

INNAUGURAL SESSION DETAILS(25th of March, 2022)

The session started with traditional Shabad by students of Akal College of Music, a kind of divine music with its great historical significance and it is actually deeply related to taking blessing from Almighty to begin any activity of great import importance and significance like our this presence conference .

The main Anchoring for this was conducted by Dr Ambika Sharma from English Language Dept of Eternal University, Baru Sahib and she coordinated the entire session along with the team very well.

Inaugural session started with the welcome addressed by our Hon'ble **PVC SIR, Dr A Singh Ahluwalia** "I welcome you on the beautiful serene campus of Eternal University, Baru Sahib for hosting the International Conference on Water, Agro, Dairy and Food Processing for a sustainable Economy."

We appreciate your exceptional efforts in reaching out to this divine place to be with us for deliberating on this topic which is getting so significant in every sphere of our life and research endeavours for a future full of responsible citizens and an inclusive society.

I must acknowledge the blessings of our founders Most honoured Sant Attar Singh ji, whom Pt Mohan Malviya ji requested to lay the foundation stone of BHU, his disciple Sant Teja Singh ji whom Malviya ji appointed the first Principal of Training College BHU, and Brahmngiani Honourable Baba Iqbal Singh ji, Former director Agriculture, Himachal Pradesh, Former President of Kalgidhar Trust and Chancellor, Eternal University whom Govt of India honoured with Padam Shri this year for his exceptional contributions in social services in the field of rural value based education.

Dear delegates and colleagues, we are on the verge of making strides in disciplines like diary, agriculture, food processing and water conservation and its judicious utilization to be sustainable. The climate change fear has been coming true and we have to make efforts to save our deteriorating eco system and depleting resources for future generations as well, by turning into global citizens for sustainable economy. The UN declaration transforming our world i.e. 2030 agenda of sustainable development calls for universal action plan for people, planet, peace, partnership and prosperity. The wisdom of traditional practices, community based indigenous knowledge and their amalgamation with modern technologies can prove to be a boon towards sustainable economy.

The beginning of full-fledged agriculture college in rural Himachal has been the vision and thought of Padam Shri Sant Baba Iqbal Singh ji as Director Agriculture and his close associate Padam Bhusam Dr Khem Singh Gill Ji former VC PAU , a well-known wheat breeder, who were chairperson and vice chairperson of this trust respectively. Hence this idea of organizing this conference by **the corporate**

research Centre and Communication Dept., of our University (Led by Prof S C Ghosh) along with our Knowledge Partner IRMA Water Centre, IRMA, Anand, Gujarat led by Dr Uday Shankar Saha, RBI Chair Professor (Ex. CGM, NABARD), who also attended & made presentation in the conference.

Taking this opportunity, I welcome our sponsors, NABARD, SED and others for their financial support to see this event happening.

Leaving the stage for further programme, it my pleasure to welcome you once again on my behalf and on behalf of everyone from Eternal University and Baru Sahib Campus. Thank you very much.

The Hon'ble VC (Dr Devender Singh) and also the president of Kalgidhar Trust, through his words of wisdom, expressed his deep sense of gratitude and extended a warm welcome to all the dignitaries present during the inaugural session. His brief deliberation also incorporated the vision and mission of the trust and the University and its relevance towards value based education and woman empowerment and the achievement made so far.

He also beautifully articulated and narrated the significance of this mega conference and its ramification towards a better and inclusive world following the sustainable practices for the verticals as incorporated in our main theme of the conference and role being played by this great university towards this end in the different verticals of this conference and other important areas.

Dr Ashok Pandey; while introducing the theme and tone setting expressed his viewpoints beautifully. His essentials are: India is one of the most water-stressed countries among the 17 countries all over the world. It has 16 per cent of the world's population, but possesses only four per cent of fresh water. The country is the world's largest extractor of groundwater, accounting for 25 per cent of the total. Some 70 per cent of our water sources are contaminated and our major rivers are dying because of pollution. In June 2019, 65% of all reservoirs in India reported below-normal water levels, and 12% were completely dry. On 26th June, the city of Chennai report ZERO water availability in its any of its reservoirs. As many as 256 of 700 districts in India have reported 'critical' or 'over-exploited' groundwater levels according to the most recent Central Ground Water Board data. On top of this, there is an increasing demand for groundwater resources for urban populations who need clean drinking water instead of relying on surface sources contaminated by upstream agricultural runoff and wastewater discharge.

The scarcity of water in India affects hundreds of millions of people across the country. In fact it threatens the livelihoods of more than 600 million people. The main issue stems from climate change, which has decreased rainfall and increased temperatures nationwide. It makes it difficult for

crops to grow without enough water. As a result, many farmers have been forced into poverty due to crop loss or because they cannot produce as much food with limited access to irrigation methods.

There are several reasons for water shortages - climate change, such as altered weather patterns including droughts or floods, increased pollution, and increased human demand and overuse of water. We have limited water conservation infrastructure -- rainwater harvesting systems, water reuse and recycling, and waste water treatment.

Agriculture production is very closely related with the water for irrigation. However, we have yet another serious issue related to soil, i.e., the poor health of soil due to acute low level of organic carbon in it. Then there is indiscriminate use of inorganic fertilizers, which together with over-exploitation of ground water is leading to un-sustainability in agriculture sector too.

Coming to third aspect of the conference, is dairy. Dairy is the single largest agricultural commodity contributing 5% of the national economy, witnessing 6.4% (CAGR) in the past 5 years. India is the largest milk producer and is ranked 1st in milk production contributing 23 per cent of global milk production. Milk production in the country has grown at a compound annual growth rate of about 6.2 per cent to reach 209.96 mn tonnes in 2020-21 from 146.31 mn tonnes in 2014-15. Dairy market in India reached a value of INR 11,357 Billion in 2020. Dairy activities form an essential part of the rural Indian economy, serving as an important source of employment and income. India also has the largest bovine population in the world..

However, milk and milk products also needs serious attention for sustainable development. The milk production per animal in India is significantly low as compared to the other major dairy producers. Moreover, nearly all of the dairy produce in India is consumed domestically, with the majority of it being sold as fluid milk. On account of this, the Indian dairy industry holds tremendous potential for value-addition and overall development.

The fourth highly relevant aspect of the conference is food processing. India's food processing sector is one of the largest in the world and its output is expected to reach \$535 bn by 2025-26. The Food Processing sector in India has a significant role in linking Indian farmers to consumers in the domestic and international markets. It accounts for 32% of the country's total food market. But opportunities are much more.

Thus, this event holds a great promise to discuss highly relevant issues in order to achieve the sustainable development goals.

As our Guest Of Honour, Dr S. K. Chakraborty, VC, Uttar Banga Krishi Viswavidyalaya, Pundibari, Coochbehar, West Bengal expressed his view points with the main theme as “Sustainable agriculture: potential of root and tuber crops”.

The gist of his talk is: Sustainable intensification of farming system is the most rational approach for assuring food and nutritional security of growing population in a developing country like India. Crop diversification is a core principle to improve resilience of the farming system to abiotic, biotic and economic stresses. Root and tuber crops have great potential to address this aspect of sustainable crop production, simultaneously ensuring food and nutritional security and farm profitability. They are the third most important food crops after cereals and grain legumes and are unique in their inherent qualities like high dry matter production and capacity to withstand the vagaries of climate change. These crops can be grown under warm humid conditions of tropical as well as sub-tropical agro-ecosystem. They do not need prime land for cultivation and can be grown in marginal farms. They have resilience to adverse climatic conditions and never let down the farmer who can expect a reasonable harvest even when other crops fail. Most of the tuber crops have higher biological efficiency as food producers with high dry matter production per unit area per unit time. They also have the potential of reversing extensive soil degradation primarily caused by intensive cultivation of grain crops. Tuber crops are best suited for sustainable production intensification campaign termed “Save and Grow” by FAO in 2011.

