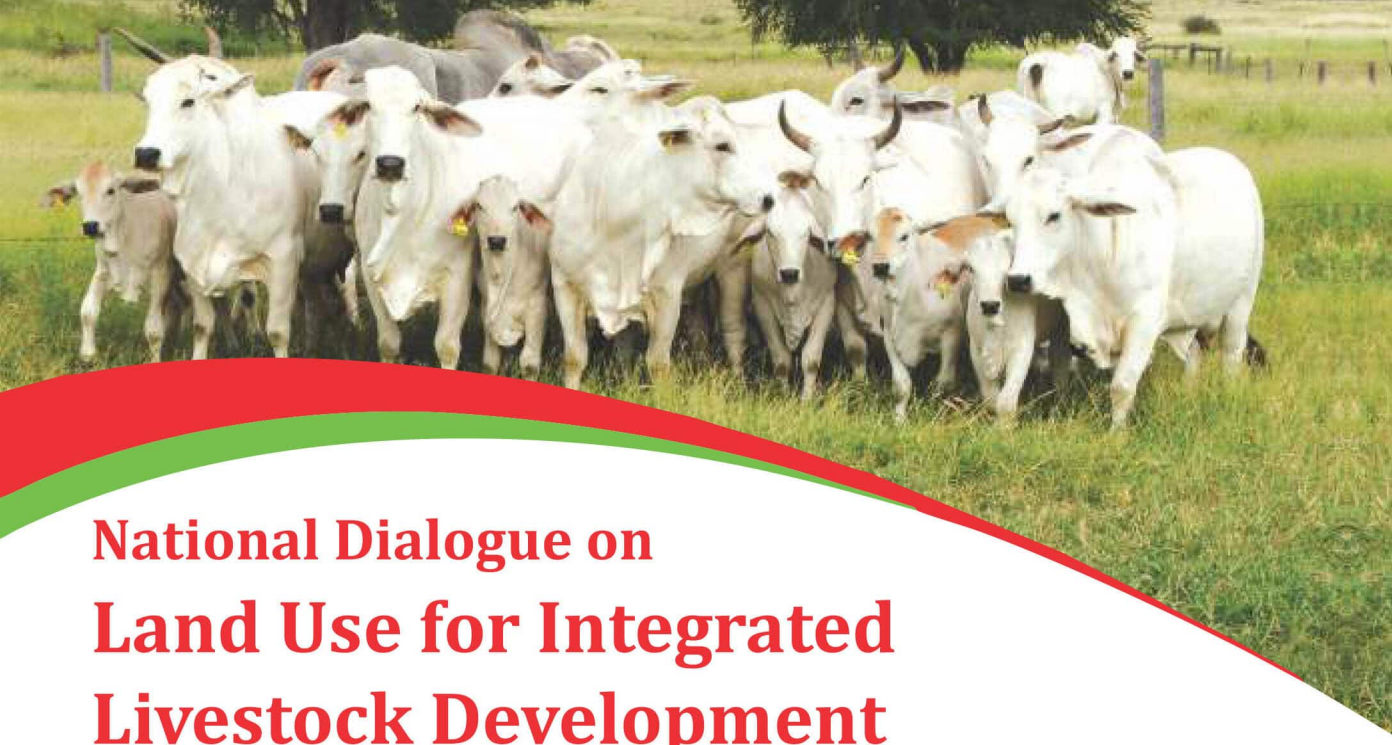

National Dialogue on
Land Use for Integrated Livestock Development

National Agricultural Science Centre Complex,
DPS Marg, Pusa Campus, New Delhi 110012

1-2 November 2019

Proceedings and Recommendations

Organizers

Trust for Advancement of Agricultural Sciences
Indian Council of Agricultural Research
International Livestock Research Institute
Arid Zone Research Association of India

Trust for Advancement of Agricultural Sciences

The Trust for Advancement of Agricultural Sciences (TAAS) was established on 17 October 2002. Its mission is to promote growth and advancement of agriculture through scientific interactions and partnerships. The major objectives are to act as a Think Tank to deliberate on key issues relating to agricultural research and innovation for development (ARI4D) and influence science based policy decisions, recognize and award scientists of Indian and foreign origin for their outstanding contributions towards Indian agriculture, motivate and attract youth (including women) in agriculture and facilitate scientific interactions and partnership at the national, regional and global level to ensure science led growth in agriculture. The main activities include: organizing symposia/ conferences/ workshops/ brainstorming sessions/ seminars on important themes, publishing of strategy papers on key policy matters, and conference/workshop proceedings, organising Foundation Day lectures/Special lectures and conferring Dr. M.S. Swaminathan Award for Leadership in Agriculture. For more details, please visit: *www.taas.in*

Indian Council of Agricultural Research

The Indian Council of Agricultural Research (ICAR), New Delhi, is an autonomous organization under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture & Farmers' Welfare, Government of India. The Council is the apex body for coordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country. The ICAR has played a pioneering role in ushering Green Revolution and subsequent developments in agriculture in India and made a visible impact on the national food and nutritional security. It has played a major role in promoting excellence in higher education in agriculture. It is engaged in cutting edge areas of science and technology (S&T) development and its scientists are internationally acknowledged in their fields. For details, please visit: *www.icar.org.in*

International Livestock Research Institute

The International Livestock Research Institute (ILRI) is the only CGIAR centre dedicated entirely to animal agriculture research for the developing world. ILRI is co-hosted by two African nations, Kenya and Ethiopia with its headquarters in Nairobi, and the principal campus in Addis Ababa, Ethiopia. ILRI's mission is to improve food and nutritional security and to reduce poverty in developing countries through research for efficient, safe and sustainable use of livestock - ensuring better lives through livestock. ILRI works worldwide to enhance its roles in food security and poverty alleviation, principally in Africa and Asia. The outcomes of these research partnerships help people in developing countries keep their farm animals alive and productive, increase their livestock and farm productivity, find profitable markets for their animal products, and reduce the risk of livestock-related human diseases. Delhi office is the regional office and coordinating the livestock research activities in South Asia. ILRI has three project offices at Hyderabad, Bhubaneswar and Guwahati.

Arid Zone Research Association of India

The Arid Zone Research Association of India (AZRAI) was established in 1962 at Jodhpur with an aim to bring the researchers working on arid zone problems under one umbrella. Since its inception, the Association is functioning from Central Arid Zone Research Institute, Jodhpur, India. The Association publishes Annals of Arid Zone, an International Research Journal. The Association periodically organizes conferences, brain storming sessions and panel discussions to exchange and share their experiences on problems related to arid zones. AZRAI has played a pivotal role in bringing scientists, planners and administrators interested in overall development of arid zone and provides a platform to discuss the issues of common interest through organizing symposia, brain storming sessions and panel discussions at periodical intervals.

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Acronyms & Abbreviations

ACU	Adult Cattle Unit
AEZ	Agro-ecological Zone
AFDP	Accelerated Fodder Development Program
AHD	Animal Husbandry Department
AHD&F	Animal Husbandry Dairy & Fisheries
AI	Artificial Intelligence, Artificial Insemination
ATIC	Agricultural Technologies Information Centre
ATMA	Agricultural Technology Management Agency
ASRB	Agricultural Scientists Recruitment Board
AZRAI	Arid Zone Research Association of India
BAIF	Bharatiya Agro-Industries Foundation
BMP	Best Management Practices
CAFRI	Central Agro-Forestry Research Institute
CAZRI	Central Arid Zone Research Institute
CGIAR	Consultative Group for International Agricultural Research
CGR	Common Grazing Resources
CIRB	Central Institute of Research on Buffalo
CPR	Common Property Resources
CRIDA	Central Research Institution on Dryland Agriculture
DARE	Department of Agricultural Research & Education
DFI	Doubling Farmers' Income
DDG	Deputy Director General
DoAC	Department of Agriculture & Cooperation

DoAHD&F	Department of Animal Husbandry, Dairy & Fisheries
DPAP	Drought Proofing Action Plan
FO	Farmers' Organization
FRI	Forest Research Institute
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
GIS	Geographic Information System
GoI	Government of India
GSFRED	Gurbachan Singh Foundation for Research, Education and Development
GVA	Gross Value Added
HYV	High Yielding Variety
IARI	Indian Agricultural Research Institute
ICAR	Indian Council of Agricultural Research
ICFRE	Indian Council of Forestry Research & Education
IFS	Integrated Farming System
IGFRI	Indian Grassland & Fodder Research Institute
ILRI	International Livestock Research Institute
KVK	Krishi Vigyan Kendra
MAFSU	Maharashtra Animal and Fishery Sciences University
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MoA&FW	Ministry of Agriculture and Farmers' Welfare
MoAHD&F	Ministry of Animal Husbandry, Dairy and Fisheries
MoEF&CC	Ministry of Environment & Forest and Climate Change
MoS&PI	Ministry of Statistics & Program Implementation
MoU	Memorandum of Undertaking
MPKV	Mahatma Phule Krishi Vidyapeeth
MSP	Minimum Support Price

NAEB	National Afforestation & Eco-development Board
NAHEP	National Agricultural Higher Education Project
NABARD	National Bank for Agriculture and Rural Development
NASC	National Agricultural Science Centre
NBSS&LUP	National Bureau of Soil Survey & Land Use Planning
NDDB	National Dairy Development Board
NDP	National Dairy Plan
NDRI	National Dairy research Institute
NFT	Nitrogen Fixing Trees
NGDA	National Grassland Development Authority
NGO	Non Government Organization
NHM	National Horticulture Mission
NIAP	National Institute of Agricultural Economics and Policy Research
NIANP	National Institute of Animal Nutrition & Physiology
NITI Aayog	National Institution for Transforming India Aayog
NLM	National Livestock Mission
NMSA	National Mission for Sustainable Agriculture
NPFD	National Policy on Fodder Development
NPG	National Policy on Grazing
NRAA	National Rainfed Area Authority
NSC	National Seeds Corporation
NSO	National Statistical Office
PPP	Public Private Partnership
PRI	Panchayat Raj Institutions
RAJUVAS	Rajasthan University of Veterinary and Animal sciences
R&D	Research and Development
RGM	Rashtriya Gokul Mission

RKVY	Rashtriya Krishi Vikas Yojana
SAU	State Agricultural University
SFRI	State Forest Research Institute
SKNAU	Sri Karan Narendra Agricultural University
SMS	Subject Matter Specialist
SNF	Safe and Nutritious Food
SSC	State Seeds Corporation
SVBPUAT	Sardar Vallabh Bhai Patel University of Agriculture & Technology
TAAS	Trust for Advancement of Agricultural Sciences
T&CB	Training and Capacity Building

National Dialogue on
Land Use for Integrated Livestock Development

BACKGROUND

Livestock and crop production are integral parts of rural economy and complement each other under mixed/integral farming. In India, agriculture and animal husbandry are interwoven with the intricate fabric of the society in cultural, religious and economical ways as mixed farming since ancient times. Livestock rearing is an integral component of rural living with cattle breeding and milk production being the important professions in rural India. Thus it was a well-knit combination of crop and dairy enterprise designed by our ancestors with the aim to fulfil farm family needs and efficiently utilize the by-products and crop residues. Most often, livestock is the only source of cash income for subsistence farms and also serves as insurance in the event of crop failure. India with only 2.29 per cent of land area of the world, is maintaining nearly 17.4 per cent of world human population and 10.7 per cent of livestock (more than 535.78 million heads) creating a huge pressure on land, water and other resources. Furthermore, some part of the country is also largely inhabitable due to harsh climate as reflected by very low population density.

At present, livestock sector is the fastest sector and in spite of little investment in the segment, it is being managed properly and also ensures positive and significant contribution in food, nutrition and environmental security of the country. Livestock sector contributes 31.6 per cent to the national agricultural gross domestic product (GDP). In some states, it even exceeds 40-47 per cent and thus plays a crucial role for national food and nutritional security. Of late, driven by a rapid increase in demand for animal food products, the livestock sector has grown faster at the rate of 4 per cent. There is considerable inter-state variation in livestock growth trends. The eastern and north-eastern states, which had been lagging behind in livestock and agricultural development, have experienced robust growth in recent years. In states like Bihar and Odisha, the livestock sector has become a leading source of agricultural growth. The sustainability of livestock sector depends mainly on sufficient availability of feed and fodder resources at affordable cost. The major feed resources for livestock

in the country are grasses, community grazing on common lands and harvested fields, crop residues and agricultural by-products, cultivated fodder, edible weeds, tree leaves from cultivated and uncultivated lands and agro-industrial by-products. Crop residues include fine straws, coarse straws, leguminous straws, sugarcane tops, etc. and are the single largest bulk feed material available easily to the farmers for feeding ruminants. In dairy farming, nutrition constitutes about 60 per cent of the total expenditure. Thus, forage crops possessing high nutritive value and better digestibility are quite important for the viability of dairy sector. The three major sources of forage supply are crop residue, cultivated fodder and forage from common property resources (CPRs) like forests, permanent pastures and grazing lands. At present, the country faces a net deficit of 35 per cent green fodder, 11 per cent dry forages, and 44 per cent concentrates. Owing to limited arable and grasslands, we are faced with a challenge to feed the fast increasing livestock population in the country. Hence, any attempt towards enhancing availability of fodder and feed resources and economizing the feed cost would result in enhanced livestock production and increased income of our livestock farmers.

