Proceedings of

International Workshop on Food Loss and Waste Prevention in South Asian Region

(30th Oct. -01 Nov. 2023)

Post-harvest losses and Food Waste varies among geographies in the world. It largely depends on the crops and commodities, duration of storage, climate, technological interventions, human behavior, traditions etc. This workshop on food loss and waste (FLW) is part of a series voluntarily organised by Thünen Institute after 2015 annual Meeting of G20 Agricultural Chief Scientists (MACS-G20) which emphasized the decisive importance to reduce FLW. During the G20-MACS held in Varanasi, India during April 2023; a bilateral meeting was held between India and Germany in which both the countries decided to organize a regional workshop to address the challenges of Food Loss and Waste. Thünen Institute, Germany has offered their experience in co-organizing this workshop in India. Despite the abundant agricultural production, a substantial amount of food is lost or wasted throughout the food supply chain, from production to consumption, and impacts food security and availability, environment, economy, and the society.

Inauguration session

The International Workshop on Food Loss and Waste Prevention in South Asian Region organized jointly by The Indian Council of Agriculture Research and the Thünen Institute, Germany commenced on 30th Oct. 2023 in the AP Shinde Hall at National Agricultural Science Centre Complex, New Delhi. Sushri Shobha Karandlaje, Hon. Minister of State for Agriculture and Farmers' Welfare inaugurated the workshop, in presence of Dr. SN Jha, Deputy Director General (Ag. Engg.) – ICAR, Dr. SK Chaudhari, Deputy Director General (NRM) - ICAR, Dr. Stefan Lange, Research Director, Thünen Institute, Germany, and around 120 delegates from India, Bangladesh, Bhutan, France, Germany, Indonesia, Nepal, and Sri Lanka.

The key take-aways as per the talk of Hon. Minister of State for Agriculture are as follows:

- Identify the primary reasons of food loss and waste,
- Education and awareness among all the stakeholders,
- Efficient harvest and storage,

- Smart distribution,
- Industry involvement,
- Donation and food banks,
- Innovation in food packaging, and
- Consumer responsibility, etc.

She emphasized that wasting food is a moral crime and exhorted all to teach their children the importance of not wasting food.

She was hopeful that the three-days workshop would help plan and act together to arrive at some meaningful policy.

Opening session

The post inaugural 'Opening session on Introduction to the workshop and theme and expected outcomes' was chaired by Dr. Himanshu Pathak, Secretary-Department of Agriculture Research and Education and Director General – Indian Council of Agricultural Research (ICAR), New Delhi, India and Mr. Stefan Lange, Research Director, Thünen Institute, Germany. The panellists for the session included Dr. SN Jha, Deputy Director General (Ag. Engg.) – ICAR; Ms. Clementine O'Connor, United Nations Environment Programme (UNEP), France; and Dr. Felicitas Schneider, Thünen Institute, Germany. Focus of the session was social, economic, & environmental aspects of food loss and waste, food waste index and SDG 12.3. Dr. Himanshu Pathak addressed about the global importance of Food Loss and waste and pointed out that the key reasons behind such losses. One of the key reasons is inadequate storage facilities. He stressed on the fact that the focus should be shifted from increasing production to protect the produced food as FL&W has major impact on climate, societies, economies, and individual health. He also discussed the issue of climate change as incidence of cyclones and global warming etc. could lead to more wastage of food in future.

Technical Session I: Assessment and Impact of Postharvest Losses and Food Waste (Oct. 30, 2023)

The technical Session on **"Assessment and Impact of Postharvest Losses and Food Waste"** was held in the afternoon of 30th Oct. 2023. The session was chaired **by Dr. KK Singh, Vice-Chancellor, SVPUAT, Meerut; and co-chaired by Mr. Sujan Pradhan, Chief Postproduction Officer, NPHC, Bhutan**. Dr Rajesh Vishwakarma, PC AICRP (PHET) & Dr S Mangaraj, HoD, CIAE Bhopal were rapporteur for the session. The session started with keynote address by **Dr. SN Jha**, DDG (Ag. Engg.), ICAR, New Delhi who described in detail about the post-harvest loss studies conducted by ICAR-CIPHET and results thereof. He informed that the studies were limited to quantitative losses only. The studies were conducted pan-India and the data collection process included enquiry through personal contacts and also