Most of the tuber crops are reservoirs of resistant starch, minerals, vitamins, antioxidants, and dietary fibres. With the rapidly changing food habits and increased migration to urban areas coupled with the projected rise in per capita income, there is a projected increase in demand for processed and ready-to eat convenience foods in the near future. In that context, there exists vast potential to develop prophylactic and therapeutic functional foods from tuber crops. Sweet potato, despite being a health food is seldom consumed by urban and elite and factory level processing does not exist presently in India, unlike in China, Japan, Korea and parts of America. The immense Nutraceutical value of tuber crops due to their anthocyanin and carotenoids content has so far not been fully exploited. Besides, there is immense potential of cassava as raw material for bio-ethanol production. All the above indicators suggest immense potential of tuber crops for rural enterprise development with respect to production of value-added food, feed and industrial products, herbal products with medicinal effects, bio-insecticides, natural food colorants, etc. Creation of agriculture related enterprises would invariably improve livelihood security of rural India. The potential of root and tuber crops in sustainable crop production intensification as well rural development will be addressed in the present topic.

Dr Dipankar Saha, our key note speaker delivered his thoughts with the main theme as “Sustainable use of water resource for food and drinking water security in India”.

The main features of his deliberation is : Groundwater is the most important natural resources for extending assured irrigation and drinking water security in India. Though volumetrically it accounts only for 38% of total utilisable water resource, groundwater caters nearly 65% of irrigation need, 85% of rural drinking water supply and more than 50% of urban water demand. About 10% of India’s GDP is contributed by groundwater and its related activities and the value of groundwater-based irrigation economy is pegged as 75 -80 billion US \$/year. Industries are also relying more and more on groundwater. The recently launched Jal Jeeban Mission, where every household is expected to provide safe and adequate drinking water through tap by 2024 in the country is largely dependent on aquifers. The efforts to increase the farmers income by providing them assured irrigation is also putting pressure on this precious natural resource.

Groundwater is annually recharged, mainly from monsoon rainfall and also from other sources. However, reckless and unplanned extraction by wells, much exceeding the annual recharge, is being witnessed in many parts of India, which is referred as overexploitation. Such a situation is creating drying up of wells, decline in water levels and groundwater quality deterioration. About 1/5th geographical area of the country is under influence of serious overexploitation of groundwater resource. The north-western India, covering Punjab- Haryana- Rajasthan-Western UP region is mapped as one of the three most severely water stressed regions in the World. Various geogenic contaminations of groundwater are also expanding over large swath of the country and many researchers link this to overexploitation.

There is an urgent need for sustainable use of groundwater to obviate the threats to food and drinking water security. The supply and demand side interventions are to be adopted carefully, considering the local conditions. It is also important to curb collateral environmental damages that emanates from overexploitation of this resource, which are like, drying up of wetlands, lesser e-flow in rivers, saline water ingress in coastal aquifers etc. Climate change is further adding complication. We need to take a scientific approach to address these issues. The involvement of different stakeholders and communities are also essential.

Mr Vivek Verma , our special Guest ‘s’ speech revolved around about his fascinating experience and exposure along with consulting practices for his clients towards practically no-use of water at all to the best possible extent in every gamut of our life cycle irrespective of any segment of our economy along with house hold sector as well. He beautifully explained about his company’s new

technology discovery, patented by govt of India. He also emphasized upon the role an educational institution like ours, can play in upbringing the exiting knowledge base w r t use of Water and its sustainable practices.

Dr Panjab Singh our CHIEF GUEST presented his thoughts with the theme of “Transformation through Agricultural Innovation”; a very important and quite relevant area o to address by a person of his calibre for this conference for a country like ours with immense potential to show the path of inclusive development in the agro sector as a whole AND TOWARDS FARMERS COLLECTIVE WELL BEING.

Indian agriculture employs 42% of workforce, contributes to about 16.5% of GDP, provides food self-sufficiency to 1.38 billion Indian population and about 66% of the population in rural India is dependent on agriculture (263 million agricultural workers). Agriculture has made a splendid growth since independence. To cite a few-food grain production increased from 51 million tons (mt) to 310 mt (X6), milk from 17 mt to 200 mt (X12), horticulture-fruits and vegetables from 32 mt to 325 (X10), fish from 0.75 mt to 14 (X18) and established itself as the second largest agrarian economy after China in the world. The country has transformed itself from ship to mouth and chronic energy deficits to right to food bill situation to net exporter with annual value of exports to 2.52 Lakh crore (2019-20). Since economic reforms began in 1991, India has remained a net exporter of agri-products and occupies a leading position in global trade of agri-products, its total agri-export basket accounts for a little over 2.5 per cent of the world agri-trade. Diversification towards high value crops (commercial and cash crops), transformation towards efficient water use, especially micro irrigation and use of mechanical and electrical sources of farm power are considered some major breakthroughs. In fact, use of animal and human power in agriculture has reduced drastically from 97.4% in 1951 to 12% in 2012-13 and the use of mechanical and electrical power has increased from 2.6% to 88%, of which tractor contributes to 48% in the same period.

Some of the major challenges faced in Indian agriculture are, declining holdings (1.08 ha in 2015-16), 86.2% of the holdings are less than 2 ha with small and marginal farmers, who account for 47% of the total area; declining growth trend in agriculture since 1980s and unabated land degradation and desertification (120 m ha degraded land) and declining organic carbon and soil quality. The major and micro nutrient deficiencies are wide spread indicating 49, 12, 5, 3 and 33 per cent deficiencies of Zn, Fe, M, Cu and Bo, respectively. Over exploitation of ground water especially in western and southern India is a matter of serious concern. India is the largest user (approximately 230 km³yr⁻¹) of ground water in the world. Agricultural demand of stored water (ground and surface) for irrigation in India is very high and it is expected to rise by 56% by 2050. Today, 1034 blocks in India are

considered as over exploited, 253 are critical and 681 are semi-critical. Per capita availability of utilizable water resources, which was 5247 m³ in 1951 has decreased to 1453 today and is expected to dwindle down to 1170 by 2050. Impact of climate change is yet another challenge to Indian agriculture. Global warming of 1.5°C and 2°C will be expected during the 21st century unless deep reduction in CO₂ and other greenhouse gas emission occur in the coming decades. Sources indicate that loss of farm revenue due to extreme temperatures and rain fall shocks is estimated to be 12% for monsoon and 6% for winter crops with more impacts on rain fed ecosystems. There are large gaps in major crops in achievable and harvested yields warranting for adoption of best management practices, site specific nutrients management, in-situ moisture management for enhancing productivity for minimising the yield gaps. While India will have sufficient supply of food grains towards 2032/33 and beyond, the country is going to face the massive deficit of oilseeds around 40 million tons and pulses and coarse cereals of 5-7 million tons besides chronic shortage of feed and fodder. Aii said and done, we still have the stigma of owning nearly one-fourth of the world's hungry, one-third of the world's stunted children, and half of the world's wasted children. To meet all these challenges, the agriculture has to be practiced differently and approached holistically using all modern tools, knowledge and technologies. This is also necessary to fulfil our several international agreements and commitments and the latest being to reduce the emission intensity of its GDP by 45%, reduce emission by 1 billion tons by 2030 and commitment to become carbon neutral by 2070 (COP-26, Glasgow, Nov.2021) besides being signatory to UNCCD and also committed to sustainable land management neutrality (26 mha by 2030).