Land use is important for livestock, poultry and fishery production. There are special land use categories for different purposes and there is a great concern for non-availability of adequate land to address the feed and fodder problem faced in livestock nutrition. The carrying capacity of our land mass for human and animal population and food/feed resource availability is posing the greatest challenge. Feed and fodder availability is getting acutely critical for our livestock. The land use needs to be focused to feed humans, livestock; empower economy, business, pleasure, wild animals and special use purposes. It is also important that proper land use contributes towards national GDP. The current increasing livestock population and the policy framework under which they operate is leading us to a grim situation where, among other things, feed and fodder limitation impacts seriously our nutritional security. Further, there is a need for revisiting land use for Integrated Livestock Development. Although India has a large population of livestock, the productivity of milk and other livestock product per animal is rather low compared to many other countries. One of the main contributing reasons is malnutrition, under-nutrition or both, beside the low genetic potential of indigenous animals. Also, adequate supply of nutritive fodder and feed is critical factor impacting the productivity and performance of the animals.

India has rich livestock genetic diversity possessing premier dairy buffaloes, draft cattle, carpet wool sheep, and prolific goat breeds. Country needs judicious strategy to meet the ever increasing food, feed and fodder demand with adequate quality and quantity. While success has been achieved to a great extent in food

production due to technological intervention coupled with government policy and farmers initiative, but in case of fodder, such government policy support and commitment is still needed to meet the feed and nutritional requirement of animals. Although the country has achieved food security, but nutritional security have not yet been achieved and livestock sector has a great role to play in achieving these targets. The demand for animal based food products is on increase. In last few decades, per capita consumption of meat in India has increased by many times compared to increase in the consumption of food grains. It is expected that it will continue to rise in the future also due to increasing urbanization, change in food habit and enhanced purchasing power.

The animals are good converters of feed and fodder into milk, meat, wool and eggs. In the absence of adequate fodder and feed, the performance of animals is affected adversely. Cultivated fodders and gathered grasses are two important sources of green fodder and each account for about half of the green fodder consumption. Grasslands are in highly denuded condition due to heavy grazing pressure. Rehabilitation of degraded grasslands for livelihood support especially in hills, semi-arid and arid regions, and also utilization of wastelands with emphasis on range grasses and legumes need to be taken up on participatory basis. Concerted efforts need to be made to make best use of grazing resources available with village *panchayats* and the wastelands along the railway tracks and on road sides by planting better varieties of range grasses and legumes, and managing these areas for livestock grazing. Common grazing lands occupy nearly 16 per cent of the total geographical area, which is gradually decreasing over the years. Area under permanent pastures and grazing lands comprises a mere 3.3 per cent of the total area, and has been declining steadily. The forest cover is available to the tune of 21.54 per cent of which over 85 per cent is protected and these lands are major grazing area for use by the livestock rearing communities. Land available for cultivation of green fodder crops in India has remained static at around 5 per cent of the total cropped area for the last few decades. Although in a few states of the country, it is a little more. Thus, the supply of feed resources has always remained short of normative requirement, resulting in non-realization of the true production potential of livestock. Indeed, the actual milk yield of bovine animals is reported to be 26-51 per cent below the attainable yield under field conditions, which otherwise could have been realized with better feeding, breeding and disease management. The capacity of consumption for the appetite of the animal is measured by the amount of dry matter in the diet, which an animal can consume. Various factors like age, milking or non-milking state, gender, working nature, feeding practices etc. were taken into consideration to assess the requirement for green, dry forage and concentrate. The total dry matter demand of livestock has also been worked out and it was converted into green, dry and concentrate requirement. Based on the

above mentioned factors, the estimated requirement for total green fodder, dry fodder and concentrate from these six categories of livestock was worked out to be 827.19, 426.11, 85.78 million tonnes, respectively.

In the absence of reliable data on crop-wise area under different fodder crops, it is difficult to estimate crop-wise/ variety-wise seed requirement. The estimated availability of certified/truthfully labeled seed of high yielding improved varieties of fodder crops is far below the estimated annual seed requirement. Shortage of quality seeds of HYVs/hybrids of fodder crops is the main reason of low green fodder yield. At present seed replacement rate in fodder crops is less than 20 per cent and higher seed replacement rate is directly correlated with higher yield. Thus, there is an urgent need to enhance production of quality seed of high yielding varieties (HYVs) and hybrids and made available to farmers at reasonable price. Fodder seed banks need to be established to provide quality seed of HYVs/hybrids when needed. Also, to ensure production and distribution of quality seeds, the seed certification standards need to be in place and the seed production need to be properly monitored to ensure quality. Also, a proper mechanism needs to be in place to provide adequate subsidy to farmers enabling them to produce required quantity of good quality seed of HYVs/hybrids of fodder crops. Availability of quality seeds, adequate short-term credit facilities to cover the operational cost along with required technical trainings can go a long way to augment the fodder production. For this, a revolving fund needs to be established. Due to lack of priority of fodder development and dedicated trained manpower in the districts animal husbandry/agriculture departments, there is no long-term vision to focus this activity. Fodder seed production is highly unorganized. Large public sector seed companies are focusing on production of seeds of food crops, while organized private sector seed companies are focusing on high value low volume crops like vegetables, hybrids and GM crops. Private sector also needs to be involved in quality seed production of fodder crops.

There are a number of non-conventional/underutilized feed/fodder resources that can supplement existing green herbage for the ruminants and other animals under varied management situations. Identification of better technologies and materials for use as resources like *Azolla* (humid and sub-humid conditions), turnip and fodder beets (intensive management system), spineless cactus (semi-arid and arid conditions) and para grass and *Coix* (water logged conditions) are proving important for livestock use. Many non-conventional feed resources considered as waste can also be used effectively to supplement the existing feed resources. Use of hydroponics, fodder cultivation on field bunds and use of agriculture waste as bioresource for feed could be other possible alternatives.

India's livestock sector offers considerable scope for enhancement as far as productivity is concerned. Our cattle and buffalo produce less than 1,000 kg of

milk per lactation as compared to 4,500 kg in Europe, more than 7,000 kg in the United States and 10,000 kg in Israel. The low productivity of livestock is due to inadequate supplies of quality feeds and fodder among various other reasons. Hence, besides considerable scope of increasing/ attaining the genetic potential of our superior indigenous breeds, quantification of existing feed resources is necessary for the development of efficient feeding strategies and judicious utilization of available feed resources, besides, planning to develop a feed security system in the country covering all the states. Thus, efforts were made to develop a more realistic methodology and estimates of feed resource availability and requirement in the country at state level. It has been observed that non-availability of adequate feed resources is the also one of the limiting factors in improving livestock productivity. However, reliable estimates on demand and supply of feed resources are not available, though some attempts were made earlier to estimate availability of different types of feed resources and their requirements at the national level. But these studies have assumed that the availability of different feeds is equal to their production; and production is equal to actual consumption, thus enabling to claim that the gap between availability and nutritional requirement is the gap between actual consumption and requirement. However, these assumptions are not always true and needs to be reconsidered with better logical assumptions and actual supportive data. In nutshell, animal husbandry is such an activity which provides livelihood support to two-thirds of rural households, especially landless and marginal farmers who control 70-75 per cent of livestock populations. Between 2004-05 and 2014-15, the livestock sector experienced a robust growth of close to 5 per cent accounting for 29 per cent of gross value of output of agriculture sector and 40 per cent of overall agricultural growth. Livestock production might face a confluence of challenges that need to be overcome to keep the growth momentum underway. Livestock productivity is low because of excessive number of animals in relation to the available resources. Increasing productivity requires optimization of population and availability of feed resources; the country remains deficit in dry fodder by 10 per cent, in green fodder by 35 per cent, and in concentrate feed by 33 per cent. Key options to augment feed resources include i) better utilization of crop residues, ii) promotion of cultivation of high yielding fodder crops, and iii) discouraging export of nutrient-rich oilseed cakes. Further, livestock sector is under-invested. It receives meagre 5 per cent of the total public investment in agriculture. The urgency now is to allocate more resources for livestock development, targeting livestock services, markets and value chains, feed and fodder resources, and R&D to harness the pro-poor growth potential to this vital component of our rural economy.

In order to address the above issues, a “National Dialogue on Land Use for Integrated Livestock Development” was organized jointly by the Trust for Advancement of Agricultural Sciences (TAAS), Indian Council of Agricultural Research

(ICAR), International Livestock Research Institute (ILRI) — Consultative Group for International Agricultural Research (CGIAR); and Arid Zone Research Association of India (AZRAI) at the National Agricultural Science Centre (NASC) Complex, New Delhi on 1-2 November, 2019. The main objectives of the Dialogue were to: i) assess the current land use for forage and livestock production, ii) find out gaps in demand and supply of green fodder, dry fodder and concentrates, iii) look at best possible options for efficient land use planning for forage production, iv) suggest needed policy reforms to meet both forage and feed requirements, and v) develop future strategy and action plan. The Dialogue comprised six technical sessions on various themes: i) livestock production on land use systems, ii) demand/ supply scenario for fodder, feed and seed, iii) Grasslands and common property resources: concerns and opportunities, iv) alternate feed and fodder resources, forage conservation and value addition, v) role of institutions for integrated forage production, and vi) enabling policies for enhancing fodder, feed and seed production including a panel discussion. A total of 115 participants from the national agricultural research system (NARS), private sector, Department of Animal Husbandry, Dairying and Fisheries (DoAHD&F), Central Forest Department, civil society organizations (NGOs, FOs), livestock farmers, entrepreneurs, and policy makers attended the Dialogue.

INAUGURAL SESSION

Dr Gurbachan Singh, Chairperson, GS Foundation for Research, Education and Development and Vice Chairman, TAAS in his address welcomed the Chief Guest, distinguished guests, invitees, and participants. He stated that area under fodder production has been almost constant for the past few decades and the livestock is the farmers' real treasure. Dr Singh accentuated that for the small and marginal farmers, the health and productivity of the livestock plays a pivotal role in earning their livelihoods. So, it is utmost essential for the farmers to ensure good health of their livestock. He also stressed on the need for feed and fodder-efficient livestock. He further stated that excellent rangelands and grasslands of the past have now degraded a great deal. Recently, India has given more focus on food crops as compared to livestock production. Since livestock sustainability is crucial, it was suggested to go now for cultivation of dual purpose crop varieties. He also mentioned about cultivation of *Prosopis, Opuntia, etc.* under low rainfall situation especially in states like Rajasthan.

Dr. JK Jena, Deputy Director General (Fisheries & Animal Sciences), ICAR accentuated that importing of livestock plays an important role in realizing the Hon'ble Prime Minister, Shri Narendra Modi's vision of doubling the farmers' income (DFI) by 2022. The livestock is deemed to be the bread earning partner for the small and marginal farmers. So, keeping the livestock healthy and disease free is

extremely important. Dr. Jena stressed on the major problems of feed and fodders that the small and marginal farmers are facing currently. He urged to look for effective measures for ensuring the proper balance between the feed and fodders for the livestock and also for ensuring the appropriate number or size of livestock with a farmer in order to have good and healthy livestock. He highlighted that country's focus on feed and fodder is low and the carrying capacity of land to sustain livestock is also low and needs to be increased.