by recording actual observation in the field/operations. The data was recorded using uniform data structures developed specifically for cereals, root & tubers, oilseeds & pulses, fruits & vegetables, meat, fish & seafood and milk & egg. The collected data was digitized and analysed using standard statistical tools. This was followed by presentations by Mr Karma Dorji, Dy. Chief Post-Production Officer, NPHC, Dr. Md. Mostafizar Rahman, and Dr. Md. Rostom Ali of Bangladesh who deliberated about post-harvest losses and some remedial measures taken in Bhutan and Bangladesh, respectively. Mr. Dorji pointed out need for specific practices suitable to reduce losses using organic means. Dr. Rahman and Dr. Ali informed that practices such as using appropriate machinery for harvesting and handling and metal bins for storage of rice have been found beneficial in Bangladesh. Mr. Pawan Agrawal of Food Future Foundation, New Delhi talked about impact of postharvest loss and waste on components of sustainability, he shared experience of collecting and distributing surplus food from wedding banquettes and other community functions. He further narrated that due to lack of coordination among various stakeholders and ministries of the government lots of efforts and resources are wasted. Ms. Ritoja Basu & Ms. Shweta Lamba from WRI explained about their efforts and experiences in Reducing Food Loss and Waste: Enabling action through the Target-Measure-Act Approach (including SDG Target 12.3).

At the end of the session the Chairman summarized the following takeaways from the session:

- Uniform methodology should be adopted in the south Asian Region to assess the losses and the methodology developed by India should be adapted for the purpose by incorporating modifications depending upon the country specific unit operation,
- Methodology to assess food waste should be prepared and comprehensive study may be taken in future to quantify the waste and identify the critical points,
- Bhutan has restrictions on using chemicals and fertilizer and hence the food loss reduction strategy should be suggested accordingly,
- Critical points must be identified for each commodity where maximum losses are occurring. Policy to reduce the losses in the critical operations should be prepared,
- National level task force should be made in each South Asian Countries to monitor and reduce the losses,
- A network of South Asian Countries should be made to work together to reduce the food loss and waste in this region,
- Convergence of different ministries should be made to work as a team to reduce food waste,
- Multi-commodity cold storages, small capacity evaporative cooled storage (for semi-dry and dry regions) should be promoted in the South Asian region,

- National Academy of Agricultural Sciences (NAAS), India should prepare a policy paper on Food Loss and Waste Management and the report should be submitted to Government of India, and
- Each participating country should prepare a policy framework for post-production management.

Technical Session II: Prevention of Postharvest Losses in the Supply Chain

Second day of The International Workshop on Food Loss and Waste Prevention in South Asian Region started with the Technical Session on Oct. 31, 2023. It was chaired by **Dr. SN Jha**, DDG, Agril. Engg. ICAR and co-chaired by **Dr. Pramod Mahajan**, Senior Scientist, Leibniz Institute for Agril. Eng. & Bioeco (ATB), Germany. Dr. Sangeeta Chopra, Principal Scientist, ICAR-IARI, New Delhi and Dr M R Manikantan, Principal Scientist, ICAR-CPCRI, Kasargod were the session rapporteurs.

Mr. Varun Khurana, Founder and CEO, Crofarm/OTIPY presented a success story on Technological interventions in managing Food Supply Chain from Farmers to Consumers. He explained that his company is into supply fresh fruits and vegetables and using certain technological interventions including digital monitoring to minimize the wastage by reducing handling and holding time, appropriate packaging materials and some economical measures to control the holding temperature. Dr. Pramod Mahajan elaborated about research initiatives being undertaken in the area of Sensors and Modelling in Postharvest Packaging and Storage of Fresh Produce. He talked about newer areas of monitoring quality of fruits and vegetables while they are handled in the market chain. Dr S Rajendran from UPL Ltd. Described about the different fumigation methods and chemicals being used from different types of commodities in India and abroad. He also talked about advantages, limitations and economics involved in use of such chemicals. Dr. Leena Kumari, Scientist, ICAR-CIPHET, Ludhiana introduced ‘Block Chain technology’ to the house and explained different constituents of the block chain and discussed the advantages and limitations of the technology. She presented a few examples of using blockchain in preventing post-harvest losses and also about further possible applications.