Among innovative agriculture, promotion of conservation agriculture, practiced on 125 mha globally and 1.25 mha in India, has proved effective in reducing the cost of production (Rs.4000-5000/ha), enhancing productivity (15-20%), save irrigation water (100-220 ha-m) and higher total organic carbon in 0-5 cm soil layer (10-13%). Technologies such as zero tillage, happy seeder, turbo seeder, shredder, bailer, land levelling, FIRB, DSR, green manuring, crop residue incorporation, bio-enriched compost etc. offer great opportunity for conservation agriculture especially in rice-wheat cropping system and irrigated systems. LCC/SPAD/optical sensors (green seeker) for real time N management and farm advisory and yield forecast can save 13-20% N use. Integrated Farming System (IFS) Models could be a mean of sustainable food system besides being highly economical and ecologically sound. Carbon foot print and energy production of different production systems viz., traditional rice-wheat system, diversified cereals (maize based) vegetables, pulses and oilseeds, and integrated farming system (IFS) involving crop, live-stock, poultry, duckery and fisheries showed that Integrated system gave 80 and 38% lower carbon foot print as compared to traditional and diversified systems. The energy production in IFS was 2.5 and 3.5 times higher compared with diversified and traditional

systems respectively. There is a need for developing location specific profitable farming system models for irrigated and rain fed ecosystems. Technologies for enhancing adaptive capacity and resilience to climate change and for mitigating GHG and enhancing productivity have been developed and need to be tried for large scale application. Improved nutrient management can significantly enhance carbon sequestration and yield in different rain fed production system. Further, small farm/ smart mechanization for precision application of seeds and fertilizers, crop health management, precision irrigation and harvesting and threshing are the need of the present day farming. Lots of advances have been made in these technologies which need to be refined and delivered at farmer's door steps for use. New technological innovations viz., vertical farming, new fertilizer materials (nano urea), new approaches to weed control, AI, IOTs, use of drones, polyhouse cultivation, ICTs for the spread of information, agro-advisories and technologies will enhance productivity, profitability and resources use efficiency. In summing up, there is a need for a paradigm shift from productivity oriented approach to profitability and enhanced income to farmers, greater focus on resource use efficiency and quality of natural resources, enhancing productivity of oilseeds and pulses, transformation towards knowledge oriented agriculture, innovation in knowledge and transfer of technologies, use of latest/ smart technologies and training with the state- of- the-art facilities to students and other stakeholders are the key for sustainable agriculture

TECHNICAL SESSION ONE

THEME: Inclusive Water Management – Macro and Micro Perspectives

Moderator Dr Dipankar Saha, Former member CGWB AND FORMER Member Secretary, Central Ground Water Authority.

The Theme and the presentations in the Session highlighted the importance of water resources for the overall socio-economic development of our country. The per capita availability of the resource is dwindling because of rapid rise in population. One major issue is equitable distribution of the resource, across the societal sectors and also among different economic and social groups. The equity issue is particularly important when the small and marginal farmers get deprived in a scarcity situation in the agricultural sector, which consumes about 75% of the total water withdrawal in our country.

Besides the volumetric stress on water resources, the quality issue and its management is also getting importance, considering the expanding pollution, affecting the aquifers, rivers, lakes and wetlands. The challenge is how judiciously this resource is used and managed at various granularity, both at micro and macro level. Adopting proper technology with the science-based understanding of the system is essential for sustainable management of the system, but also it must be seen how best the benefits can be accrued by different socioeconomic strata of the society and also the environmental and ecological issues are addressed. Different stakeholders must be involved and the community, both in urban and rural areas, must develop a sense of belonging in the management of the resources.

He illustrated his view points while highlighting the present water management scenario in our country. Inclusive Water management has now become a global issue. As far as India is concerned, it is highly water stressed due to high population and comparably less water resources thereby making water management a national priority. Moreover, India is one of the world's largest groundwater users as water is the main driving force for agriculture. Further, less rainfall, insufficient storage capacity and lack of waste water treatments has worsen the conditions and had led to contamination of water resources giving rise to health and hygiene concerns. Therefore, efficient, cost effective and eco-friendly water management programs are the need of hour to harvest, store, re-use and dispose Water effectively.

Speaker 1: Dr Nilotpal Pathak, Partner, I- Ventures Advisors Private Ltd, Gurgaon

Topic: Emerging Investment Opportunities in the Agritech and Agri infrastructure

The speaker mainly focused on challenges and opportunities associated with Agritech investments, Food infrastructure and Businesses in India. In the presentation, speaker briefly discussed the demand for the food and pressure on agriculture sector to meet the energy needs of people around the globe. The speaker further discussed Indian's stand in this context and various opportunities present in India. In addition to this, speaker emphasized the role of investors and explained the trends emerging in India from investor's point of view.

Dr Pathak also drew attention towards inadequate infrastructure and policy inconsistency both at govt and private enterprises level towards integrated inclusive water availability for the farmers pan India. At last, speaker concluded the topic with future outlooks

Speaker: Mr. Lalit Sharma, Principal Scientist, Water Research and Training Sehgal Foundation, based at Gurgaon with HQ at USA

Topic: Ground water development and water quality Management for better health

The speaker mainly discusses the salinity issues related with water which is a known global problem as it was reported in the year 2000 that people are facing the challenges related to salinity issues whereas 16% of land area is threatened by the groundwater salinity and the complications related to salinity are increasing day by day. The speaker emphasized the need for cost effective and eco-friendly innovations to resolve the above mentioned issue as most of the methods are not efficient and are quite expensive. In this regard, speaker describes the working of the saline aquifer developed by him and his co-workers which harvest the rain water and exchange it into groundwater. The water thus gets stored in fixed pockets, did not get contaminated with other saline source nearby and could be reused in its fresh form whenever required. Speaker further claimed outstanding results obtained from the said innovation.

Topic 3: A socio-scientific approach to groundwater management: Experiences from the field

Speaker: Marcella D'Souza, Director, Centre for Resilience Studies (Wres) and fmr ED- Water shed Organization Trust, India

In this presentation, speaker stressed upon socio-scientific approaches to groundwater management and how it could help the rural community. Due to arid and semi-arid land in India along with environmental changes, summers are getting hotter and larger leading to shortage of water. Speaker highlighted the need of ground water management as 55% of our population consists of farmers and semi-farmers who mostly rely on groundwater for irrigation /farming. Based upon the importance of the topic, speaker explained various water management theories such as the theory of change, water stewardship and water use management, water budgeting-village level, community led 3-D modelling of water resources (Co-Drive-VI) and the WOTR approach which could prove an asset in managing groundwater issues.

Topic 4: Management and policy initiatives for sustaining ground water use in the state of Haryana

Speaker: Mr. Sanjay Marwaha, Member – Haryana Water Resources Authority, Panchkula

The speaker gives a brief introduction about issues related to management of ground water in India. However, he mainly discussed ground water management by the Haryana state. According to the speaker, several factors such as less rainfall, inadequate surface water availability, groundwater depletion, less fresh water aquifers and saline aquifers, water logging, water and soil salinity are leading to ground water stresses in Haryana. Keeping in view the severity of factors, Haryana government has promoted and launched numerous initiatives and policies respectively to overcome the situation. The various policies include HWRA – 2000, Pond authority – 2018, TWW utilization policy – 2019 and MICADA – 2020. Micro irrigation, waste water treatment and integrated approaches are the main initiatives led by the Haryana state. It has been further stated that the various policies and initiatives taken by the Haryana government from time to time has helped a lot in handling issues related to water management.