Dr H Rahman, Regional Representative, South Asia, ILRI briefed about the organization's major contributions made towards the development and enhancement of good and healthy livestock around the globe. He emphasized about the organization's main aim to provide food and nutritional security to the small and marginal farmers of the world and the country in particular. He stated about the commitment of the ILRI for providing the livelihood to the small and marginal farmers along with ensuring the sustainable animal production in the world. He emphasized that the livestock provides livelihood to around 1.3 billion poor people along with providing 39 per cent protein to the globe. So, their protection from diseases and enhancement in productivity is essential to ensure the good livelihood of the farmer. He also spoke about the importance of livestock globally and particularly in India which contributes 26 per cent to India's gross domestic product (GDP) from this sector. He further stated that demand for animal protein is now very high. He informed that Addis Ababa has huge livestock germplasm collection which needs to be exploited.

Dr Trilochan Mohapatra, Secretary DARE & Director General, ICAR & Chief Guest of the function, in his inaugural address applauded the scientists for their tremendous efforts to improve the health of the livestock and emphasized on the need for developing land use plans on priority. He also accentuated on ensuring the quality of land for better production and stated that the wet lands are being used for feeding the animals in the Eastern India. He urged to have appropriate diet schedules for rearing livestock in good and healthy conditions. He further, opined to carry out the livestock grazing in such a way that would prevent the destruction of important pasture species effectively. Dr Mohapatra urged the farmers to carry out livestock's health check-ups regularly and ensure balanced nutrition for enhanced productivity of livestock in the long-term. He emphasized on involving the private entrepreneurs for realizing the vision more effectively and stated that while providing nutritional security to millions of people, livestock sector plays an important role in the socioeconomic development of the country. Further, as the livestock is mostly owned by resource-poor and poverty affected population, inclusiveness in growth and development and empowerment, amongst poor people is possible at a faster pace through livestock only. He talked on demand supply scenario of feed and fodder, and stated that land will not be

enough in future to produce food, feed and fodder, and hence land use planning will become very important. He informed that both ICAR-IGFRI and ICAR-CAZRI have developed over 40 varieties which need to be spread in the areas of greater demand. Fodder production plans have also been developed for each state, which need to be disseminated and implemented. He also opined about the need for ensuring availability of quality seed and planting material, multipurpose crops, agro-forestry system, nutrition aspects, use of degraded lands, use of drones for aerial seeding, youth participation, private partnership in this sector, and proper policies to be in place.

Dr RS Paroda, Former Secretary, DARE & DG, ICAR & Chairman, TAAS in his Chairman's remarks accentuated on the effective use of land in ensuring the effective development of the livestock which has contributed significantly towards agricultural GDP. Dr Paroda emphasized on taking-up effective measures for ensuring the balance between demand, supply and marketing of the fodder and livestock feed in the country. He stressed that nutritional security of livestock is vital for enhancing the farmers' income and urged the youth to be trained and choose the livestock rearing as their career option. He further stated that the country does not have authentic data on land use, feed and fodder production and other parameters in livestock sector, hence using big data, artificial intelligence, correct data need be gathered and appropriate plans need to be developed and executed accordingly. Although country has created large number of institutions under ICAR but the scenario seems to be the same. He also highlighted about animal insurance cover, tenancy issues, new options for feed and fodder, support for credit, coordination and convergence, promoting export of meat, change in research agenda, climate change issues, and necessity of agro-forestry for carbon sequestration, etc.

TECHNICAL SESSION I: LIVESTOCK PRODUCTION AND LAND USE SYSTEMS

Co-Chairs : **Dr AK Misra**, Chairman, ASRB, New Delhi
Dr JS Sandhu, Vice Chancellor, SKNAU, Jobner, Jaipur

Rapporteurs : **Dr SK Mahanta**, Principal Scientist (Animal Nutrition), ICAR-IGFRI, Jhansi
Dr GK Gaur, Principal Scientist, ICAR-IVRI, Izatnagar

The Technical Session I "Livestock Production and Land Use Systems" was chaired by Dr AK Misra and Dr JS Sandhu. Dr SK Mahanta and Dr GK Gaur were the rapporteurs. In his opening remarks, after welcoming the audience, Dr AK Misra stated that performance of the livestock sector has not been optimum due to lack of critical inputs and services and poor linkage with the market. As the

farmers do not adopt improved breeding, feeding and management practices, the productivity of large and small ruminants is poor. Use of balanced compounded feed is negligible and health care is mainly dependent on traditional medicines and ultimately, fate of the animals. However, as the investment level and out-of pocket expenses are almost negligible, farmers continue to rear livestock. Poor infrastructural facilities for delivery of livestock support services are another serious constraint. The small size of land holding with low production potential also limits the scope for growing green fodder on agricultural holdings. Hence, the animals depend on common property resources (CPRs) which are not systematically managed and the quality of feed and fodder from common lands is also inferior. Dr Misra further mentioned that livestock rearing can become an economic enterprise if development initiatives strengthen the entire value chain and the activity is self-sustainable. Farmers can be motivated to adopt technically sound and economically viable improved livestock farming practices only if they are assured of goat markets and quality input services. The livestock improvement program in India should focus on indigenous cattle, goat, pigs and poultry. The rural poor require a selective cattle breed improvement program which can serve their requirement for draught animal power and increase the milk yield. In the peri-urban areas and among the resource-rich farmers, cross-bred animals can become instruments of dairy development. Goat rearing is required to be promoted to provide meat and milk. Investment initiatives can also be taken up for promoting small-scale enterprises in rural areas to process the livestock produce. Dr JS Sandhu added that fodder availability from trees especially *khejri* (*Prosopis cineraria*) is important but authentic data are not available, which needs to be gathered.

In the Session, four presentations were made by Drs ML Madan, Former DDG (Animal Sciences), SK Singh, Director, ICAR-NBSS & LUP, AK Roy, Former Project Coordinator (Forage Crops) and and AK Srivastava, Member, ASRB.

Dr ML Madan, Former DDG (Animal Sciences), ICAR made a presentation on the topic "The Land in Dialogue with Livestock". He stated that livestock has significant role in agricultural growth and national economy. He also mentioned that livestock and birds are outnumbering human population. He stressed on land holding size and challenges there on; only 4 per cent under pasture, 22 per cent under forest area, about feed loss, urgent need to restructure feed and fodder policy, need of designated ministry, national feed and fodder mission, comprehensive policy on forage production, better coordination and convergence, and augmenting carrying capacity.

Dr SK Singh, Director, ICAR-NBSS & LUP, Nagpur presented a paper on "State of Land Use System for Livestock Sector: Current Status and Future Prospects". He stated that sustainable agriculture is one of the options for attaining the much desired food security and preserving the natural resources. For achieving the

goal, there is need for higher investment on conservation of natural resources. Regularization of subsidies and single window funding from different state owned programs are other options which ensure right kinds of help to the right people. State owned soil conservation work not only protects the land from degradation but also ensures employment to the weaker and land-less farmers. It is also expected that sustainable area based agriculture ensures high organic carbon foot print in soils with concomitant reduction in loading of inorganic particulates in the environment and also ensures enough allocation of land for livestock and fishery sector to meet the demand of feed, fodder and wood. There is immediate need to formulate a land use policy for protecting sustainable area of different crops and also to preserve the freed non-arable land by the intensification for livestock management. There is also an urgent need for policy support to ensure application of best management practices (BMP) in the sustainable area of different crops.

Dr AK Roy, Former Project Coordinator (Forage Crops), ICAR-IGFRI, Jhansi while speaking on "Feed and Fodder for Livestock Production: An Overview" presented an overview of feed and fodder for livestock production in the country. He highlighted that three major sources of fodder supply are crop residues, cultivated fodder from arable land and fodder from common property resources (CPRs). Forage crops face unique problems as they are region and season specific, each zone having its own preference and adaptability of forage crops. He presented livestock statistics also, around 500 million units of cattle, buffaloes, goat, sheep, yak and mithun which works out to be approximately 232 million adult cattle units (ACUs), and requirement of green, dry forage and concentrates depends on various factors like age, milking/ non-milking state, gender, working nature, feeding practices, etc. As per recent estimate, requirement of green, dry fodder and concentrate was worked out to be 827, 426, 86 mt respectively. There is deficit of 11.24 per cent for green fodder and 23.4 per cent for dry fodder. On status of poor fodder availability, he further stated that these are fulfilled through grazing (18%), cultivated fodder (28%), and through crop residue (around 54%). About 50 per cent of non-descript breeds depend on grazing only. There is dire demand of breeders' seed of over 40 varieties already available to meet the requirement. States like Punjab, Haryana, Madhya Pradesh, and Himachal Pradesh have surplus fodder production. With the shifting of dairy from household entity to future agri-business and entrepreneurship, the future strategies demand precision technologies and suitable location-specific feeding model considering profitability and livestock health. To utilize surplus fodder, post-harvest techniques like hay making, baling, silage making, feed block making etc. and storage facility is needed. He further stated that a national program in mission mode is the need of the hour for accelerating production

and effective utilization of fodder; grassland and grazing policy and rejuvenation of degraded pastures; and promotion of entrepreneurship and opportunities in commercial venture.

Dr AK Srivastava, Member, Agricultural Scientists Recruitment Board (ASRB) presented his paper on the topic "Trends in Efficient Livestock Management for Successful Dairy Farming". He stated that among the livestock, cattle and buffalo are considered to be the most important and contribute a major share in sustaining the agricultural economy of the country and account for over 75 per cent of the total output value of the livestock sector. The growth rate of livestock sector has been more than 4.4 per cent per annum and it contributes around 29 per cent in agriculture and allied sectors. He mentioned that there is an increase by 40 per cent in cross-bred animals from 33.76 to 98.17 million and in indigenous cattle by 10 per cent. For efficient livestock management and profitable dairying farming, the suitable technological backstopping and policy measures are immediately required to protect the smallholders from several risk factors and also to increase the income from livestock. He further stated that it is essential to address issues like (i) wide gap between availability and demand of frozen semen doses and breeding facilities. The quality semen production must reach to 140 million doses from the present 97 million doses; (ii) continuous decline in male and female fertility; no doubt, intense genetic selection has increased milk yield, however, selection has also changed the reproductive physiology of the cow and led to decrease in reproductive efficiency; (iii) large number of low producing animals in India competes with high producing livestock for limited resources of feed, fodder and other inputs. Due to poor feed management, 7.7 per cent of buffalo and 10 per cent of cattle have never calved. The present smallholder livestock production system in vogue contributes to the nutritional and livelihood security of a large segment of the country's population. Keeping animals is an important risk reduction strategy for vulnerable communities, and cattle and buffaloes are important providers of nutrients and traction for growing crops in smallholder systems. Any step that would compromise their livelihood would have serious adverse effects on their economic development and food security. Thus, we need to have a mechanism/legislation in place that protects the interests of large number of smallholder population while facilitating scaling up commercial dairy production system.

Major Highlights

- There is need for restructuring or formulation of Feed-Fodder Program and Policies keeping in view the overall agricultural transition occurring in the country including livestock sector and the current needs. There is urgent need for national land reconciliation, convergence of different schemes with fodder

components, shifting supports from input to output based, avoiding losses of available feed resources and a comprehensive grazing policy.

- Sustainable agriculture is one of the options to achieve the much desired food security, besides preserving the natural resources. Estimates suggested that sustainable agriculture is capable to achieve the targeted production during 2030 - 2050 by utilizing 89 and 103 mha of lands, respectively and also expected to help in doubling the farmers' income by 2022. Hence, sustainable area based agriculture for different crops needs to be adopted to ensure the allocation of more land for livestock sector in near future.
- To meet the increasing demand of livestock products, the country is witnessing a transformation in livestock sector from subsistence oriented to commercial /semi-commercial activity. Such transformations include changing from large number of small farms to small number of large farms with large herd size. In commercial production system, high producing animals are kept and managed under better breeding, feeding, housing and health care. However, it may impact adversely the smallholder dairying in the country. Hence, an appropriate mechanism/ legislation needs to be in place to protect the interests of smallholder dairy farming while up-scaling commercial dairying under changing scenario.
- Focus of livestock farming is shifting from resource poor household entity to commercial farming, which needs precision technologies and location-specific feeding models based on quality fodder with profitability and better livestock health. Therefore, a specific national program in mission-mode with policy support is needed to accelerate production and efficient utilization of fodder resources and promotion of entrepreneurship.