Key takeaways:

- Digital technologies including blockchain coupled with sensor networks can be leveraged to enhance the efficiency of supply chain and reduce food losses
- Chemical fumigants and Controlled atmosphere treatment can be used to prevent storage losses of food grains

- Packaging and instrumentation interventions in storage of fruits and vegetables is key for quality retention and loss prevention

Technical Session III: Prevention of Food Waste in Households and Community Activities

The session was chaired by **Dr. Felicitas Schneider**, Thunen Institute, Germany and **Dr. Md. Mostafizar Rahman**, BSMRAU, Bangladesh. Session Rapporteurs were Dr Sandeep Mann ICAR-CIPHET and Dr M K Tripathi, ICAR-CIAE Bhopal.

The panellists for the session included **Ms. Heena Yadav, FSSAI; Ms. Paramita Dutta Dey, NIUA; Dr. Meenu Verma, IGNOU; Mr. Chandrasen Kumar, DGM (Stocks); and Dr. Shalini Radra Guar.** This session highlighted the household contribution to the total food waste and difficulty in quantifying it.

At the outset the Session Chair highlighted that household contribute significant food waste and it is very difficult to plug it. Moreover, she emphasized upon raising awareness and sensitizing people to alter their behaviour regarding household waste and ultimately, reducing it significantly. She also suggested that making a sustainable and wise decision regarding purchase of food may help to tackle food waste.

Ms. Heena Yadav, the keynote speaker of the session talked about FSSAI's initiative on Prevention of Food loss and waste. It was highlighted wide impact of food waste including nutritional security, carbon emissions, economical issues and resilience of our food system. One third of the total food produced in the country gets wasted whereas 1 billion people suffers from hunger and food scarcity. Most of the food waste occurs at food service sector, hotels, restaurants, wedding parties, airlines, mass catering, supermarkets and food processing industries. To tackle this issue, under sustainable development goals 12.3., FSSAI has initiated Eat Right Movement that promotes eating safe, healthy and sustainable food. The organisation has also taken an initiative, named, "Safe food, share food" which is a 360° approach for prevention of food waste based on change in policy, technological solutions to reduce food waste. It is an integrated approach where technological interventions with ongoing programs focusing alteration in social and behavioural aspects. The speaker introduced the audience to "Indian Food Sharing Alliance" which is combination of NGOs and small agencies which are focused on sharing and donating surplus food. A web platform/web app and Toll-free helpline has been initiated to organise food collection and its donation. In association with CII, a resource centre is established to connect agencies for food donation. Additional support is

required through CSR activities to make this initiative successful. FSSAI has also carried out sensitization activities to prevent food wastage as every citizen has a vital role to play. However, lack of infrastructure and transport, lack of integrated food chain and consumer behaviour are major challenges on the road ahead. They have introduced common donation spots such as agencies marked spots, community fridges on police station or at slums, etc. The food collected from these spots can be sold at low price or given free of cost to economically challenged sections. Quick service restaurants need to find a balance between safety and donation.

Ms Paramita Dutta Dey, NIUA, highlighted the challenges faced in food waste treatment and the key actors and their business role in manging the food waste. She shared Food waste management strategies and emphasized the need of national food waste reduction strategies as she quoted that about 40 to 125 thousand tonnes of food waste will be generated in 2030 which is quite worrying. SDGs are there and policy framework is there but we need to work on proper planning, enforcement and strategizing. We have seen Swatchta mission and because of proper communication awareness on Swachhta has been created but for avoiding food wastage such communication is lacking. Segregation of waste at source is also a challenge due to lack of awareness. Some of the key players that can play an important role in prevention of food loss and waste includes consumers, business stakeholders, farmers and civil society. It was suggested that strategies from other countries regarding FLW can be adopted. Also, strict legislations regarding food losses could help in reduction of food losses. Other initiatives such as creation of businesses based on surplus food; charities and tax incentives. She also mentioned existing initiatives that are being implemented for food waste management such as policies to handle social functions, food waste reduction bill 2018, bio-fuel policy 2018 and promotion of food donation by FSSAI. In conclusion, India needs a national food waste reduction strategy with clear demarcation among roles of government bodies like central, state and local bodies.