TECHNICAL SESSION TWO (2.00.-3.30 PM)

Dr. JB Prajapati, Chairperson, VKCoE, IRMA- The moderator

He inaugurated the session (Theme: Dairy Management: Different dimensions)

During his 10 minutes deliberation, he elaborately touched upon the essence of the main theme and beautifully explained the different dimensions of the Dairy Management with special to reference to the work of IRMA and its corresponding strategic significance for the dairy industry as a whole for our country.

The first speaker was Mr Shri Pranav Shah (Process category Director, SPX Flow Denmark). He emphasized on the water management in Dairy & Food through Innovative process solution. The concluding remark of Shri Pranav Shah was sustainability by innovation in order to feed and nourish 96 billion peoples by 2050.

The details of his deliberation are:

All dairy plants run on raw material milk, however the second most abundantly used fluid is water. If we do a quick 80/20 analysis of consumables, water will come on top 20 consumables, meaning if steps taken on reduction of water it will help to tackle one of the substantial issue and drive dairy operations towards sustainability. Moreover, saving water gives an opportunity to save energy too, for e.g. while saving hot water or recirculating it or recuperating it or regenerating it, heat energy is also saved along with water. Similarly, same goes for chilled water/cold water too.

Let's us start seeing the milk collection area first. Milk is delivered to dairies via road or rail. It can come from far afield to meet the processing demands of larger dairies, and this adds a significant carbon footprint to milk and other dairy products being made. A large proportion of the raw milk, however, is water. If this is removed using membrane filtration or evaporation, the volume shrinks to around one quarter. This proportionally reduces the number of trucks or rail tankers required for transport, directly lowering emissions and environmental impact. This process can also help to generate potable quality of water at the source of milk production, which can be used for all purposes including human and cattle water consumptions.

Layout optimization

The layout of a dairy has long lasting impact on the water consumed for next 30 years of processing plant life. We, at SPXFLOW recommend a compact yet ergonomic layout. A dairy designed with shorter, more compact lines offers several benefits to ongoing operations. Firstly, the layout requires fewer connectors and bridges to support the pipes. This means that, over time, the plant is less susceptible to issues due to failures around these points and requires less maintenance. Ergonomic designs and shorter distances between equipment also help maintenance technicians work more efficiently. Shorter process pipes ensures shorter CIP circuits and less water consumption.

Using every drop

A dairy plant designed to maximise the use of raw materials will greatly assist with its sustainability. Cleaning is a fundamental part of all dairy processing. As product is flushed from a line, however, care must be taken not to lose total solids. By collecting and treating flushing water, which can be achieved using reverse osmosis SPXFLOW APV Goldstream, milk solids can be recovered. The recovered water can also be re-used for processing, rather than discarding it as effluent, thereby optimising the use of natural resources.

To optimise sustainability, a plant needs to run with maximum uptime and the shortest possible cleaning cycles. This requires skilful process engineering to ensure cleaning is effective but not wasteful. Whenever a cleaning cycle takes place, it needs to efficiently remove all remaining product, soil and bacteria from the line. This requires the use of clean-in-place (CIP) chemicals but, to reduce cost and environmental impact, these should not be over-used. A plant should be designed to re-use CIP fluids until the end of their efficacy. Chemicals from the previous cleaning cycle can be re-used for the first stage of CIP in the next cleaning cycle. Separator or membrane technology can be utilised to clean CIP fluids so they can be used again and again.

For more viscous products, the use of CIP fluids can be greatly reduced if pigging or scraping systems are first used to clean the line. This not only reduces the amount of chemicals required to maintain the system, but also reduces cleaning time, thereby enhancing productivity.

Tempering the very hot and very cold

High-pressure steam generation is another large overhead for a dairy plant and one where it is essential that energy used to create it is not lost or wasted. Once the steam has been used for its primary task, the heat from the resulting condensate or low-pressure steam can be collected and used for operations such as pre-heating. Leading dairy processing solution providers offer a wide variety of equipment, including steam recuperation systems and pre-heaters, to maximise the use of the energy captured in the steam in other processes throughout the plant.

Chilled or ice water is another area where optimum design can enhance sustainability. Produced using compressors with large motors, this is typically the costliest utility in a dairy. However, if tap or well water is used for the first stages of cooling hot products, the amount of chilled / ice water required can be moderated. Many designs of 2, 3 or 4 section heat exchangers are available to conserve energy used in this area.

Other areas to consider

Another area critical to plant performance is the automation system. If instrumentation is calibrated and the plant accurately controlled, errors will be reduced and there will be a high level of confidence in the measurements being taken. This means that setpoints can be adjusted to tighter limits, thereby optimising levels of heating, cooling and energy usage throughout the plant.

Other factors when designing a sustainable dairy plant include the use of high efficiency motors, pumps, valves, etc. Hygienic zoning should also be carefully considered as this can have significant impact on plant efficiency. Any contamination due to equipment failure will lead to a batch being scrapped and the control of food safety measures is critical.

Finally, operators in the dairy need to be trained so they are aware of the importance of sustainability. If this is at the forefront of their minds, they can help to work and innovate to continually enhance sustainability performance to the benefit of everyone.

Summary

There are many factors in the design and operation of a dairy plant that can improve its sustainability. The ideal is a plant that produces little or no effluent, makes use of every part of the raw milk, completely optimises energy usage and minimises volumes of water and

other utilities used for processing. Alongside the processing design of the plant, renewable energy sources, such as solar panels on the plant roof, could also be considered.

Leading dairy processing experts, such as SPX FLOW, have a great deal of experience in plant designs to optimise sustainability and are continually striving to find new ways to reduce environmental impact and increase processing efficiency of future plants. They can also review the design of existing plants and offer assistance in ways to improve efficiency.

The 2nd Speaker in this session was Dr. Dharma Hagare, who emphasized on sustainable water and nutrient management with in dairy farms in context to Australian experience, he emphasized on the minimum use of fresh water, rain water and storm water harvesting as a solution for sustainable water management. His abstract contains all other details as well.

The 3rd Speakers for this session were Dr Manab Chakraborty; Advisor to Bangladesh Govt in Dairy Industry area/ Mohd Abdul Kalam Azad, Advisor to Bangladesh Govt. in the same area

There theme was on dairy value chain in Bangladesh.

They highlighted through their presentation some of the most important features of the dairy industry scenario/ Characteristics of Dairy industry in Bangladesh as follows:

Low milk yields 200-250 litres during a 10-month lactation period against 9000 litres in the Netherlands, and 2140 litres in Brazil, and 900 litres in Pakistan.

Unlike India, focus is on hybrid cows, not buffalo

Small organised sector – 20 odd companies

Market share Milk Vita Coop 44%, PRAN and BRAC ARONG 22% each

90% of the milk comes from small producer having 1 or 2 Zebu cows

Very little product diversification

Marketing is disorganised in the hands of village traders (“Ghosh”)

There is scarcity of good quality feed and fodder

They concluded while suggesting some of the initiatives being taken by the Bangladesh Govt and its strategic implications for south Asia as a whole (Details are available in their presentation)

The fourth speaker, Mr Aditya Jain. He highlighted some of the most important aspects during his speech during the session. The essentials of his deliberations are:

1.Cooperative model of Dairying is the best model for dairy development in India being implemented by NDDDB, Amul and State Dairy Federations. This gives the best returns to farmers which lead significant socio-economic changes in rural India.