TECHNICAL SESSION II: DEMAND/SUPPLY SCENARIO FOR FODDER, FEED AND SEED

Co-Chairs : **Dr AK Srivastava**, Member, ASRB, New Delhi
Dr Bhag Mal, Senior Consultant, TAAS, New Delhi

Rapporteurs : **Dr Vijayalakshmy Kennady**, Scientist, ILRI South Asia Office, New Delhi
Dr Durgesh Kumar, Scientist, ICAR-IARI, New Delhi

The Technical Session II "Demand/Supply Scenario for Fodder. Feed and Seed" was co-chaired by Dr AK Srivastava, Member, ASRB and Dr Bhag Mal, Senior Consultant, TAAS. Dr Vijayalakshmy Kennady and Dr Durgesh Kumar acted as rapporteurs. The Session started with brief remarks by the Co-Chairs. Dr AK Srivastava started the session with his opening remarks on demand and supply of feed and fodder and stated that there is tremendous pressure of livestock

on available total feed and fodder, as land available for fodder production has been decreasing. He informed that India faces a net deficit of about 36 per cent green fodder, 11 per cent dry crop residues and 44 per cent concentrate feed ingredients and to meet the current level of livestock production and its annual growth in population, the deficit has to be met either from increasing productivity, utilizing untapped feed resources, increasing land area or through imports. The crop diversification, which is seen in the recent years with commercial crops replacing drastically the traditional cereals / coarse cereals, is likely to have an impact on the availability of crop residues which used to have a major role. Production of these cereals is stagnating at around 30 mt per year and to meet the feed requirements, there is a need to improve productivity of these coarse cereals. The CPRs are important sources of livelihood and income for poor people in all the states. Sizeable amount of fodder demand is fulfilled through vast grasslands and rangelands. There is likelihood of huge demand of 1,012 mt of green fodder and 631 mt of dry forage by the year 2050. To meet out the deficit, green forage supply has to grow at 1.69 per cent annually. Also, there exists significant gap between requirement and availability of quality fodder seeds. The country has huge opportunity to increase green fodder production and availability through enhancing seed replacement rate. In the absence of reliable data on crop-wise area under different fodder crops, it is difficult to estimate crop-wise/ variety-wise seed requirement. Dr Bhag Mal stressed that the actual potential of quality fodder production for animal feeding has not yet been fully tapped in the country and can be exploited in future. Due to lack of priority of fodder development and dedicated trained manpower in the districts Animal Husbandry department, there is no long term vision to focus this activity. Fodder seed production is highly un-organized. Large public sector seed companies are focusing on production of food crop seeds, while organized private sector seed companies are focusing on high value low volume crop like vegetables, hybrids and GM crops, hence there is an urgent need to engage them for fodder seed production as well. For demand and supply requirements, it was suggested to constitute a small group to examine the issue in depth.

During the session, five papers were presented by Dr PK Ghosh, NAHEP, ICAR; Dr Raghavendra Bhatta, Director, ICAR-NIANP, Bengaluru; Dr TK Walli, Former Head of the Division, ICAR-NDRI, Karnal; Dr Braja Bandhu Swain, Senior Scientist, ILRI, and Dr D Vijay, Principal Scientist, ICAR-IARI, New Delhi.

Dr PK Ghosh, NAHEP, ICAR made a presentation on the topic "Demand, Supply and Marketing of Fodder: Status and Future Actions". He highlighted the current scenario and future challenges and opportunities relating to demand, supply and marketing of fodder in the country, where in he mentioned that India accounts for around 15 per cent of world's livestock population in 2 per cent of world's

geographical area indicating huge pressure on land. As per prediction, meat and milk consumption in India is likely to grow at 2.8 and 3.3 per cent per annum, respectively, indicating huge demand for livestock products in near future. Hence, there is an urgent need for improving the productivity of livestock, which requires overcoming feed and fodder scarcity and improvements in faster delivery of animal health and breeding services. Currently, the country faces a net deficit of 32 per cent green fodder and 11 per cent dry crop residues and it may also aggravate in the years to come. The area under fodder crops has also remained almost static (around 5%) for the past few decades and is not likely to increase in future. Among others, he also highlighted on the need for improving rangeland, enhancing fodder production from problem soils, forages from forest areas and non-arable land, land use policy, and establishing forage seed markets. To promote fodder production and marketing, it is necessary to improve storage systems on-farm as well as en route and at distant markets. Fodder markets are unorganized and informal and the role of the public sector/ government is negligible. For most fodder markets,there is no dedicated market place and these are often organized along roadsides and without legal credentials. Creation of specific market places will facilitate flow of market information, increase interaction among buyers and sellers and facilitate transparency and competition leading to better trading of fodders.

Dr Raghavendra Bhatta, Director, ICAR-NIANP, Bengaluru presented a paper on "Demand, Supply and Marketing of Livestock Feed: Status and Future Options". He highlighted various constraints associated with proper availability of feed and fodder and different technological interventions to overcome those constraints wherein he stated that the overall livestock population has remained fairly constant over the past 10-15 years, production of milk, meat, egg and fish has witnessed significant growth during the last decade. Production of milk increased from 63.8 million tons in 1994-95 to 176 million tons in 2018-19, and compound cattle feed production is estimated to be around 15-20 million tons by 2025. During the same period, the requirement of broiler feed and layer feed will be around 26 million tons and 13 million tons, respectively. Further, fish feed production will be around 5-6 million tons and shrimp feed production around 8-10 lakh tons. The considerable deficiency of dry roughage, green fodder and concentrates would further widen by 2025. It was also pointed out that there is a need for improvement in increasing feed, fodder and concentrate requirements in the country. With increasing demand of livestock products such as milk, meat and eggs in the overall dietary consumption chart of the people, it is empirical that livestock sector also has to gear up suitably to meet the increasing demand. However, several factors such as increasing scarcity of land for fodder and grain production, land fragmentation, crop diversification, water availability for feed

and fodder and impact of climate change are major issues impacting the livestock feed production and feed use landscape in India.

Dr TK Walli, ICAR-NDRI, Karnal presented his paper on "Current Status of Demand, Supply and Marketing of Commercial Complete Feed". He highlighted the use of crop residues as feed resources, regional disparity in straw availability and technology for development of straw based densified feed blocks. He also highlighted about the present status of straw based complete feed technology and various ways to popularize the technology. He also pointed out that paddy leaves are less digestible due to silica content and it needs improvement to make it more digestible.

Dr Braja Bandhu Swain, ILRI, Bhubaneswar spoke on the less "Availability and Requirement of Dry and Green Fodder in Different Agroclimatic Zones of Odisha: Opportunities and Challenges". He stressed upon the importance of livestock sector in Odisha and also about the demonstration and cultivation of different fodder crop varieties by ILRI in Odisha. He stated that milk availability in Odisha is almost half (115 g) than the national average (230 g). To increase the availability of quality green and dry fodder in Odisha, he pointed out to take steps like, extensive promotion of feeding chopped straw and maize stover along with mineral supplementation, increase the area under green fodder cultivation and the availability of high yielding quality fodder seed and planting materials in time, inclusion of fodder crops in the cropping system, enhancement of farmers' knowledge on livestock rearing and management and postharvest management on crop residues as well as fodder crops and fodder cultivation, and promotion of dual purpose crops. He also flagged various issues related to feed and fodder production in Odisha.

Dr D Vijay, ICAR-IARI, New Delhi made a presentation on "Demand and Supply Status of Fodder Seeds". He discussed the actual demand and supply status of quality seeds in the country. He also stressed upon the import of huge quantity of fodder seeds into the country and also mentioned about different constraints faced in fodder seed production and marketing. Currently, the country has massive requirement of fodder seed which need to be made available for its effective marketing. The bottlenecks for its availability need to be identified and targeted action plan be developed. Similarly, enhancement of *per se* seed availability is required to be worked out considering difficulties in production, marketing and policies. The government support in developing grasslands in a holistic manner rather than the present piece meal approach would greatly help in changing the grassland scenario of the country. The development of sown pastures in a public-private partnership (PPP) mode involving the local bodies and farmers' groups is urgently needed. These measures would help in strengthening the seed chain through assured market demand and attract multiple players in forage seed production.

Major Highlights

There is a great diversity of feed resources and production systems which acts as a critical factor in precise quantification of feed supply demand scenario. This needs to be revisited. The actual survey of demand, supply and availability of green fodder, dry fodder and concentrates has to be made and be calculated based on production systems so that the real database on green fodder, dry fodder and concentrates production and availability can be created. The major highlights of this session are as follows:

- There is an urgent need to make provision of dedicated fodder marketing nitche and to have well organized markets with increased interactions among buyers and sellers. Creating enabling policy environment for transparency and fair trading of fodder involving all stakeholders/ actors also needs priority attention.
- The technology of developing straw based densified feed blocks is extremely important especially for easy transportation from areas of over-production to the areas of deficit production and for preparing balanced feed. This technology needs to promoted and popularized among the farmers.
- There is need to provide institutional support like credit facilities, technology development and fodder processing facilities to small holder farmers. Improvement in storage systems on-farm as well as en-route and at distant markets also needs to be given due attention.
- There is urgent need to collect reliable data and develop strong databases on fodder seed production. There is also a need to increase the availability of quality seed and planting materials and the entrepreneurs need to be encouraged to undertake seed production. There is also a need for the development of seed grid and strengthening of seed chain.
- Appropriate guidelines for regulation of imports and exports of feeds, and fodder seeds, etc. need to be developed on priority.
- Greater thrust needs to be given for enhancement of farmers' knowledge on importance of green fodder for enhancing livestock productivity through different extension programs.
- There is an urgent necessity for taking suitable measures for improving rangelands, and enhancing fodder production from problem soils, forest areas and non-arable lands.
- A committee of eminent forage experts should be constituted to revisit the requirement and availability of feed and fodder and suggest appropriate measures for strengthening the entire seed production chain.

TECHNICAL SESSION III: GRASSLANDS AND COMMON PROPERTY RESOURCES: CONCERNS AND OPPORTUNITIES

Co-Chairs : **Dr Gurbachan Singh**, Former Chairman, ASRB & Chairperson, GSFRED, Karnal
Dr H Rahman, Regional Representative-South Asia, ILRI, New Delhi

Rapporteurs : **Dr D Vijay**, Senior Scientist, ICAR-IARI, New Delhi
Dr DBV Ramana, Principal Scientist (AN), ICAR-CRIDA, Hyderabad

The Technical Session III was co-chaired by Dr Gurbachan Singh, Former Chairman, ASRB and Dr H Rahman, Regional Representative South Asia, ILRI. The session was initiated by Dr Gurbachan Singh with the welcome remarks and brief introduction of the session topic. He mentioned that common properly resources (CPRs) include all resources like village pastures and grazing grounds, village forest and woodlands, protected and unclassed government forests, waste land, common threshing grounds, watershed drainage, ponds and tanks, rivers, rivulets, water reservoirs, canals and irrigation channels. These resources were largely under the control of the local communities. Gradually, CPRs available to the villagers declined substantially over the years. CPRs directly or indirectly play an important role in enhancing and stabilizing the income, employment and substance of village community by providing multiple products to various activity of their farming system. On grasslands, he stated that it is highly variable and the area and productivity is decreasing continuously because of increasing human pressure for cultivation of food grain crops. Traditionally grasslands are mainly utilized by pastoralist's community. Rearing animal compositions are based on fodder resources and their availability. Besides grasslands, CPRs serve the needs of poor resource farmers. For fodder, practically all rural poor and landless farmers depend on CPRs where their animals graze as well as they collect fodder. Dr H Rahman stated that actual database is not available. In the country, the Sub-Mission on 'Feed and Fodder Development' under National Livestock Mission (NLM) is under operation and is addressing the problems of scarcity of animal feed and fodder resources from arable and non-arable lands. He emphasized on the need for better management of grasslands and common property resources.

1. **Dr OP Yadav**, ICAR-CAZRI, Jodhpur presented a paper on the topic "Grassland Resources and their Restoration in Indian Arid Regions-Current Status and Future Needs". He stated that hot arid zone (Thar Desert) of western Rajasthan (about 60% of total area) has mixed farming system and it provides main support to the huge livestock population of the region and also provides round the year employment opportunity. He also mentioned about the reduction in grazing area, gradual decline in CPRs, significant replacement of grassland by *Prosopis juliflora*. He further stated that sheep population is going down

whereas goat population is on increase. Perennial grasses such as *Lasiurus scindicus*, *Cenchrus ciliaris*, *C. setigerus*, *Dichanthium annulatum*, *Panicum antidotale* and *Cymbopogon jwarancusa* are highly nutritive and well adapted to the Thar Desert environment. He pointed out that managed rotational grazing is the only system economically viable in the semi-arid tracts and near forest lands, but the institutional arrangements and the technical guidance still need priority attention. Creative strategies need to be explored. He gave an overall scenario of grassland resources in the arid regions including *Banni* grasslands and their present status. He presented suitable methods to restore the degraded grasslands in the arid region and also highlighted the important success stories which resulted from the interventions made by CAZRI in grassland restoration.