Mr. Chandrasen Kumar, DGM, FCI headquarters, presented on the topic "Inventory management strategies to reduce food loss and waste." In an introduction to FCI, it is the largest food system that is managed publicly comprising 31% of wheat and 38% of rice production of India and contributing to management of food security to India. Food loss and waste is double whammy problem 9.8% world people face hunger every day. FCI is storing 70 MT of foodgrains under scientific storage over six decades. Proper loading, unloading, storage, accounting and reporting are the strategies for loss prevention. ICAR-CIPHET conducted scientific study on more than 80 godowns and provided realistic norms for storage loss/gain of

moisture and storage operations. Reduction in weight with storage was observed in rice and increasing trend with storage was noticed for wheat.

FCI has helped to save about 4.7 million tonnes of food in the last decade by reducing it's operational losses in the supply chain of the central pool of wheat and rice stocks. This could be achieved due to the recommendations emanating out of a long-term study conducted by ICAR-CIPHET, Ludhiana. Food supply design and SOPs in India are cost effective and can be adopted by low-income countries in order to control FLW.

Dr. Meenu Verma (IGNOU) presented the profound influence of cultural and societal norms on food loss and waste. She delved into the interplay between food profiles and cultural aspects, particularly in the generation of various byproducts and food loss. The reverence of food in different religions, where it is often seen as a form of divinity, leading to a reduction in food waste within these religious communities. Moreover, cultural factors significantly affect both the production and the nature of food waste. Food waste generation is a multifaceted issue occurring at various levels, including households, hotels/shops, religious occasions, and festivals. Several determinants contribute to this problem, such as consumer attitudes, preferences, planning, storage, packaging issues, portion sizes, and socioeconomic factors. Additionally, the diversity of dishes on menus plays a crucial role in food waste generation.

It is worth noting that some national policies, laws, and regulations have already been established to address and mitigate food loss. These measures aim to control and minimize food waste, promoting a more sustainable and responsible approach to food consumption.

Dr. Shalini Rudra Gaur, ICAR-IARI elaborated the expertise of Indian women in utilising whole of the agri produce & hardly anything left over is going as waste. Our traditions evolved to use each and every part of different raw product. Every part of agri produce has various nutritive values and quite novel taste in order to prepare different cuisines. She discussed the innovative use of byproducts from fruits and vegetables in the creation of different food, health ingredients, and nutraceutical products as per our traditional knowledge. Also Provided a concise overview of many byproducts, highlighting their composition, health aspects, and their utilization in the development of value-added products that contribute to a circular economy. The importance of indigenous technology in preserving food, minimizing waste, and harnessing byproducts for cleanliness, economic, environmental, and nutritional benefits needs to be documented including the role of antinutritional compounds and the importance of proper reduction methods before integrating these byproducts into food applications, ensuring their safety and nutritional value.

Key takeaways:

This session highlights the household and community contribution to the total food waste and difficulty in quantifying it. Moreover, it emphasizes upon raising awareness bringing regulations, policy framework, use of latest technologies and sensitizing people to alter their behaviour regarding household/community waste and ultimately, reducing it significantly.

- A comprehensive analysis of food waste and food losses on a global scale, with a specific focus on the Indian context needs to be done and multifaceted impact of food waste on the economy, environment, climate change, and food security is also needed.
- FSSAI's efforts, such as the "Pink Book" for sensitization, emphasizing the importance of proper planning during food purchases, "Eat Right India" initiative, promoting safe, healthy, and sustainable eating habits and acknowledging the food service sector's role in planning and ensuring food safety within policy frameworks to effectively combat food waste at both household and community levels.
- Food Waste Prevention can be tackled with a 360° Approach comprising of web/AI based technological solutions, basic safety guidelines, surplus food donations/collection and distribution of food.
- The identification of crucial factors involved in the generation of food waste and highlight how this significantly affects both income and the environment, like communication done for Swachh Bharat Abhiyan.
- Collaboration among various organizations to collectively address the issues surrounding food waste and the clustering of activities related to food waste to enhance efficiency and effectiveness.
- National-level food waste reduction policy which include mechanisms for waste production, waste prevention, and proper food waste valorisation.
- Estimation of greenhouse gas emissions resulting from food waste generation and its environmental impact.
- Awareness on Effective Storage Practices including proper inventory management by Emphasizing that maintaining grain health, preventing spoilage, averting pest infestations, and quick segregation can significantly reduce losses during storage.
- The awareness about Indian traditional knowledge on byproducts utilisation to younger generation into food applications while ensuring their safety and nutritional value is need of the hour in order to reduce food wastage.
- Making a sustainable and wise decision regarding purchase of food and portion control at hotels and restaurants may lead to tackle food waste.