2.Setting up of Cooperation ministry by Government of India will help in promoting agri business, FPOs and other organizations which will help on increasing the income and health of producers

TECHNICAL SESSION THREE (3.45 –5.35PM)

Theme: Agricultural and Horticultural Sustainability Practices –Different perspectives

Moderator Dr. Akhilesh Kumar (Postdoc – Israel), Founder & CEO –EDEN Horticulture Services

AOD: Horticulture potential in HP and Hilly states

He introduced the session and welcomed all the speakers of the session. He explained about the sustainability in general along with the different agricultural and horticultural sustainability practices in the country.

This session was dedicated towards emerging trends of cooperative farming through Farmers Producers Organization (FPO) in India.

Dr Uday Shankar Saha, RBI Chair Professor of IRMA Anand spoke about importance & relations infrastructure and development, agricultural production infrastructure, potential for processing, need for management for reduction of post-production losses, and need for promoting cooperative farming and aggregators of women & youths in production and processing system as also marketing. He shared updated information about government initiatives for agriculture infrastructure, creation of different funds for various types of infrastructure development through NABARD needed different agriculture sectors.

Dr Atul Kumar Professor from Jawaharlal Nehru University New Delhi talked about climate smart agriculture and prospects. He explained how climate change has become a political issue these days where small farmers are least contributors but heavily affected.

Mr Kalyan Goswami Director General Agro Chem Federation of India discussed emerging challenges in the agriculture sector and scope of sustainable agriculture in India. He urged there is a need for policy reform to promote sustainable agriculture to enhance farmers' income.

Dr Meenu Chhabra Associate professor from IIT Jodhpur talked about power generation through photosynthetic sediment microbial Fuel Cell (SMFC) which can be very useful in future from sustainability aspects.

Last talk of this session was delivered Prof. Vinay Nangia from ICARDA Texas USA who delivered a talk about agriculture evolution and importance of sustainability especially in the context of water conservation. His emphasis was on application innovative technologies like IoT application, drone, nano technology application in agriculture may contribute in sustainable agriculture.

Detail elaboration

Speaker 1 Dr Uday Saha (RBI Chair Prof, IRMA, Anand,

Topic: Agricultural Infrastructure for sustainable income and farmer's prosperity

Dr Saha presented the importance of infrastructure and development having direct relationship with development and poverty reduction. He had shown that Infrastructure development index (IDI) in terms of all types of infrastructure (Physical, Social, Institutional/ Financial and Information infrastructure) and poverty reduction are directly related, i.e., higher the IDI, lower the poverty level. However he focused on efficient use of infrastructure for socio-economic development of the country.

He explained the infrastructures used in Agriculture, their types and in order to get sustainable income for farmer's prosperity, adequate production and post-production related agricultural infrastructure are to be created and used efficiently. For the purpose, necessary policy Formulation, effective implementation, and monitoring for periodic review by all relevant stakeholders are crucial for such policy execution successfully. There is an immediate need for knowledge based sustainable agriculture practices for inclusive development and rural peoples' prosperity. There is need for prioritising for policy

formulation and providing a mission mode execution and dissemination of efficient usage of infrastructure, adoption of Agriculture practices by knowledge dissemination and training for sustainable higher income for making change management for sustainable economy. Keeping in view the linkage of natural resources and production system, he emphasised on water shortage/scarcity in the World and also in India and focused for creation of necessary water infrastructure as also ensuring effective/productive utilization, judicious and balanced use of inorganic and organic inputs for food security and sustainability. Promotion of groups/cooperatives of farmers, ensuring participation of women and youths in both production and processing in group mode at village level, post production management and marketing for better price realization. Dr Saha presented the updated policy measures of Govt. of India and schemes formulated under different infrastructure schemes for agriculture/horticulture production, processing and storage/marketing purposes and implemented with full participation by NABARD and Banks. He also suggested for prioritizing the utilization of natural resources effectively and use the production system more efficiently for food/agricultural security and sustainability. In this regards, Dr Saha also suggested a number of policy measures with focus on efficient productive utilization for sustainable economy, particularly for farmers/rural peoples prosperity.

Speaker 2: Dr. Atul Kumar, Professor, Energy studies programme at Jawaharlal Nehru University, New Delhi

AOD: Climate smart agriculture and Prospects

Topic: Sustainable Development in changing climate: Risks and opportunities in Agriculture Sector.

He explained about the greenhouse effect, climatic change impacts like health impacts, effect on crop yield, forest impact, water resources, Erosion and emulsion of coastal lands, loss of wildlife diversity and species range shifts. He explained about the equity issues pertaining to the climate. The impact of climate change in Agriculture Sector and told that there is decrease in the yield of agriculture crops along with lower animal growth rates and productivity in pastoral systems.CO2 emissions mitigation options for Agriculture Sector like using better irrigation systems, energy efficient pumps and utilization of renewable energy. Discussed about Existing challenges for small holders like lack of management and technical

skills, poor bargaining power, finance, technology and infrastructure. He concluded that merging development with adaptation perspectives could mutually strengthen the capacity to sustain the climate change.

Speaker 3: 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”

He explained about the different facts and challenges of Indian Agriculture Sectors like low productivity, small land holding, harvest and post-harvest losses, climate risk and low investment on Research and development. He explained about the food waste impact, sustainability and hunger. Priorities for Indian Agriculture like increasing crop productivity, farm profitability for sustainable Agriculture. He concluded that in order to increase sustainability we could start with rain fed areas as they are practicing low resource agriculture, have low productivities. Restructure Government support to farmers by giving team incentives towards resource conservation along with rewarding outcomes like total farm productivity or enhanced ecosystem services and extend the short term transition support to individuals liable to be adversely impacted by large scale transition to sustainable agriculture.

Speaker 4: Dr. Meenu Chhabra: Associate Professor Department of Bioscience and Bioengineering, Indian Institute of Technology Jodhpur

Topic: Effect of cathodic culture on wastewater treatment and power generation in a photosynthetic sediment microbial fuel cell (SMFC): *Canna indica* v/s *Chlorella vulgaris*

She explained about the microbial fuel cells and how it is used to treat waste water and produce electricity .They are robust, stable and achieve high power output. Algal microbial fuel cell requires high maintenance and needs continuous algae harvesting which needs a biorefinery approach. Other aspects that needs exploration includes microbial community analysis, long term operation, rhizosphere characterization and design optimization

Speaker 5: Prof. Vinay Nagia , Ph.D., Research leader –Soil, Water and Agronomy, Principal Water Scientist, International Centre for Agriculture Research in the Dry Area (ICARDA)

AOD: Climate proofing smallholder agriculture for 2050

He explained about the in last 75 years population doubled, economy grown by 7 times and world grain demand has tripled. Human demands had surpassed earth regeneration capacity. Fossil fuel consumption increased 4 times leading to increasing CO2 levels thereby causing global warming leading to rising temperatures, falling water tables, collapsing fisheries, soils are eroded. Human being requires 2500 cal/ day. In semi-arid and Arid tropics around 840 million malnourished people are remaining and it takes 1 litre of water to produce 1 calories of food and more than 70% of fresh water withdrawal is used for food production. Due to which there is water shortage that mitigates variability. So globally we have to produce more food with less water and generate bigger livelihood with lower volumes. In order to do that we need to expand irrigated areas, expand rain fed areas by using more green water and increase water productivity by producing more crop with lesser water. He suggested about the few methods to save irrigation water. He told that by using drip irrigation over flood irrigation as it increases crop yields by 8-29% while reducing the water consumption by 9-70%. Developing countries are switching from traditional flood irrigation scheduling method to ICARDA'S smart system which saves 32% saving of irrigation water and 50% increase in water productivity and payment for ecosystem services to save water for nature. In the end he concluded that there is no going back from some climate induced changes but there is a hope that digital technologies can bring transformative changes in livelihoods and food security.

