strain in Himachal Pradesh was planned to curb out constraint of curtailed number of EPN fauna present in soil. About 158 soil samples were collected from 56 localities of 6 districts (Solan, Sirmaur, Shimla, Kullu, Una and Mandi) and 28 samples from Kullu, Sirmaur, Shimla and Solan districts were found to be positive for EPN population. The indigenous population SD7 strain was isolated from the Deothi area of district Solan and morphologically identified using the taxonomic keys as *Heterorhabditis bacteriophora*. Their associated bacterium was also isolated and grown on NBTAgar media. For *in vivo* culturing *Corcyra cephalonica* and *Galleria mellonella* were used as bait insect. The maximum number of IJs using the *in vivo* technique was recovered from *Galleria mellonella* (23,100 IJs). *In vitro* culturing of SD7 100IJs/50mm petri plate was applied on four different types of modified media. The minimum time taken for emergence of IJs was found in modified Wout Media (WM) (1-2 million IJs) and the maximum progeny production was observed on Dog biscuit medium (DBM) (2-3 million IJs). The result of the study concludes presence of indigenous EPNs in different localities of the state but with low frequency of occurrence and this inadequacy can be removed using the *in vivo* and *in vitro* techniques successfully.

Keywords: Artificial media; Entomopathogenic nematodes; Identification; Mass production, Sustainability; *H. bacteriophora*

WADFPSE/OP/23

Pest Status of Subfamily Lymantriinae (Lepidoptera: Noctuoidea) from India

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Abstract
Insects, being most significant species both in terms of diversity and richness, are known with over 1,020,007 species and considered as the most successful organisms on planet Earth. Insect pests are the main source of biotic stress on agricultural crops, fruit trees, ornamental plants and forest trees. These creatures can have adverse and damaging impacts on agricultural production and market access, natural environment and our lifestyle. The order Lepidoptera comprising of moths and butterflies is the second largest insect order and provides important model systems for studies on genetics, physiology, development, ecology and evolutionary biology. The subfamily Lymantriinae with 2500 known species is one of the most important families of order Lepidoptera. These moths pose significant economic, ecological and recreational costs as their populations defoliate natural and urban areas. The spongy moths are highly polyphagous and their larvae have broader host plant ranges than most Lepidoptera. An insight to the pest status of subfamily Lymantriinae will be discussed in detail.

Keywords: Lepidoptera, Lymantriinae, Pests

WADFPSE/OP/24

Screening of Biofilm Formers in Lettuce: A Necessary Step for Food Safety

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Abstract
Food borne outbreaks associated with fresh vegetables are increasing on a large scale. Biofilm has been linked to a number of pathogen outbreaks, accounting for up to 80% of microbial infections A biofilm is a multi-layered structure generated by planktonic cells in a liquid adhering to a solid substrate or by agglomeration of floating cells. A biofilm has established functions like barrier to disinfectants, antimicrobials, and other hygiene measures, and is a source of serious illnesses in humans. The present study investigates the biofilm forming ability of pathogenic bacteria isolated from farm fresh produce of lettuce. A total of 20 isolates were screened after obtainment from different lettuce samples taken into account for their biofilm forming ability. Initial screening for biofilm formation was done using congo red agar plate test, test tube test and other qualitative tests. Results revealed that 9 isolates were potential biofilm formers and rest non biofilm formers. However, spectrophotometric study suggested their efficiency from moderate to strong biofilm production capacity. Scanning electron microscopy (SEM) gave a perfect view of sessile communities dense in structure. Results of the work underline the biofilm forming and potentially virulent capacities of isolates from the surface of lettuce. Ii will help in designing proper control strategies for food safety.

Keywords: Biofilm formation; Lettuce; Screening, SEM.

WADFPSE/OP/25

Stress Management among the Banking Employee in Urban Areas

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Abstract
Banking commerce has developed into one of the very competitive sectors in India. The banking commerce, since the commencement of this decade, has been in facade of greater challenges in terms of global banking and technological changes. Stress is predictable on the part of the employees as the procedures, system; techniques are getting difficult with the use of advanced technology. Stress can be caused by many factors and the effect of stress will vary with each individual. Stress management is a normal part of life. It reduces efficiency, physical and emotional health, so it's significant to get ways to maintain it under control. The study was conducted in Hisar district of Haryana with the aim to study the stress among the bank employee. Samples of 50 female respondents were taken randomly from hisar district. The study was exploratory and data taken through the small questionnaire. The study was conducted to understand how to deal with stress and its significance in banking employees. The result showed that 50% of respondent experience more workload about the work whereas 10% do not feel any workload. 40% of the employees strongly agree that working hours is appropriate, while 30% of the employees strongly disagree with the working hours. Whereas 25% respondents are bad attitude toward working condition, 35% respondent belief that working condition is average, 15% of the employees have the attitude that the working condition is good and 30% have the opinion that the working condition is very good.