2. **Dr Gurbachan Singh**, Former Chairman, ASRB deliberated on the topic "Non-traditional Fodder and Feed Resources" and their importance in the wake of fodder deficiency scenario. He gave detailed presentation on *Opuntia* and *Prosopis,* particularly thorn less varieties and their suitability as alternate feed resource for arid regions. He emphasized on the need to establish a network program on *Opuntia* and *Prosopis* in collaboration with developed countries where *Prosopis* pods have been exploited as animal feed and link them to the livelihood of farmers.
3. **Dr V Sridhar**, NDDB, Anand made a presentation on "Integrated Feeding System and Digitization of Feed and Feeding Information" and highlighted the need for an integrated feeding system, its merits and cost-effectiveness. He also mentioned about sport medicine *vs* traditional medicine, nutrient requirements, balanced ration to animals, use of waste materials like mango seed kernel, tomato, papaya, etc. A 'What if' analysis conducted by NDDB on the data captured from various regions of the country shows that if farmers can adopt a 'Strategic Animal Nutrition Plan' designed by animal nutritionists and enabled/delivered by institutions such as Milk Unions, an improvement in net income of farmers by about 30-40 per cent is possible. He emphasized on season based balanced nutrition and other scientific interventions to improve livestock productivity. He also explained about the need for digitization of feed and feeding information through software-based ration developing plan at the state level.
4. **Dr Inder Dev**, ICAR-CAFRI, Jhansi talked on the "Role of Agroforestry in Meeting Forage Requirements" with particular emphasis on silvipasture system. At present, there has been radical change in realising the importance of forages in agroforestry-based integrated farming system. There is a dire need to rehabilitate the soil health and maintain water resources to develop

sustainable land use like agroforestry based production systems. The tree leaf fodder provides 50-90 per cent of the forage demand during lean period. The over-exploitation and unscientific management of fodder trees has depleted this resource at huge environmental cost. Foliage of fodder trees could be fed to the livestock in mixture with crop residues and hay. Mixing of tree foliage with dry roughage improves their palatability and nutritive value. Under agri-horti-silvicultural system besides growing fruit trees and fodder crops, fast growing nitrogen fixing trees (NFTs) like *Leucaena leucocephala* can be lopped two to three times in a year to provide fodder and fuelwood. Under horti-pastoral system, forage crops can be grown in wide inter-row spaces of fruit trees for economic utilization of orchard lands, which can be fed as fresh and is also conserved as hay for winters. Considerable area is available under orchards and interspaces between fruit trees which could be gainfully utilized for the production of fodder by growing perennial grasses and legumes. Forage grasses/ legumes/fodder trees grown on terrace risers and bunds arrest the nutrient loss in runoff water under high rainfall conditions. It is imperative to improve the common grazing resources (CGR) through the introduction of fodder trees for improved productivity of the livestock. He detailed the available tree and pasture species for different agro-ecological zones. He highlighted various canopy management practices and the need for genetic selection in fodder tree-based systems. Future thrust needs species screening, tree management, growing fodder trees along road side, and identification of suitable species for different agroclimatic zones.

5. **Dr SK Mahanta**, ICAR-IGFRI, Jhansi made a presentation non "Grazing Management in Silvipastoral Systems: Challenges and Opportunities". He highlighted that silvipastoral system needs care and attention and is much better for sustainability. It has huge potential in India, but the adoption rates are still low because of several challenges like shortage of better planting materials, inadequate research/innovation, lack of market infrastructure, rigid legislation in respect of tree felling, wood transportation, processing, etc. Although silvipasture is usually established by planting trees in existing pastures, this eliminates costs of forage establishment, shrub and bush control, or removal of timber harvest residues. He further stated about the principles of selecting the trees and forage species in the system when the animal component is introduced into it and also deliberated about the positive and negative interaction effects of animals in the silvipasture system and suitable measures to reduce the negative impact. He also highlighted various challenges and opportunities for grazing management based on research conducted at ICAR-IGFRI.

Major Highlights

- Grasslands are in a perilous state and need to be restored and maintained on an urgent basis by using all the available technologies developed by various research institutes.
- Documentation of success stories of grassland development, silvipasture system is urgently required. Silvipasture/ agroforestry systems need to be upscaled to the extent of 500-1,000 ha by including the grazing component.
- A large-scale model in approx. 500 ha area of rejuvenated grassland using all the available techniques, viz., reseeding, growing of bushes, and planting of trees for top feed is to be developed to demonstrate, create awareness and convince the policymakers and funding agencies.
- A network program on use of non-conventional fodder resources needs to be initiated. To start with, important species of genus *Opuntia* and *Prosopis* should be targeted as these genera are already exploited for fodder production in other countries.
- Location-specific agroforestry systems suitable for degraded lands in arid and semi-arid regions are urgently needed to be developed for augmentation of fodder resources.
- Integrated feeding system with animal-specific nutrient management along with interactive digitization of feed information is to be taken-up on priority for efficient feeding management.

TECHNICAL SESSION IV: ALTERNATE FEED AND FODDER RESOURCES, FORAGE CONSERVATION AND VALUE ADDITION

Co-Chairs : **Dr MP Yadav**, Former Vice Chancellor, SVBPUAT, Meerut
Dr CS Prasad, Former Vice Chancellor, MAFSU, Nagpur

Rapporteurs : **Dr Purushottam Sharma**, Principal Scientist & Nodal Officer, ATIC, ICAR-IGFRI, Jhansi
Dr A Dey, Principal Scientist (Animal Nutrition), ICAR-CIRB, Hisar

The Technical Session IV was co-chaired by Dr MP Yadav, Former Vice Chancellor, SVBPUAT, Meerut and Dr CS Prasad, Former Vice Chancellor, MAFSU, Nagpur. The rapporteurs for this session were Dr Purushottam Sharma, Principal Scientist & Nodal Officer, ATIC, ICAR-IGFRI, Jhansi and Dr A Dey, Principal Scientist (Animal Nutrition), ICAR-CIRB, Hisar. In their remarks, Co-Chairs Dr MP Yadav and Dr CS Prasad while introducing the topic stated that the shortage of quality feed and fodder has been identified as a major constraint in livestock production in India, which from time to time, experience shortage of animal feed of the conventional

type. Although forages, such as grasses, legumes and tree forages, and the agro-industrial by-products are available, their utilization as an animal feed and fodder is limited due to the presence of dietary anti-nutritional factors like tannins which affect the voluntary intake and gastro-intestinal function of the animals. Great economic losses through general loss of condition. Poor weight gain, insufficient production and death have been attributed to these dietary factors. Further, increased costs of feed and the desire to enhance on-farm livestock feed production have created a need for alternative fodder and forage crops. Historically, many crops such as fodder beets, carrots and kale were used for livestock feed. Many small-scale crop producers in India are looking to diversify their farming operations to include livestock. This interest has developed from the decreased sales they are realizing from vegetable and small fruit crops at direct sale venues. With their knowledge of crop production and access to equipment necessary to produce these alternative forage crops, the ability to diversify their operations with livestock becomes more feasible.

In this Technical Session, three presentations related to alternate feed and fodder resources, forage conservation and value addition were made by Dr V Padmakumar, ILRI; Dr K Gridhar, ICAR-NIANP and Dr Anup Kalra, Ayurvet Research Foundation.

Dr V Padmakumar, ILRI, Patancheru Centre while presenting the paper on "Improvement of Fodder Value of Crop Residues: New Options to Improve Animal Productivity and Natural Resource Usage" stated that straws and stovers occupy over 70 per cent of animal diet in most developing countries in Asia which is expected to increase in future due to various reasons including shrinking of grazing resources. Therefore, improving fodder quality of straws and stovers assumes great importance from the animal nutrition perspective. One of the ways by which quality can be improved is by making use of cultivar dependent variations in straw/stover quality either by exploiting existing variation or through targeted genetic improvement. He highlighted about a study on genetic variation for grain yield, straw yield and straw quality traits in 132 diverse rice varieties recommended for different ecologies in India which revealed highly significant variation among different cultivars for traits like grain yield, straw yield and all straw fodder quality. Samples taken from Kolkata fodder market showed that straws with superior fodder quality (better digestibility) fetch premium price of additional 25 per cent. Improvement of grain and crop residue traits, producing dual-purpose crops with both high grain yields for humans and nutritionally rich crop residues for livestock, could significantly increase milk production with no additional requirement for land, water and labour. Further, he reported that natural resource usage of land, water and biomass is efficient where livestock production is based on crop residues and other by-products that do not contain

human edible nutrients. He also emphasized on the use of another method to improve the fodder value of crop residues through deconstruction of ligno-cellulose complex in the cell wall of straws and stovers.

Dr K Giridhar, ICAR-NIANP, Bengaluru spoke on "Low-Cost Feed Production for Livestock: New Options". He stated that local feed resources like *Azolla*, areca sheath, dehulled maize cobs, groundnut haulms, sugarcane thrash, sunflower heads, fruit residues, ayurvedic residues, brewery waste, etc. have been found useful and some of them are being effectively used with adoption of suitable processing techniques. Use of these alternative feed resources is an economical way for sustainable livestock production. *Azolla* can be used as a valuable green feed protein supplement mixed with crushed maize grain or bran of wheat or rice. *Azolla* is very useful under low input livestock production system. There is enormous opportunity for utilizing wastes from domestic kitchens as well as hotels as feed for livestock with suitable processing. Several trees produce protein and mineral rich top feeds and help to bridge the deficit of green fodder. In dry regions, their utility is much more pronounced. Trees like *Sesbania*, subabul (*Leucaena leucocephala*), *Gliricidia, Melia, Acacia* species, etc. perform well even in drylands. Strategies for strengthening the feed base should focus on regional availability and suitability of potential low-cost feed resources. Increased usage of these feeds will lessen the dependency on conventional ingredients and make livestock farming more profitable.

Dr Anup Kalra, Ayurvet Research Foundation, Kaushambi (Ghaziabad) while presenting the paper on "Ayurvet ProGreen Hydroponic Production System: Technological Innovation in Green Fodder Production" highlighted that rapid urbanisation and increasing mining areas have caused shrinkage in the area of green fodder production. Hence, increasing demand for green fodder can alternatively be met by producing fodder through hydroponic techniques which requires less amount of water compared to traditional method of fodder cultivation and land is not required at all. He emphasised that 'Ayurvet' is the pioneer in developing hydroponics technology in India, and certain technological innovations were taken up for production of highly nutritious, palatable and digestible green fodder as well as in the design and process of production. He also reported about the success story on hydroponics especially Ayurvet's ProGreen hydroponics machine. However, it is not well established whether hydroponics is economically viable. Although the cost of hydroponics unit reduced considerably from Rs 25,000 to Rs 12,000, still farmers may not be able to afford and, hence NABARD needs to come forward to support hydroponics fodder production.

In concluding remarks, Dr CS Prasad mentioned that fruit wastes are to be gainfully used, small scale units need to be established. Hydroponic fodder production

should be cost effective and useful for smallholder farmers and NABARD may come forward to support such programs.

Major Highlights

- The crop residue based livestock production system is amongst the most efficient production systems and needs to be vigorously promoted.
- Technology on deconstruction of ligno-cellolosic material holds great promise. There are several technologies available and user level feasibility of these technologies should be assessed. There is also a need to identify appropriate institutional and industrial partners for technical assessment and socioeconomic feasibility.
- The crop cultivars with higher crop residue digestibility should be developed. The 1 per cent increase in digestibility can enhance milk yield by 6-8 per cent which can create huge impact and increase profitability of farmers.
- Greater thrust needs to be given to the development of dual purpose crop cultivars and their promotion for wider use so that better quality dry fodder is available to the livestock.
- The propagation and upscaling of several unconventional feeds, agro-industrial by-products and fruit and vegetable residue has to be taken-up urgently involving small scale industries, milk federations and animal husbandry departments.
- Coordinated efforts are needed for exploiting alternate feed resources. Several trees have immense potential for use as top feed and can prove to be effective bridging the demand - supply gap by providing nutritious green fodder as well as leaf meal.
- *Azolla* is also an important additive to improve nutrients in animal ration whose potential is still untapped for which concerted efforts need to be made. While considering newer feeds, the availability of the resources at regional level and the cost involved in its value addition has to be primary consideration.
- Low cost technology of hydroponic fodder production needs to be popularized on priority and also funding needs from NABARD/ Govt. Also, intensive research is needed to make it more efficient and cheaper.
- While considering newer feeds, the availability of the resources at regional level and the cost involved in its value addition has to be primary consideration.
- Quality control is one of the major issues in compound feed industry. There should be periodic quality check of ingredients. The government should set up “Feed Quality Regulatory Authority” to enforce the quality standards properly.