TECHNICAL SESSION FOUR (9.15- 10.45 AM) ON 26TH OF March, 2022

Theme: Food & Nutrition- Policy, Technology & Sustainability Issues-A Critical Assessment

Moderator, Dr. Sunil Pareek, Professor (Horticulture PHT), Director (IQAC), HOD of Dept. of Agri & Environmental Sciences, NIFTEM.

During his starting comment, with the theme: Food & Nutrition- Academics, Policy, Technology & Sustainability Issues-A Critical Assessment, discussed about the Current Trends in Processing and Next Generation of Future Food and emphasized on the 3d food printing, meat and plant protein (texture vegetable proteins) and usage of block chain to secure the food sector.

He beautifully highlighted the shifting trends of food habits of urban populations more towards healthy food choices and during this process become victim of false claim by the food producing companies through their advertisements. Emerging food technology trends mark a shift towards sustainable and personalized food choices. These include alternative protein sources, local foods, Nutraceuticals, and personalized nutrition.

He also emphasised about the environmental impacts on food production and its sustainability domain and the measures the food producing companies need to be aware of to avoid any unruly legal fault.

He also indicated the shift of technology in the food industry as a whole and its impacts in overall productivity, quality and profitability.

The 1st speaker of this session was Dr. JB Prajapati, Chairman, VKCoE of IRMA Anand. He is also the President of Gujrat chapter of IDA (Indian Dairy Association). He discussed on the role of functional fermented foods for public health and social well-being and emphasized on the usage of fermented foods to promote the health, reduce the health care costs and solve the problem of malnutrition.

His detail deliberation is there in the Abstract as provided in the Souvenir published for this cause to disseminate our message for the greater cause of welfare of the people of our country.

The 2nd Speaker in this session was Dr. Latha Sabikhi, Principal Scientist, NDRI, Karnal who delivered the presentation on Nutraceuticals and their Processing Aspects in which she discussed the various modern & newer techniques such as Electro-osmotic dewatering, High hydrostatic pressure, Low temperature plasma, Nanotechnology, radio-frequency drying and high voltage electric discharge & Laser ablation to process the Nutraceuticals. (Abstract attached)

The 3rd Speaker for this session was Dr. Deepti Gulati, Industry Chair Professor: Nutraceuticals and Fortification at NIFTEM, Sonapat. She presented her deliberation on the topic of “Food Fortification: Bridging the Nutrition Gap” and emphasized on the advantage of food fortifications, regulatory support and the work of Government of India in the production of staple fortified food such as rice, wheat, milk, salt, oil etc to prevent the micronutrient malnutrition

The fourth speaker was Dr. Vivek Srivastav, Vice President – Research & Development and Operations, Esperer Onco Nutrition discussed on the topic of “Nutraceutical-

Imperative Component of Lifestyle and Wellness” and emphasized on the usage of Nutraceutical to prevent the diseases (heart disease, cancer, diabetes etc.).

The essentials of his speech are:

Nutraceutical is the hybrid of ‘nutrition’ and ‘pharmaceutical’. Nutraceuticals, in broad, are food or part of food playing a significant role in modifying and maintaining normal physiological function that maintains healthy human beings. The principal reasons for the growth of the Nutraceutical market worldwide are the current population and the health trends. The food products used as Nutraceuticals can be categorized as dietary fibre, prebiotics, probiotics, polyunsaturated fatty acids, antioxidants and other different types of herbal/ natural foods. These Nutraceuticals help in combating some of the major health problems of the century such as obesity, cardiovascular diseases, cancer, osteoporosis, arthritis, diabetes, cholesterol etc. In whole, ‘Nutraceutical’ has led to the new era of medicine and health, in which the food industry has become a research-oriented sector.

Today, Nutraceuticals have evolved from their traditional background to a highly scientific field where the efficacy and safety of the products are backed by evidence, new research, and developing technologies.

Nutraceuticals have attracted considerable interest because of their potential nutritional values, safety, affordability, and multiple therapeutic effects and are often seen as an attractive option to conventional treatments

Nutraceuticals have a powerful effect on your body, and that’s why it’s important to consume only the recommended amounts of Nutraceuticals. It is also important to talk to your health professional about your symptoms and Nutraceutical use.

TECHNICAL SESSION FIVE (11.00-12.30 PM)

Mr Sanjay Marwaha, Moderator, a very senior and seasoned person from the Water segment and associated with govt of Haryana" as Member- Water Resource Authority.

His deliberation was related to topic "MANAGEMENT AND POLICY INITIATIVES FOR SUSTAINING GROUND WATER USE IN THE STATE OF HARYANA “besides being the Moderator.

Mr Marwaha highlighted the current water availability scenario in Indian context in various states across the country and explained the stress on groundwater resources for various uses specially agriculture.

He described in detail about the block Wise Ground water resource availability and indicated that there are huge declines of groundwater levels because of need for agriculture, domestic/drinking and industrial uses.

He informed that Haryana state is contributing to a large extent to the country needs in respect of food grains, fisheries, and so many other high productivity value items despite the fact that the nature has not been kind as compared to the eastern part of the country as far as availability of groundwater resource is concerned.

He also explained that despite having arid to semi-arid climate and having average rains during last couple of decades, the area put to agriculture and production of crops has not declined but increased. This all has been possible at the expense of Ground water resources. However, this dependency on Ground water to meet the demands has resulted in depletion of groundwater in the northern and southern part of the state.

He spoke at length regarding the initiatives undertaken by state of Haryana for ensuring sustainability of water resources. He talked about crop diversification scheme, micro irrigation schemes, utilization of treated waste water in place of fresh ground water etc.

Further he laid emphasis on the integrated approach being adopted by the state towards water management in long terms.

His detail deliberations along with other speakers' details are as follows:

He mainly highlighted the current water availability scenario in Indian context in various states across the country and explained the stress on groundwater resources for various uses specially agriculture.

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Speaker 1 DR. ZHONGHUA CHEN, Western Sydney University

He spoke about “Genetic and physiological improvement of potassium transport for water use efficiency in barley”.

He shared their precious experiences on various activities which are as follows:

Frequent drought events in all states, long lasting drought reduce food production in Australia.

Drought led role, Barley is a key agricultural commodity in Australia, Transport of potassium is important for drought tolerance in plants, typical shaker type K⁺ channel structures and potential interacting molecules.

AKTIs have evolved streptophyte algae for potassium uptake.

Silencing of HVAKTI reduces drought tolerance in barley roots and regulates root Homeostasis for drought tolerance in barley.

Tissue and cell type gene expression pattern, HVAKT2 and HVAKI.

Silencing of HVAKT2 and HVAKI confers drought tolerance in barley leaves and regulates K⁺ and H⁺ homeostasis in drought.

Method to reduce drought in Maize crop

Speaker 2: PROF. BASANT MAHESHWARI, Western Sydney University

AOD: Managing the invisible – Participatory Monitoring and Management of Ground water at the Village Level’.

He shared his experiences on: Ground water sustainability, MARVI managing, some highlights emerged from MARVI work which are people related problems, lack of understanding, engage and empower, develop robust village level ground water science.

Partnership- 9 organs, MARVI project- key activities.

Two options of MARVI project, complexity of groundwater management, the role of MARVI.

MARVI- local management of groundwater use.

And the end, he explained about Bhujal Jankaars (B. Js), what we really do in the MARVI project like work with panchayats, connect to the agencies. Knowledge transformation processes for B. Js, Resource mapping, rainfall, measuring weather, check dam monitoring, development of ground water science and the implementation of it.