Session IV: Role of Food Bank Networks and Circular Economy

This session was Chaired by Ms. Clementine O'Connor, UNEP and Dr. Kodithuakku Arachchige Sarath Sirilal, Sri Lanka. Ms. Clementine O'Connor discussed about conversion from linear economy to circular economy. She further emphasized impact of the level of processing on waste generation and need of data to unlock circular opportunities. The rapporteurs of this session were Dr. M.S. Sajeev and Dr. Anamika Thakur.

The Keynote speaker of this session was Dr. Vandana Singh from IFBN. She spoke on the Role of Food Bank Networks in prevention of Food Loss & Waste. She explained the concept of Food banks. She explained how food banks came into existence to utilize wastage of food by providing food to the needy ones. Mr. Anshuman Sidhant explained about cold chain support programme in India introduced by UNEP.

Dr. Nitin Dumasia and Ms. Ingeborg Bayer discussed on the impact of food loss on the environment. They showed us how water is exploited. They also elaborated on the concept of greenhouse gas protocol.

Ms. Shalini Goyal briefed about the concept of circular economy. Being the pioneer in the popularization of circular economy, she pointed out various factors to be adopted for food sector.

There were two papers on value addition of Agro-Industrial by products presented by Dr. Sunil Khare, Professor, IIT-Delhi & Dr. Dinesh Kumar, Head, ICAR-IARI, New Delhi, respectively. Dr. Khare explained about the microbial conversion of agro residues for the production of chemicals. He also explained about solid state/ submerged fermentation and one pot bioprocess on various commodity chemicals. Dr. Dinesh Kumar explained about the novel approaches for the valorization of Agro-Industrial by products. He gave special emphasis on citrus fruits for the production of bio flavonoids, pectin, terpenes and nanocellulose.

The key takeaways from the session include:

- There is a need for brainstorming for developing a robust policy for establishment and operation of food banks.
- The cold-chain network is burgeoning area for south Asian countries, adequate infrastructure, physical as well human resource, is required to support the cold-chain.
- The food loss and waste have huge impact on the environment. Along with the FLW attention should also be drawn towards water wastage.

- Circular economy, secondary agriculture, waste valorisation are some of the possible means to curb the FLW and also reduce their adverse impact on the ecology.

Field Visit: Mother Dairy Fruits and Vegetable Pvt Ltd. Mongolpuri New Delhi

On the third day of the workshop, participants embarked on a field trip to Mother Dairy Fruits & Vegetable Pvt. Ltd. in Mangolpuri, New Delhi. The visit began with the warm reception of all participants at the Mother Dairy site, where refreshments were served, setting a welcoming and comfortable tone for the experience.

Led by the Mother Dairy Fruits & Vegetables team, participants were guided through a comprehensive briefing on various facets of the dairy industry and Mother Dairy's significant role within it. The team highlighted the company's commitment to meeting diverse consumer needs through its strategic diversification into fresh fruits & vegetables, ice creams, and beverages. The visit afforded participants the privilege of witnessing the inner working patterns of the Mother Dairy plant, with a particular emphasis on gaining a firsthand understanding of the supply chain management processes related to fruits & vegetables. This aspect proved to be a highlight of the visit, offering valuable insights into the intricacies of production, sourcing and distribution logistics, quality control in cooperative model. The tour of Mother Dairy's Mangolpuri facility not only exposed participants to the complexities of production and supply chain management in the realm of fruits & vegetables but also underscored the company's dedication to quality, sustainability, and consumer well-being.