TECHNICAL SESSION V: ROLE OF INSTITUTIONS FOR INTEGRATED FORAGE PRODUCTION

Co-Chairs : **Dr AK Singh**, DDG (Agril. Extn.), ICAR & Director, ICAR-IARI, New Delhi
Dr OP Yadav, Director, ICAR-CAZRI, Jodhpur

Rapporteurs : **Dr AK Patel**, Head, Livestock Production Management, ICAR-CAZRI, Jodhpur and
Dr PC Lailer, Head, Animal Nutrition Division, ICAR-CIRB, Hisar

This session was chaired by Dr AK Singh, DDG (Agril. Extn.), ICAR & Director, ICAR-IARI, New Delhi and co-chaired by Dr OP Yadav, Director, ICAR-CAZRI, Jodhpur. Dr AK Patel, Head, Livestock Production Management, ICAR-CAZRI, Jodhpur and Dr PC Lailer, Head, Animal Nutrition Division, ICAR-CIRB, Hisar acted as rapporteurs. In his opening remarks, Dr AK Singh mentioned that major focus of the Departments of Animal Husbandry, Dairy & Fisheries (DoAHD&F) and Agriculture and Cooperation (DoAC) has been to promote stall feeding based mainly on cultivated fodder and feed meals, a part of the *Rashtriya Krishi Vikas Yojana* (RKVY). However, there has not been any program by these departments to develop fodder resources on CPRs. The forest departments have been, over the past Five Year Plans, engaged in managing grazing lands that have been legally classified as forests. A centrally sponsored scheme titled "Area Oriented Fuel and Fodder Project Scheme" under National Afforestation & Eco-development Board (NAEB) has also been implemented over the 11th Plan period. In spite of efforts by the Ministry of Environment & Forest and Climate Change (MoEF&CC), development of the grazing lands has not received any concerted focus during the past Five Year Plans. Hence, there is a need to formulate a national policy on grazing-cum-fodder and pasture development in collaboration with ICFRE- a Centre of Excellence on fodder and pasture development on CPRs to coordinate and steer various research, educational and extension programs under the proposed scheme, map ecologically sensitive grasslands across different agroclimatic zones and development of appropriate rehabilitation models, rehabilitate degraded forests through silvipastoral practices of integrating grasses and fodder trees, develop fodder blocks in forest fringe villages through revival and development of pastures on CPRs in collaboration with *Panchayati Raj* institutions, create fodder banks/ storage facilities in partnership with user groups, develop seed/ germplasm banks and nurseries in every state for pasture development program in collaboration with research institutes, and promote incorporation of fodder trees with agricultural practices towards agroforestry initiatives. Dr OP Yadav added that DoAHD&F, DoAC and ICAR are independently dealing with the subject of fodder and livestock production which create several operational difficulties. He emphasised that there should be greater coordination and convergence among these departments.

In this session, five presentations were made by Dr Girish Sohani, BAIF, Pune; Dr AK Gahlot, Former Vice Chancellor, RAJUVAS, Bikaner; Dr VV Sadamate, Former Advisor, Planning Commission, New Delhi; Ms Shikha Verma, Advanta Seeds, Hyderabad; and Dr RK Pandey, Society for Biodiversity Conservation and Sustainable Development, Jabalpur.

Dr Girish Sohani, BAIF Development Research Foundation, Pune presented a paper on "Role of NGOs in Feed and Fodder Development in India". He reported in his presentation about non-availability of good varieties of sorghum, *bajra* and hybrid napier, use of unconventional *Cactus*, agrobiodiversity conservation, directions for fodder and feed security, shift in farming systems, role of newer technologies, potential role of NGOs in research and multiplication of planting materials, conservation of traditional varieties; and community based upscaling for technology transfer, training and capacity building, and networking etc. He emphasized that a huge gap exists between the availability and the need of feed and fodder resources which is expected to further widen in the coming decades. This gap is due to variety of factors, ranging from increased burden of livestock population beyond the carrying capacity of land; shrinkage of common lands used as grazing lands as well as the continuing drop in the operational land holding size; shift in cropping patterns towards mono cropping/cash crops etc. The problem needs urgent attention and will have to be addressed partly by corrective strategies and appropriate policies and also developing and harnessing improved production technologies; widespread application of fodder preservation methods; use of unconventional fodder sources; a renewed thrust on developing tree fodder resources; and developing methods for widespread dissemination of the above measures to a large number of producers. He emphasised that the NGOs can play a big role to harness its full potential if there is a proper recognition by the policy makers.

Dr AK Gahlot, Former Vice Chancellor, RAJUVAS, Bikaner while making a presentation on "Role of Village Communities and Panchayats in Forage Production" mentioned about socioeconomic importance of the sector, higher expenditure on feed and fodder production (over 50%), lack of market linkage, suggestions on policy issues, viz., availability of resistant varieties, exploitation of apomixis, forage from non-arable land, grassland restoration, fodder from problem soils, post-harvest technologies and institutional management. He further stated that the key driving forces for feed and fodder development in the coming years would be on productivity enhancement, shift to commercial production systems and convergence with other flagship schemes of the government like MGNREGA, RKVY and watershed program. The productivity of these common property resources (CPRs) needs to be increased by policy intervention, for which suggested interventions are

development of fodder mission, policy on developing fodder banks, national grazing policy, national CPR policy, legal protection to grasslands, policy for utilization of non-traditional lands for forage resource development, regulation on pesticide residues contamination in livestock products, management of natural calamities and linkage between DoAC, DoAHD&F and MoEF&CC. He also mentioned about GoI programs, like National Mission for Sustainable Agriculture (NMSA), Accelerated Fodder Development Program (AFDP) as a sub-scheme of RKVY and Drought Proofing Action Plan (DPAP) under National Rainfed Area Authority (NRAA). Examples of certain efforts involving villagers, *Van Panchayats* and other agencies like CPR management in Rajasthan, *Jal Sabha*, and Village Forest Joint Management were also highlighted.

Dr VV Sadamate, Former Advisor, erstwhile Planning Commission (now NITI Aayog) made a presentation on "Innovative Strategies and Reforms for Enhancing Delivery of Livestock Extension Services". He opined that efficacy of program delivery and extension systems is a serious concern and is weak in sub-sectors like animal husbandry. Extension models in India currently in operation are public sector extension service providers comprising research institute outlets and development department units, private sector extension service providers, farmers and farmer organizations (FOs), NGOs and the media. The performance of these models needs drastic reforms to make them responsive to the emerging AHD scenario, especially in enhancing farmers' awareness. He further stressed on promoting chains of extension service providers through farmer-scientists interactions, private sector participation, strategies for disadvantaged areas, revisiting training and capacity building (T&CB) strategies, and convergence and coordination between KVKs and Agricultural Technology Management Agency (ATMA). He opined to make provision of one additional subject matter specialist (SMS) exclusively for feed and fodder program at each KVK. He further suggested for motivating farmers to go for fodder/ green fodder, and to make quality fodder seeds available to the livestock farmers' through milk cooperatives. Since, degradation and decline of CPRs is causing serious concern to the small scale animal grazers and thus, the issue needs serious attention of policy makers and extension services. Stakeholders and research organizations would need to play an important role in operating the feed fodder policy options not only for the cattle and buffalos but also for sheep, goats, rabbits, pigs and backyard poultry. The media also needs to play a significant role in orientation of extension services (both public and private) in this important task.

Ms Shikha Verma, Advanta Seeds, Hyderabad presented a paper on "Role of Private Sector in Forage Production" and highlighted the issues such as productivity, stagnant area under forage production, benefits of green fodder, constraints in forage production, strategies to address the gaps , NGOs participation, and private

sector participation especially the role of Advanta Seeds, etc. She emphatically stressed that Advanta Seeds has been a pioneer in investing in the R&D tirelessly to educate farmers on the nutritional requirement of livestock and adoption of new high yielding varieties (HYVs) with improved cultivation practices. She further suggested that a holistic national program would be necessary to boost fodder production, conservation and utilization program to ensure fodder availability in the country throughout the year.

Dr RK Pandey, Society for Biodiversity Conservation and Sustainable Development, Jabalpur spoke on "Forage Production and Grazing Concerns in Forest Areas: Options and Strategies". He highlighted the major concerns for quality deterioration in forest areas, grassland policy issues, non-implementation of recommendations of GoI's "Task Force on Grassland and Deserts 2006", and scientific management of grasslands in forest ecosystem, etc. These recommendations need to be adopted and practiced to protect, restore and conserve our grassland ecosystems in order to sustain livestock/wildlife in a sustainable manner. He further suggested that there is a need for National Policy on Fodder Development (NPFD), National Grazing Policy; research monitoring, restoration, site-specific management, and skill enhancement; adequate management interventions; and periodic management plan and adequate funding support.

While appreciating the presentations made by speakers, the Co-Chairs emphasized that there is requirement to have authentic data estimation for green fodder, dry fodder and concentrates so that proper policies are developed and implemented. Also, models for self-sufficiency in feed and fodder are to be developed and shared. A networking mechanism using electronic media also needs to be in place. The ICAR may develop MoUs with smallholder farmers.

Major Highlights

- There is a huge deficit in both dry and green fodder availability for the livestock in almost in all parts of the country which needs to be addressed urgently. The reason for gap in demand and availability is mainly due to increased burden of livestock beyond the carrying capacity of land, shrinkage of grazing lands, continuing drop in the operational lands, a shift in cropping pattern towards monocropping and cash crops disrupting traditional circle that provided a variety of feed resources from farm produce to the farmer's livestock operations. NGOs can play a significant role in contribution of new technologies for breeding excellent fodder varieties, alternate feeds like hydroponics, silage, leaf meals, feed blocks, spineless cactus, etc. Community based initiatives should be taken for agrobiodiversity, silvipasture management, upscaling of scientific pasture development, and required policy support for enhancing fodder production.

- The productivity of CPRs needs to be increased by policy interventions like creation of fodder mission, enabling policy on developing fodder banks, national grazing policy, national CPR policy, and legal protection to grasslands, utilization of non-traditional lands for forage resource development and linkage between DoAC, DoAHD&F and MoEF&CC.
- There is a need to develop innovative extension strategies and increase the outreach program through media (print, electronic and social). Concerted efforts need to be made to: i) motivate farmers for increased production of fodder, ii) make quality fodder seeds available through milk cooperatives (currently it is around 25%), and iii) put greater research focus on improved varieties of fodder crops. KVKs, ATMA and private extension agencies would need to demonstrate the economic significance of fodder production over crop production on research farms and fields for different micro-agro situations.
- Private sector can play important role to commercialise the seed production of HYVs of fodder crops to reach the end user at a mass level. Advanta Seeds has been a pioneer private company in investing in R&D for HYVs. Entrepreneurship model and scope of private participation needs to be created and encouraged to fill the existing gaps in demand and availability of dry and green fodder as well as concentrate.
- Forest areas are also good source of grasses as it has grasslands which not only provide habitat, shelter and food for both livestock and wild life but it serve important catchment for rivers, streams, reservoirs, check-dams and village ponds and hence there is a need to develop scientific management of grasslands in forest areas involving several technical aspects and regular monitoring for production of quality fodder. To ensure the sustainable use of grasslands in forests areas, there is a strong need to develop National Grazing Policy.

TECHNICAL SESSION-VI: ENABLING POLICIES FOR ENHANCING FODDER, FEED & SEED PRODUCTION FOR LIVESTOCK DEVELOPMENT

Co-Chairs : **Dr RS Paroda**, Former Secretary, DARE & DG, ICAR & Chairman, TAAS, New Delhi
Dr ML Madan, Former DDG (Animal Sciences), ICAR, New Delhi

Rapporteurs : **Dr Sunil Kumar Tiwari**, Head, Division of Crop Production, ICAR-IGFRI, Jhansi
Dr Braja Bandhu Swain, Scientist, ILRI, Bhubaneswar

This session was chaired by Dr RS Paroda, Former Secretary, DARE & DG, ICAR & Chairman, TAAS, New Delhi and co-chaired by Dr ML Madan, Former DDG (Animal

Sciences), ICAR, New Delhi. Dr Sunil Kumar Tiwari, ICAR-IGFRI, Jhansi, and Dr Braja Bandhu Swain, ILRI, Odisha acted as rapporteurs.