Speaker 3: MR VIVEK VERMA, C&MD, Spray Engineering Devices Ltd Mohali, Punjab

AOD: Technological Break Through in Water Treatment for Strategic Advantage- SEDL.s Achievement.

He delivered a judicious lecture in which he shared various experiences which are as follows:

Innovative sustainable solution using low temperature evaporation technology.

About the focus on sugarcane processing.

Organization mission statement which was dedicated for sustainable environmental department to unlock perpetual food and energy resources.

Company overview: It was started in 1992, Business area.

Current stages of wastewater treatment:

1. Territory- Removal of pathogens and nutrients.
2. Secondary- Removal of organic matter.
3. Primary- Removal of suspended matter.

He explained about current wastewater treatment scenario, simplified process with LTE^o, current evaporation scenario, LTE^o and recharge of groundwater, LTE^o- process flow i.e. low temperature evaporation technology.

He had also focused on:

Major take ways of LTE^o technology- USP' which emphasized on water recovery up to 99% and non- chemical treatment.

Plate heat exchange arrangement.

Delhi MSW leachate- Ramky infrastructure New Delhi.

Deepak nitrate, Gujrat, United breweries Ltd, Lactose India Ltd, Gujrat, Textile processing plant, Rajasthan, AL- KHALEEJ sugar (biggest refinery in Dubai).

Speaker 4: PROF. BRAHMA SINGH, PhD (Hort.) Padma Shri Awardee

AOD: Vertical Horticulture Farming.

He explained about importance of Vertical farming and discusses different vertical farming method as like hydroponics vertical farming, hydro culture farming and Aquaponic farming system.

He said Vertical farming has the potential to significantly increase food production while reducing the environmental footprint of the agricultural

TECHNICAL SESSION SIX (12.30-2.00PM)

Theme: Agricultural and Sustainable Development – Different Aspects

Moderated by Dr.US SAHA, RBI Chair Professor, IRMA, Anand.

Four speakers participated in this session and presented papers.

Rapporteurs were Dr. Vikrant Tyagi, Assistant Professor and Ms Ramandeep Kaur, Ph. D scholar, Department of Genetics, Plant Breeding and Biotechnology, Dr. Khem Singh Gill Akal College of Agriculture, Eternal University, Baru Sahib. The anchor introduced the chairman and speakers at the start of the technical session. The chairman invited the first speaker to the dais to start the conversation.

The moderator at the beginning of session, Dr Saha briefed and laid importance on the theme on Agricultural and Sustainable Development and emphasized on the need for various crops and other agri-related activities which may directly or indirectly help in ensuring the sustainable agricultural production system, The event featured a panel discussion/presentation on several aspects of economic development through sustainable agriculture.

Our first speaker was Dr S. K Chauhan, Dean, Department of Economics, Akal College of Economics, Commerce & Management, Eternal University, Baru Sahib.

His topic of deliberation was “Role of Apis mellifera Honey Bees in Sustainable Farm Production”

ABSTRACT

The findings of a study reveals that the increase in crop productivity by placing honeybees in the fields was recorded higher (20.66%) in Punjab and Haryana than 18.37 per cent in Himachal Pradesh. The average yields of guava grown without honeybees were 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 fruit 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.

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 underestimated 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
- iii) Chilly weather during winter season at the time of blossoming of apples

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.

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

Sr. No. Crops Within State (Himachal Pradesh) Outside State (Punjab & Haryana)

| | Without honeybees | | With honeybees | | Percent change | | Without honeybees |
|-----------------------------|-------------------|----------------|-------------------|----------------|-------------------|----------------|-------------------|
| | Without honeybees | With honeybees | Without honeybees | With honeybees | Without honeybees | With honeybees | |
| 1. Apple | | | | | | | |
| (<i>Malus sylvestris</i>) | 13.40 | 16.50 | 23.13 | NA | NA | -- | |
| 2. Citrus | | | | | | | |
| (<i>Citrus spp</i>) | 9.80 | 11.60 | 18.37 | 12.10 | 14.60 | 20.66 | |
| 3. Guava | | | | | | | |
| (<i>Psidium guajava</i>) | NA | NA | -- | 10.77 | 11.40 | 5.85 | |
| 4. Mango | | | | | | | |
| (<i>Mangifera indica</i>) | 7.10 | 8.00 | 12.66 | 8.06 | 9.20 | 14.14 | |
| 5. Mustard | | | | | | | |
| (<i>Brassica sp</i>) | 0.83 | 1.00 | 20.48 | 1.32 | 1.66 | 25.76 | |
| 6. Sunflower | | | | | | | |
| (<i>Hellanthus annus</i>) | 0.21 | 0.25 | 19.05 | 0.40 | 0.51 | 27.50 | |

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.

Our second speakers were Dr. Raj Bhandari, EX NITI Aayog, from Mumbai and Dr. Joanna Kanepotaka, Director and Co-Founder of Food 2030 and Global leader of eminence on the crops grown in semi-arid tropics, from Australia.

The topic of **their mutual discussion was “How to leverage the benefits of millets-good for you, good for planet and good for farmers”** and the discussion carried out by online mode. They had a very interesting session about nutritive values and importance of millet consumption for human body. Dr. Joanna initiated their discussion with the view that how millets are good for us after that Dr. Raj Bhandari stated about nutritive values of millets and highly recommended millets in our daily diet for health benefits. He concerned that Plenty of micronutrients in abundant amount are present in millets which led to overcome the issue of hidden hunger or malnutrition. Millets help to improves many other health factors like cardiovascular diseases, anemia etc. Dr. Joanna said about their survey and studies done in last 4 years about the nutrition and health benefits of millets and this programme created to support farmers, tribal and women to engend them in millet value chain and also other different approaches for growing millet industry. After that Dr. Raj Bandari focused on the concept of one health and one planet and the millets are C4 crop plant which produces high biomass as compared to other crops. He tooks audience attention for the silent pledge to reduce carbon footprints on 26th of march between 8.30-9.30 pm worldwide. The water efficiency of millets and rice was compared and he also mention SatGuruji for consciousness about planet who said we have to preserve soil health because soil is living and without living organisms in the soil it becomes sand. Dr. Joanna talked about the challenges and solutions occurred in millets production due to climate changes. At the end Dr. Raj and Dr. Joanna raised their concerns about awareness of people about millets and also the health issues and demands of the farmers overwhelmed by millet consumption and production.

Our third speaker was Dr. Vinod Kumar, Assistant Scientist, Department of Biochemistry CCS Haryana Agricultural University, Hisar, Haryana. The Topic was Biotechnology for Sustainable Agriculture Development. Initially he talked about contribution of biotechnology in major areas of food and Agriculture by taking some examples from real factors. He mentioned Dr. H.S.Dhaliwal for their work on wheat bio-fortification through conventional breeding approaches. He was stating about the phytic acid their synthesis and storage, mutants and Expression of phytase gene in transgenic plants. After that he showed some case studied and conclude his presentation and suggested that biotechnology should be given priority in National Agriculture Policy so that many of important factors can be improved.

After the lectures by the speakers the session was opened for discussion by the chairman and questions were asked from the panellists.

The chairman concluded the session by stating that biotechnology plays vital role in agriculture food production and quality improvement purpose and also the sustainable agriculture were the main concerns in the session.

TECHNICAL SESSION SEVEN (2.30-4.00 PM):

Theme: Special Session: Cross Functional Nature

The rapporteurs were Dr. Gagan Preet Kour Bali (Assistant Professor) and Ms Jaspreet Kaur Brar (PhD scholar), Department of Zoology, Akal College of Basic sciences, Eternal University.