Valedictory Session

The valedictory session was held in the afternoon of 1st Nov. 2023 in the AP Shinde Hall, NASC, New Delhi India. The session was chaired by Dr. SN Jha, DDG (Ag. Engg.), ICAR, New Delhi and Co-Chaired by Dr. Felicitas Schneider, Coordinator of Collaboration Initiative Food Loss and Waste launched at Meeting of Agricultural Chief Scientists of G20 countries, Thünen Institute of Market Analysis, Federal Research Institute for Rural Areas, Forestry and Fisheries, Bundesallee, Germany. Dr. Nachiket Kotwaliwale, Director, ICAR-CIPHET, Ludhiana, India presented a brief report about the various sessions held during the workshop and key takeaways/ recommendations emerging from those sessions. All the recommendations were accepted to be part of the final report of the session. Dr. K Narsaiah, ADG (PE), ICAR, New Delhi presented a brief report on the field visit undertaken by the participants and the key learnings from the visits. He further deliberated that cooperative federations like AMUL, Mother Dairy have not only helped farmers in increasing their income but also helped in

reducing losses and adding value to the process industry residues and emphasized the importance networking among countries of South Asian Region.

Following are the recommendations collated from different sessions of the workshop:

- Uniform methodology should be adopted in the south Asian Region to assess the losses
- Critical points must be identified for each commodity where maximum losses are occurring. Policy to reduce the losses in the critical operations should be prepared,
- National level task force should be made in each South Asian Countries to monitor and reduce the losses with convergence of different ministries/ public and private entities
- A network of South Asian Countries should be made to work together to reduce the food loss and waste in this region and country should prepare a policy framework for post-production management including mechanisms for waste production, waste prevention, and proper food waste valorisation and incentivising the efforts to prevent food loss and waste
- Multi-commodity cold storages, small capacity evaporative cooled storage (for semi-dry and dry regions) should be promoted in the South Asian region,
- Digital technologies including blockchain coupled with sensor networks and modelling can be leveraged to enhance the efficiency of supply chain and reduce food losses
- Wholistic approach should be adopted for Food Waste Prevention by employing web/AI based technological solutions, basic safety guidelines, surplus food donations/collection and distribution of food.
- Making a sustainable and wise decision regarding purchase of food and portion control at home, community events, hotels and restaurants may lead to tackle food waste.
- The awareness about Indian traditional knowledge on byproducts utilisation to younger generation into food applications while ensuring their safety and nutritional value is need of the hour in order to reduce food wastage.
- The cold-chain network is burgeoning area for south Asian countries, adequate infrastructure, physical as well human resource, is required to support the cold-chain.
- Circular economy, secondary agriculture, waste valorisation are some of the possible means to curb the FLW and also reduce their adverse impact on the ecology.
- All the participating countries will observe International Day of Awareness on Food Loss and Waste Reduction every year on 29 September and take the pledge to positively reduce food loss and waste which has major bearing on food security, economy and the environment.

(**Pledge**: I (Name of oath taker) solemnly affirm and pledge to prevent food loss and wastage in our family, offices, industries, society, and communities. I also promise to encourage other fellow human beings to value food and prevent food loss and wastage.)

Dr. Felicitas Schneider, Co-chairperson, showed satisfaction with the activities and discussions which were held during the workshop. She asserted that food loss and waste is not an issue for any single country or community or region, but it has global implications and collaborations beyond the regional boundaries are imperative. She was hopeful that these activities would help form a global policy to address the issue of food losses and waste. She hoped that successful models of food banks are created to effectively utilize the food being wasted from community events. Dr. Schneider wished that Food Losses and Waste becomes an important agenda at the MACS-G20. She further informed that a summit named 'Global Forum for Food and Agriculture' is being held in Germany with aims to Ensure global food security, end hunger and make agriculture more sustainable. She encouraged the workshop participants to take part in that summit too. Dr. SN Jha, in his address as chairman, reiterated India's commitment to work for reducing food losses and wastes. Dr. Jha expressed his happiness about joining of representatives from all the countries of south Asian region. He urged that the collaboration and cooperation should continue after the workshop. He emphasized that preventing food losses and waste is in the interest of both producers and consumers of food. He also assured that ICAR will provide all support to make 'Food Losses and Waste' as an important agenda during next G20 summit. Dr. Devinder Dhingra, Principal Scientist, ICAR, New Delhi proposed vote of thanks to the ICAR, the Thunen Institute, all the participants and their sponsoring agencies.