During the session, a policy paper on 'Policies and Programs for Efficient and Cost-effective Feed, Fodder and Livestock Production' was presented by Dr PS Birthal, ICAR-National Institute of Agricultural Economics and Policy Research (NIAP), New Delhi. In his presentation, he pointed out that recycling of agro-byproducts and residues can save 40 mha from fodder cultivation; and dung as manure can provide NPK equal to 1-2 mt. He presented holistic view of efficient and cost effective livestock production and gave critical analysis of prioritised areas for policy intervention. Dr Birthal further elaborated about the importance of mixed farming system in South Asia with special reference to India. He also mentioned that livestock sector provides manure for crop, while crop sector provides residue for livestock feed, which is equal to 23 million tons of concentrate. The salient points emerged from the presentation and discussion include: i) comprehensive development and enabling policy environment needs to be geared-up for faster growth of livestock sector including feeding, health, market and institutional support, ii) animal breeding demands immediate attention as there is lack of progeny bulls and artificial insemination (AI); the extension system in livestock is very poor leading to inefficient delivery system which needs to be made more effective, iii) currently very low budget is allocated (less than 5% of total budget allocated to agriculture and allied sectors) for this sector and hence there is an urgent need for enhanced investment in livestock sector particularly on feed and fodder development as well marketing, iv) there is need to optimise the number of livestock in the country and it needs to be ascertained as to whether the livestock sector has to develop based on resource-driven approach (feed, fodder, breeding and health services) or supply-driven approach (number-driven growth), v) problem of surplus cattle needs to tackled urgently involving scientific interventions like sex-semen, eco-farming and political interventions as strategic options in the long run, vi) problem of feed and fodder security can be solved to greater extent by waste reduction of dry fodders and linking it with incentive at farmers level, emphasis on dual type fodders, strengthening fodder seed chain, creation of live and storage fodder banks, management of CPRs and planned interventions in the context of changing climate, vii) there is great need to revamp the market, pricing, and finance and trade issues in the livestock sector. For example, pricing of milk needs to be changed from two axis (fat & SNF) to three axis model (fat, SNF, and bacterial load/quality), and viii) authentic statistics on feed and fodder resources, economics of livestock production system and other emerging trends of market, finance & trade needs to be properly analysed and put in place for a robust and viable livestock sector for the support of agrarian economy.

PANEL DISCUSSION

Panelists : **Dr AK Srivastava**, Member, ASRB, New Delhi
Dr Praveen Malik, Animal Husbandry Commissioner, AHD&F, GoI
Dr Suresh Pal, Director, ICAR-NIAP, New Delhi
Dr H Rahman, Regional Representative, ILRI-South Asia, New Delhi
Dr VK Yadav, Director, ICAR-IGFRI, Jhansi
Dr KP Viswanatha, Vice Chancellor, MPKV, Rahuri

Dr AK Srivastava highlighted the issue of fast growth of livestock sector with limited investment in the past four decades, however its productivity is dependent on availability of adequate and good quality feed and fodder. For better utilization of dry fodder, he suggested that science-based interventions like nutrient utilization through rumen manipulation and straw based feed densification block to be attempted. He suggested to constitute an expert group to assess the exact situation of feed and fodder in the country so that policies regarding its availability, marketing, value addition of dry fodder may be put in place. He stressed on the need for nutrient utilization for better penetration of fodder technologies. Also, fodder seed chain needs to be made functional involving all stakeholders.

Dr KP Viswanatha informed that in Maharashtra, livestock has been integral component in the program "Doubling Farmers' Income (DFI)" and income to the tune of 50-60 per cent has been reported from animal component under mixed farming situation. Thus, animal component acts as a buffer to bear the risk in almost all the farming situations. He emphasised that for viable livestock development, issues like focus on dual purpose varieties, maintaining fodder seed chain, making deliberate attempt for enhancing the area under forages as India is now food surplus nation, introduction of Fodder Security Bill and policy on fodder market should get top priority. Cropping system is shifting at fast rate which is adversely affecting fodder production. He further stated that goat milk processing units be established in Maharashtra and fixing minimum support price (MSP) for milk may also be considered.

Dr Praveen Malik highlighted that looking to the importance of livestock in Indian agriculture, separate ministry has been formed as Ministry of Animal Husbandry, Dairying and Fisheries (MoAHD&F) in 2019. He emphasised that there is need to reduce the cost of livestock management particularly on feed and fodder, which can be achieved through integration of crop and livestock on integrated farming system (IFS) model basis. He further added that economic models on fodder and silo pits to be promoted at block level with the help of designated implementing agencies. He also mentioned about proper utilisation of unutilised lands, pasture/ *gochar* lands, and riverside areas for fodder cultivation. National Livestock Mission

(NLM) has been commissioned in which adequate attention needs to be given on feed and fodder. He also opined that there is need for convergence of livestock sector programs with other mission schemes like National Horticulture Mission (NHM), MGNREGA and Regulation Bill on Animal Feed is need of the day. He further emphasized that good quality seed required to be produced in plenty. Also, there is a need to integrate animal livestock, fishes and poultry so that the by-product of one can be used by the other.

Dr Suresh Pal provided the lucid account of the economic status of livestock growth in the country. He informed that it is the fastest, demand driven and sustaining. He was of the view that in the present scenario, scale of production, livestock production diversity, tax provisions in marketing and financial system are the key drivers for wider market coverage and export potential. For attaining these ambitious objectives, the service sector needs to be modernised and there should be organised fodder production for dedicated dairy (diverting land from other crops). He further emphasised that pasture based dairy needs to be promoted in India as it is prevalent in many countries. There is also a need to develop capacity for pasture lands and for that around 25 mha fallow land needs to be developed into pastures. Also, the role of *panchayats* needs to be re-defined.

Dr H Rahman highlighted the role of CGIAR in capitalising the opportunity with national partners on livestock sector. He has spoken about low budget allocation in spite of very high contribution to agricultural GDP, crop insurance, fodder quality, women empowerment in the sector, crop-livestock coordination, etc. He explained the importance of mixed crop-livestock production system for better livelihood and enhanced income generation potential across the globe. He was of the view that investments are relatively low in this sector and insurance is also not in conformity to that of crop sector. He emphasized on the need for having a National Policy on Grazing (NPG) so that grazing lands and pastures again become a potential source of fodder supply to livestock keepers of small and marginal category. He further added that ILRI as a policy promotes women empowerment and successful models of women-based livestock management can be replicated in India as well. He also indicated that social taboos which are a great hurdle in promotion of this sector also need to be addressed amicably.

Dr VK Yadav stressed upon poor fund allocation (only 2.3%) for food and fodder, the strengthening of fodder seed chain, utilization of orchards for intercropping with fodders and using fallow lands. He specifically emphasized on rejuvenation of grasslands, pasture lands and vast program on silvipasture utilizing degraded lands spread over across the country. He pointed out that the fodder shortage is not uniform but it has regional and seasonal dimensions. Hence, region based

solutions would be required to deal with this important issue. He pointed out that creation of fodder banks, MSP for fodders, chain of forage storage at taluka/ tehsil level and regulatory mechanism for grazing will go long way to address fodder shortage issue to a larger extent.

Dr Madan stressed on the need for restructuring of food and fodder policy, quality aspects, nutritional security, good extension system, Good agricultural practices (GAP) for increasing productivity, input subsidy, eco-regional land use, and realistic assessment of situation through an expert group, a flagship inter-institutional program on silvipastoral system and CPRs, promotion of alternate feed and fodder resources, and higher fund allocation etc. Dr CS Prasad advocated for regional planning while Dr JS Sandhu commented that there should be a policy in place for fodder tree plantation and seed production. Dr RS Paroda highlighted on the need for developing a holistic policy on livestock as well as fodder and feed.

PLENARY SESSION

Co-Chairs : **Dr RS Paroda**, Former Secretary, DARE & DG, ICAR & Chairman, TAAS, New Delhi
Dr JK Jena, DDG (Fisheries & Animal Sciences), ICAR, New Delhi

The Plenary Session was co-chaired by Dr RS Paroda, Chairman, TAAS, New Delhi and Dr JK Jena, DDG (Fisheries & Animal Sciences), ICAR, New Delhi. In this session, the session-wise highlights and recommendations were considered and adopted. Several important points emerged which included overcoming feed scarcity, curbing the wastage of dry fodder, incentives required for farmers and feed industry to reduce waste, opportunities for inter-regional trade in feed and fodder, increasing production of dual purpose crops, technical options to add value to fodder, strengthening fodder seed supply chain, developing varieties with improved quality of seed and fodder and resilience to climate change, improving quality of pastures and grazing lands, linking farmers to markets, providing funding support to value chains for inclusive growth, and promoting export of meat/live animals. Major challenges in livestock sector including poor animal health, shortage of feed and fodder, reproductive diseases/disorders, late sexual maturity, wide gap between availability and requirement of proven dairy bulls, infertility among cross-bred males, shortage of vaccines and poor diffusion of latest technologies need to be addressed on priority.

SALIENT RECOMMENDATIONS

For harnessing full potential of land for integrated fodder and livestock development, sound strategies need to be developed, promoted and implemented expeditiously for which the following major recommendations need urgent attention:

- The availability of both dry and green fodder as well as concentrate for the livestock is continuously decreasing throughout the country. As per best estimates available, the projected demand for dry fodder, green fodder and concentrate is 468, 213 and 81 mt on dry matter basis, whereas the availability is around 417, 138 and 44 million tons leaving a short fall of 11, 35 and 45 per cent, respectively. This wide gap between demand and availability is of prime concern and hence needs to be addressed on priority. As a first step, the Government needs to have more reliable estimates of area under fodder cultivation in the country, for which use of big data and geographic information system (GIS) could be helpful. Also, the minimum area under fodder production has to be almost doubled as against 4.6 per cent at present. Similarly, the estimates of demand and supply of feed and fodder as well as area under cultivation are based on secondary data and are highly variable. As feed and fodder is an important component, the need for reliable data at field level is most critical. For this, the National Statistical Office (NSO), Ministry of Statistics and Program Implementation (MoS&PI), should generate reliable data on a regular basis being a national priority. Also, an expert committee should be constituted to assess and suggest ways to meet the requirements of green and dry fodder as well as concentrates for accelerating the growth of livestock sector in India. The committee could comprise of Animal Husbandry Commissioner, Directors of ICAR Institutes (IGFRI, NDRI, NIAP, and CAZRI), Project Coordinator (Forage Crops), ICAR and some senior scientists including economists/statisticians. This committee could also review the database on feed and fodder resources, forage seed production requirement, economics of livestock production, marketing, credit and finance, and trade related issues and suggest measures for future growth.
- Availability of quality seed is the most important input for increased fodder production. Hence, priority attention is needed towards increased availability of quality seed and planting materials. Also, the old varieties need to be denotified and replaced with new high yielding varieties/hybrids and their seed production be accelerated through public/private partnership. The Central and State Government fodder farms need to be assessed for their better utilization for production of seed and planting material. Forage seed indent and production chain must be maintained through better coordination and advance planning. Keeping in view the shortage of feed and fodder, a well-planned and closely monitored program on forage development including quality seed production under the on-going “National Livestock Mission” must be strengthened and monitored closely. Also, there is a need to establish fodder banks/seed banks for use during the natural calamities. The National Seeds Corporation (NSC), State Seeds Corporations (SSCs) and other certified seed companies need to

think some 'Out of Box' solutions like establishing producer companies, farmer associations, market linkage with private sector agencies, follow seed quality norms strictly, need to revisit the seed quality standards, explore possibilities to market fodder seeds beyond cooperatives and promote seed production, etc. Involving ICAR institutions, State Agricultural Universities (SAUs), State agencies, private sector along with farmers' participation in a holistic manner could help in addressing this issue in proper perspective.