The session was moderated/chaired by Dr. U S Saha, RBI Chair Prof, IRMA, who emphasized the need and importance of various multi-functional areas which have direct linkage for production and financial support mechanism towards Sustainable economic development. This session included special lectures by the four speakers. The session was held in panel discussion mode/presentation and the field of study was Cross functional nature. Dr. Saha, commended the presenters of this session and introduced them and expected that the speakers would provide insights in their presentations of the session.

He invited the first speaker and encouraged him for giving insights for discussion.

First Speaker: - Mr. T R Kesavan, Group President, TAFE LIMITED, Chennai. He was the online speaker and delivered his lecture on the topic “Integrated precision farming”. He began with the introduction of the phases of farming in the agriculture. He gave information about 1950s and 1980s agriculture that was only focused on the agricultural productivity and after 2010, the focus shifted towards the sustainable agriculture practices like water waste reduction, environment protection and technology as enabler. He also explained that in the precision farming it is possible that the every seed you seed in the soil, germinates. They have combinations of seeding, watering, fertilizing and the more importantly by using appropriate drones for the both spraying and fertilizing, it is easy to reduce almost 50% of the fertilizer. He also described how to utilize all the technological inputs including digitization mode. After he finished his lecture, the chairman of the session, Dr. U S Saha asked a question to Mr. TR Kesavan to cite an example of integrating of all areas mentioned by him earlier. He answered to his question that the people had integrated between farm and farm gate, given examples of the places where it happened like Karnataka and Gujarat. In the end chairman thanked for his informational lecture and introduced the next speaker of the session.

Second Speaker: - Dr. J L N Shastri, Ex, CEO- National Medicinal Plants Board, Government of India. He delivered his lecture via online mode through a PowerPoint presentation on the topic “Opportunities with food and nutrition in Ayurveda”. The presentation began with the introduction to Poshan Abhiyaan and Ayurveda to fill the mandates of poshan abhiyan. He also discussed the Ayurveda’s approach for disease classification and both over and under nutrition problems. He described the food into two categories according to Ayurveda, i.e. Anna Varga (solid diets) and Darva Varga (liquid diets). He also notified that the daily routine plays a major role in public health. Later he apprised the audience how Ayurveda approaches for the prevention and management of the disease. He showed ten different categories of foods in the trade in his slide. At the end Dr. J L N Shastri concluded that according to Ayurveda, the human creation happens proper and improper, depending on the food taken by the mother. He focused on the reintroducing of the traditional foods in the categories of nutraceuticals, functional foods, dietary supplements; botanical drugs etc. would provide new opportunities. The chairman appreciated the way he acquaint the audience about the principles of the Ayurveda and questioned about the quality of the ayurvedic medicines and what efforts are taken in analysing the quality. Dr. J L N Shastri responded to his question that each system have their own pharmacopoeis and pharmacopoeial standards and still updating.

Third speaker: - Prof. Rajeev A, Associate Professor, IRMA. He was an offline speaker and delivered a presentation on the topic “Data Analytic for Sustainable Agriculture”. He mainly focused on the dairy sector of the agriculture. According to him, the dairy is one major sector which is involved in the farmer’s income generation as well as economic and environmental performances. He discussed the latest technology used in the dairy farming like Geofencing/RFID autotracting for smart monitoring, sensor enabled technology/ automatic disease detection for cow observation, Automatic concentrate feeders for feeding and auto-milking/robotic milking for the milking process. He also described the sources of Data in Dairy Farming and the tools of Data Analytics useful in the Dairy industry. His lecture ended by focusing on the key target areas that was Data Analytics on cattle breed selection, Route optimizing for dairy milk collection, forecasting of milk production for cooperatives and supply chain performance analysis for milk collection. The chairman of the session thanked Prof Rajeev A for his informative presentation and inquired if he had started any experiment practically, to which Mr Rajeev replied that he has been working on this root optimization

and came up with the results and applied new algorithms and were able to reduce distribution and procurement time, which was leading to better performance and milk quality.

Fourth Speaker: - Dr. Saibal Paul, Associate Director, Membership, Policy, Strategic Initiative, Sa-Dhan, New Delhi.

He was an offline speaker and the topic of his discussion was “Indian Microfinance Sector - Outreach and impact on agriculture, dairy etc. of the Unreached”. He began his presentation with the introduction to poverty and microfinance. He showed the national multidimensional poverty index report 2021 that reported about 25.01% of Indian population remains multidimensional poor. He introduced the audiences with the term Microfinance which is lower smaller size products for poor people that includes loans, savings, insurance and pension. He reported that out of 17, microfinance can address 10 SDGs directly or indirectly. He articulated that the microfinance is women predominant and showed a group based model in a table that reported the category of the borrowers and the 98% of the customers were women. He also informed that the agriculture has always got very upper hand in microfinance. He presented a graph that showed accessing loan for agriculture has gone high from 15% to 48% whereas animal husbandry has gone down from 39% to 13%. In the end he mainly focused on the impact of microfinance, how their 60% of customers have improvement in their financial capacity. After his lecture, session was opened for discussion by the chairman and questions were asked from the panellists.

In the end of this session, the chairman Dr. U S Saha expressed his gratitude to and thanked all the speakers for their informative lectures and also thanked the organisers for giving him the opportunity to moderate the session.

Additionally, he also highlighted some important dimensions of his deliberation.

The objective of innovation can only be realised if it is adopted and for adoption finance is important ingredient. Any country will seldom develop if the innovations are not reaching to the last person, especially the poorer ones. The National Multidimensional Poverty Index report 2021 used health, education and standard of living indicators to determine the incidence and intensity of poverty experienced by population is depicting that 25.01% of Indian population remains multidimensionally poor, in absolute terms its enormous. Banks have structural challenge to reach to the last person. Over two have half decades, microfinance sector has proved its efficiency in reaching to the financially marginalised population. Microfinance is lower denomination financial products designed for poor people,

the major products are Loans, Savings, Insurance and Pension. Out of 17 , microfinance can address 10 SDGs. The World Bank has called South Asia the “cradle of microfinance.” Statistics indicate that some 45% of all the people in the world who use microfinance services are living in South Asia. As on 31 March 2021 the NBFC/NBFC MFIs and Non NBFC MFIs (non SHG) are serving more than 42 million accounts of poor people (98% women) with Rs. 1,13,459 crores portfolios; additionally, Small Finance banks have served 125 lakh accounts and have Rs. 31,109 crores as portfolio; the SHG Bank Linkage Programme is reaching to more than 1.1 crore SHGs with an outstanding loan portfolio of Rs. 1,03,290 crores; the combined micro credit portfolio of 262 lenders has reached Rs. 2,52,181 crores through 108.6 million active loans.

The Institute of Development Studies (IDS) in the United Kingdom (UK) in association with three Universities in the UK - Bath, Sheffield and Sussex had conducted an impact study on the borrowers of Share Microfine Limited/ This is the first MFI institution to receive the NBFC license from the Reserve Bank of India. The report indicated that 76.8 per cent of SHARE’s clients have experienced significant reduction in poverty over the preceding four years, and half of them are no longer poor; also women are confident to solve their social problems. Cashpor, an under section 8 company has internal mechanism to assess the impact of their interventions through Progress out of Poverty Index (PPI) tool. According to the assessment, mature clients who had borrowed 4 or more times from CASHPOR had experienced some reduction in their poverty since they began borrowing from CASHPOR 58.58% had come completely out of poverty, with a PPI score of >29.