Keywords: Stress, Management, Banking, Employee

WADFPSE/OP/26

Food Security and Sustainability in India

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Abstract
Food is what people and animals eat to survive and to provide nutritional support for an organism. It usually comes from animals or plants. Food security has been a major concern in India. Food security defines three content i.e. availability, accessibility and affordability of food to all the citizens of the country at all times. Availability means a supply of the sufficient quantities of food and physical presence of complete stock of food in a country. Accessibility identify that food is within reach of every person. Affordability means that an individual has enough money to purchase sufficient and nutritious food. India is the largest stock of grain in the world i.e. 120 million tonnes (as of July 1, 2021). Chhattisgarh was recently enabled The One Nation One Ration card plan for fulfilling the food security in the state and this scheme has be converted into operational in 35 states and union territories. It is now covering 96.8% of the population included in the National Food Security Act. On 31st October, 2020, 17 states that have implemented the scheme are Andhra Pradesh, Goa, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Manipur, Odisha, Punjab, Rajasthan, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh. India ranks 74 out of 113 major countries in terms of food security index. Through Inadequate food distribution India is suffering from one of the largest numbers of undernourished people in the world. During the period of COVID-19 pandemic, food security was in an alarming situation across India. With situations like lockdown, many families lost their income which ultimately led to challenging situations for the availability of food for all. At last we conclude that food security is important with the purpose of every individual in the country has easy access to safe and healthy food.

Keywords: Food, Food Security, Food Security Plan

WADFPSE/OP/27

Trophic Transfer of Nanoparticles in Aquatic System

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Abstract
Nanoparticles (NPs) are used in varied range of products such as ink, cosmetic products, electronic devices, paints, and plastics. Some nanoparticles (Silver) possess anticancer and antimicrobial properties making them associated with sectors like health care, textiles, purification, and sanitization. The biggest threat of using nanoparticles is their transfer and magnification in the trophic food chain, i.e., trophical transfer. It is considered as an influential exposure route for the accumulation of nanoparticle in the organisms of aquatic biota and induce adverse effects in the organisms. Aquatic system is considered as the sink and destination of nanoparticles. Understanding of trophic transfer is important for the assessment of environmental risk. Before getting accumulated in the organisms (aquatic) nanoparticles are subjected to various transformation processes along the environment. Mostly there are four factors that affect the trophic transfer of NPs – (1) Transformation of NPs in the environment, (2) uptake and accumulation in the organisms, (3) localization and fate inside the organisms, and (4) digestive functioning of predator organisms. As the fish food is among the essential source of protein for humans so, there is the probability of health risks associated by the consumptions of nanoparticles polluted aquatic food.

Keywords: Nanoparticles, Trophic transfer, Aquatic toxicology.

WADFPSE/OP/28

Water Pollution and its Quality Monitoring

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Abstract

Water is most vital liquid for maintaining the life on the earth. About 97% water is exists in oceans that is not suitable for drinking and only 3% is fresh water wherein 2.97% is comprised by glaciers and ice caps and remaining little portion of 0.3% is available as a surface and ground water for human use. Fresh water is already a limiting resource in many parts of the world. In the next century, it will become even more limiting due to increased population, urbanization and climate change. Improper disposal of solid waste, sewage water, and too much use of fertilizers are the main reasons of water contamination. The use of polluted water enhance the value of conductivity, total dissolved solids (TDS) and sodium absorption ratio etc. in ground water and exceeds the national standards. Important physical parameters that are tested included Total dissolved solids (TDS), Electrical conductivity (EC) and pH of water. While, important chemical parameters have been tested were Bicarbonates, chloride, sulfate, magnesium, calcium, hardness, sodium, potassium, alkalinity and nitrate. Total dissolved solids (TDS) in drinking water is originates many ways from sewage to urban industrial wastewater etc. Therefore, TDS test is considered a sign to determine the general quality of the water. Colors in ground waters can originate from decomposition of organic matter and leakage through sewage. According to WHO standards pH of water should be 6.5 to 8.5. Bicarbonates concentration in water relies on pH and is usually less than 500 mg/l in groundwater. It is the standard alkaline constituent found almost all surface and ground water bodies and therefore affects alkalinity and hardness of water. High concentration of sulfate may be due to oxidation of pyrite and mine drainage. Alkalinity is the presence of one or more ions in water including hydroxides, carbonates and bicarbonates. Nitrate one of the most important diseases causing parameters of water quality particularly blue baby syndrome in infants. The sources of nitrate are nitrogen cycle, industrial waste, nitrogenous fertilizers. Unfortunately, the intensity of waterborne diseases in under developing countries is very high due to polluted drinking water and poor hygienic condition. The awareness campaign on waterborne diseases and importance of safe water for human health should be commenced by government.

Keywords- Water pollution, assessment, water quality standards, quality monitoring.

WADFPSE/OP/29

The Role of Psychological Intervention in Modifying the Behaviour of Farmers

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Abstract
Agriculture is the most ancient occupation of India. We can consider it as a back bone of our country. Although farming is psychophysiological demanding occupation. It has extensive range of physical, biological, chemical and mechanical aspects which has psychological effects on farmers. These psychological factors are determining the attitude and behaviour through concept formation, decision making and other cognitive functions. Further, on the other hand every glitch has reconciliation and in this psychological intervention programmes are playing very vital role in restructuring the attitude of farmers which is leading towards their wellbeing and life satisfaction. The objective is to sensitize the role of psychological intervention such as Behaviour modification approach, Transactional, ABC Model of Attitude, attributional model etc. in extension activities of agriculture that can consequence healthy cognition of farmers, which is mandatory for the success of this traditional occupation. The study is based on the secondary data from different articles, research papers and review of literatures to explore the role of psychological intervention in the behaviour modification of farmers. Psychological interventions through various programmes might be beneficial in the reconciliation of all the conflicts of farmers that are determining the attitude and behaviour that is leading to psychophysiological problems.

Keywords: Agriculture activities, Behaviour Modification, Stress management, Cognition

WADFPSE/OP/30

State wise Trends and Growth Patterns of Milk Production in India

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Abstract
The present study examines the state wise trend and growth patterns of milk production in India over the period from 2001-2019. Percentage share and compound annual growth rate used to extract the results. Data for state wise milk production has been taken from official website of National Dairy Development Board (NDDB). The overall picture reveals that Uttar Pradesh secured the first position in milk production in the country followed by Rajasthan and Andhra Pradesh. On the other hand Goa, Delhi and Himachal Pradesh come at lowest positions in the overall milk production in the country. The milk production growth rates have shown continuous rising trends in three different sub periods. The states whichever have shown the high percentage share are due to the more disposable incomes and health awareness. In addition to these, the government initiatives and programmes have also made entering and sustaining in the sector feasible and profitable.

Keywords: Milk production, Health awareness, Growth Patterns

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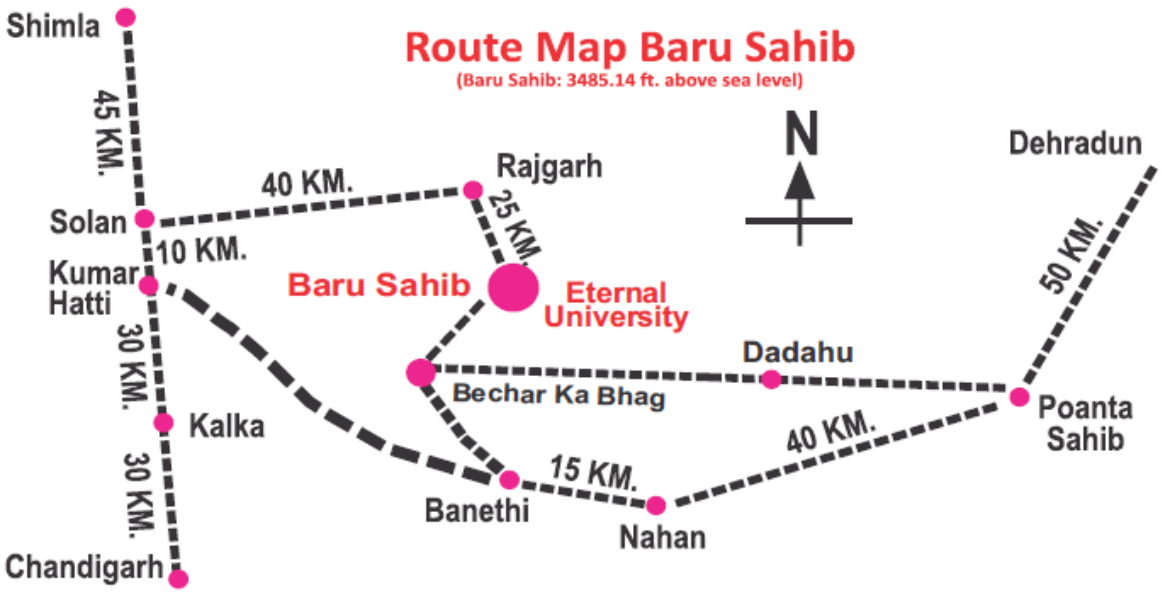

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