- Adoption of improved production technologies and promotion of some important fodder resources for diverse edaphoclimatic conditions like: *Azolla* (humid and sub-humid conditions), turnip and fodder beets (intensive management system), spineless cactus (semi-arid and arid conditions) and para grass and coix (water logged conditions) can augment fodder resources during the lean period. Similarly, many other non-conventional feed resources considered as waste can also be used effectively to supplement the existing feed resources. Use of hydroponics, fodder cultivation on field bunds and use of agriculture waste as bioresource for feed could be other possible alternatives. Concerted efforts are, therefore, needed for promoting new food-fodder-based production systems; forage production from problem soils, fodder conservation (bailing, densifying, silage, hay making, complete feed block, leaf meal, legume blocks, etc.) and better utilization of tree biomass as fodder.
- There is an urgent need for establishing a National Grassland Development Authority (NGDA), which could have an oversight role to develop national policy on land use for fodder production, national grazing policy and to take care of all aspects relating to integrated fodder and livestock development. Also, such an institution could build stronger linkages for better coordination and convergence among Ministries and Departments such as: Department of Agriculture and Cooperation (DoAC), Indian Council of Agricultural Research (ICAR), Department of Animal Husbandry, Dairying and Fisheries (DoAHD&F), Forest Research Institute (FRI) and Ministry of Environment, Forests and Climate Change (MoEF&CC).
- The existing 'National Livestock Mission (NLM)' commenced from 2014-15 should also include Fodder Mission for addressing feed and fodder requirement in the country for better impact. Under the umbrella of Mission, there should be provision of advancing credit and needed subsidy to small and marginal farmers engaged in livestock production. In the livestock sector, insurance scheme which is presently spread in 300 selected districts requires to be promoted to all districts in the country to provide protection mechanism to the farmers and cattle rearers against any eventual loss of their animals and to enhance their risk bearing capacity. Also, there is need to augment

the efforts of the states to allow small and marginal farmers to gain better price realization, access to markets, improved technologies for value addition and technical support. In general, the marketing of livestock has not been given due attention either in National Livestock Mission (NLM) or in *Rashtriya Gokul Mission* (RGM). The technologies for fortification of crop residues for making good fodder need to be outscaled. Value addition of dairy products, namely, milk, *dahi*, cheese including mozzarella, whey powder, dairy probiotics and nutraceuticals have provided handsome returns and therefore, become imperative for the dairy industry.

- There is full justification for an eco-regional planning in all States for the cultivation of fodder crops. For this, greater focus needs to be given on: (i) characterization of agro-ecological zones (AEZ) coupled with establishment of regional AEZ databases, (ii) initiation of farmer-led innovations through community and stakeholder involvement in agroecology-based agricultural crop planning and implementation, and (iii) utilization of locally available information for most sustainable cropping/farming practices. It is, therefore, suggested that greater emphasis needs to be given now on eco-regional scientific land use planning that is farmer and stakeholder participatory and ecologically sustainable in long-term and will immensely help in bridging the gap between demand and supply of feed and fodder. Also, there is need for intensifying research to develop and grow high yielding nutritive varieties of fodder crops that can withstand well to the changing climate scenario. The local genetic resources need to be tapped for such purposes and the farmer perception of the older vs. newer varieties must also be kept in view. A single policy approach for the entire country may not be practical and regional needs are required to be considered. Also, research on integration of livestock production and farming systems need to be initiated on eco-regional basis.
- Grasslands are invariably in very poor state and need to be restored on an urgent basis. In this context, there is an urgent need for improving rangelands, enhancing fodder production from problem soils and from village common property lands. For this, available resources under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), *Rashtriya Krishi Vikas Yojana* (RKVY), and watershed programs for development of pastures, common property resources (CPRs) and forest lands through involvement of village communities and *panchayat raj* institutions (PRIs*)* could help to a great extent.
- The livestock sector, though critically important for sustainable development of agriculture and nutritional security of teeming millions in the country, has not received required policy and funding support which it deserves. The R&D allocation to the livestock sector has hardly exceeded 4 per cent. Therefore,

the budget allocation to the livestock sector be increased either to match its contribution to agricultural GDP or at least it be doubled as a first step to overcome existing imbalance. Currently, the sector is facing several challenges rooted to their high population numbers with low production capacity, changing life style of animal owners, reduction in farm size due to family division, limited and poor quality feed/nutrition, expanding urbanization, accelerated climate change and an acute rural/urban divide. Appropriate policy initiatives with adequate investment support needs to be in place to ensure that each of these challenges are converted to opportunities not only to enhance the farmers income but to bring a quality change in the health and nutrition standard of the animal population.

- Among other major concerns for the livestock sector are the poor animal health and disease situation which gets further badly dented by poor feed and nutrition shortage. The endemic and newly emerging diseases, shortage of vaccines, poor vaccination coverage, wide gap between availability and requirement of proven dairy bulls, reproductive diseases/disorders, infertility problems and poor diffusion of latest technologies result into a huge financial loss to the national economy. Any road map for livestock development must include a massive inclusive development investment into health sector. By 2050, the milk demand in the country would be 350-380 mt, and the number of animal farms will decrease and herd size would become large (around 250), partly due to involvement of smallholders to form producer companies which will require strong technological backstopping. Hence, the viable options for further improvement of dairy sector are technology-driven production, and enhancing processing and value addition which need to be given priority attention. There is shortage of frozen semen and progeny tested bulls, and artificial insemination (AI) covers only up to 30 per cent of dairy animals and hence the focus on animal breeding demands immediate attention. Also, the extension system in livestock sector is very poor leading to inefficient delivery system which needs to be addressed on priority.
- There is need to optimize the number of livestock population in the country. It also needs to be ascertained whether this sector has to be developed based on resource-driven approach (feed, fodder, breeding and health services) or supply-driven approach (number-driven growth). In the circumstances, the country either has to restrict the livestock population or increase area under fodder production to meet existing fodder deficit. Problem of surplus and unproductive animals needs to be addressed urgently under a well defined policy, including scientific intervention like sexed-semen use as a viable option. There is also need to distinguish between non-descript cattle and

recognized indigenous dairy breeds, and to optimize the number of desired breeds and their population.

- With majority of our livestock being reared by owners who are landless or having marginal land holding, the animals have to be fed or taken to pastures for nutrient intake. Grazing pastures and other village *Gochar* grazing lands are particularly essential for pastoralists, who move from place to place for grazing these animals. In some ecosystems in the country animal species like camel, goats and sheep are exclusively reared under hot, dry, desert conditions with animals surviving mostly on browsing. There is an urgent need to provide policy support to these nomads/pastoralists and facilitate and strengthen their nutrient resource base through massive eco-regional agroforestry and/or silvipasture. Also, there is a need for developing an enabling policy framework under which the nomads/pastoralists can operate smoothly.
- There is an urgent need for a suitable policy to make provision of dedicated fodder marketing chain on priority with increased interactions among buyers and sellers, including value addition of dry fodder, use of straw based feed blocks, creation of storage systems on-farm as well as en-route to distant markets. There is great need to revamp the market, pricing, and finance and trade issues in the livestock sector. For example, pricing of milk to be changed from two axis (fat and SNF) to three axis model (fat, SNF and bacterial load/quality). Also, we must develop appropriate guidelines for regulation of imports and exports of feeds, and fodder seeds, etc. The technology of developing straw based densified feed blocks for easy transportation from surplus production areas to deficit areas is now available with many institutions but needs a suitable mechanism for popularization among farmers. There is need to provide institutional support like credit facilities, technology development and fodder processing facilities to smallholder farmers.
- There should be a clear mechanism in place for faster delivery of extension technologies in the livestock sector which has remained grossly neglected in the past as only about 5 per cent of the farm households in India have access to information on livestock technology. Innovative extension strategies are to be developed along with increasing the outreach program through media (print, electronic and social) to motivate farmers to go for fodder production. *Krishi Vigyan Kendras* (KVKs), Agricultural Technology Management Agency (ATMA) and private extension agencies would need to demonstrate the economic significance of fodder production over crop production on research farms and fields for different micro-agro-situations. Also, concerted efforts need to be made to make quality fodder seeds available through milk unions and milk cooperatives (currently it is around 25%), and enhancing research focus on

developing improved varieties of fodder crops and improved fodder extension services. There is need for training and capacity building of extension workers of Govt., private sector, dairy cooperatives and NGO's in fodder production and utilization technologies the latest technologies.

- Technology on decomposition of ligno-cellulosic material holds great promise. Available technologies need to be assessed and gainfully adopted. There is an urgent need for institutional, especially public-private partnership, for technical assessment and socioeconomic feasibility, since 1 per cent increase in digestibility can enhance milk yield by 6-8 per cent. Such an option can increase productivity and income of farmers tremendously. Integrated feeding system with animal-specific nutrient management along with interactive digitization of feed information is to be taken-up on priority for efficient feeding management. In order to meet the nutritional requirements of animals, there is a need to increase the bioavailability of nutrients from feeds and fodders using biotechnological approaches.
- Private sector including NGOs can play major role to commercialize the seed production of HYVs of fodder crops to reach to the end user on a large scale. It can contribute significantly towards developing new technologies for breeding better fodder crop varieties, fodder production through hydroponics, and preparation of good quality silage, leaf meals, feed blocks, etc. Community based initiatives also need to be taken up for agrobiodiversity, silvipasture management, upscaling of scientific pasture development, and policy support for fodder production. Entrepreneurship model needs to be developed and public-private participation be encouraged to enhance feed and fodder production to fill the gap between demand and availability.
- A synergistic approach between the forestry and livestock departments needs to be adopted for controlled grazing and/or for dry fodder production. Animals under controlled grazing help considerably in providing rest period to the grazing areas for further revival of their vegetation cover. Moreover, the forest departments also need seeds of different grasses and legumes with high quality biomass yields. The plantation of trees which have high fodder value needs to be given a high priority under different afforestation programs. For this, the staff of forest department needs to be educated and trained. Hence, an appropriate system for livestock management needs to be evolved through inter-departmental cooperation and proper understanding. In order to have a faster pace of integrated livestock development, better coordination and management between crops and animal science sectors is required, quality forage seed production chain be maintained, seed bill needs to be passed by the Parliament,

a rolling plan be prepared and the role of private sector, as in other sectors, must be encouraged. The problem of shortage of feed and fodder can also be solved to some extent by reducing waste of dry fodders and horticultural wastes for fodder purposes and linking it with incentive to the farmers.

In his concluding remarks, Dr JK Jena, emphasized that livestock happens to be the bread earning partner for the small and marginal farmers and keeping livestock healthy and disease free is extremely important. He further added that appropriate strategies are urgently needed to guide livestock keepers in balancing the use of feed and fodder to ensure more productive livestock, which would enable them to keep fewer more productive animals. He also opined for taking effective measures for ensuring the appropriate number/ size of herd in order to have good and healthy livestock.

At the end, Dr RS Paroda stressed on the need for formulating an expert group including personnel from ICAR-NIANP, ICAR-IGFRI for recommending suggestions as how to manage marketing, issue of green/dry fodder, their value addition; also real requirement in this sector; eco-regional planning, net capitalized technologies around silvipastures, strengthening of extension system including youth entrepreneurs to be brought forward, need for insurance for all kinds of animals, and improving productivity of feed, fodder and animals (cattle, buffalo, sheep and goat). Further, he emphasized that for addressing the issue of livestock development along with feed and fodder issues, no sectoral approach would be sufficient and hence there is an urgent need to develop comprehensive approach of action on various aspects: i) development of feed & fodder database involving working groups, ii) area-specific eco-regional development approach, iii) greater focus on better management of CPRs (particularly silvipastures), iv) tapping export potential of Indian livestock products, v) insurance of milch animals, and harnessing the benefits from Sub-Mission on Feed and Fodder under the National Livestock Mission.

Dr Bhag Mal extended vote of thanks and expressed gratefulness to Dr RS Paroda, Chairman, TAAS for his able leadership and constant guidance in organizing the National Dialogue on Land Use for integrated Livestock Development in collaboration with Indian Council of Agricultural Research (ICAR), International Livestock Research Institute (ILRI) and Arid Zone Research Association of India (AZRAI), Jodhpur. He profusely thanked Dr Trilochan Mohapatra, Secretary, DARE & DG, ICAR and Dr AK Singh, Director, IARI & DDG (Agril. Extension) for their support to the National Dialogue. He also sincerely thanked all the co-chairs, panelists, speakers, rapporteurs and participants. Finally, he thanked all chairs and committee members for making various organizational arrangements and also to Dr NN Singh, Dr Umesh Srivastava and Ms Simmi Dogra of TAAS for their immense support for successful organization of this event.

Annexure I

Program

DAY 1: FRIDAY 1 NOVEMBER 2019

08.30-09.30	**Registration**	
09.30-11.00	**INAUGURAL SESSION**	
09.30-09.40	Welcome Remarks	**Dr Gurbachan Singh** Vice Chair, TAAS & Former Chairman, ASRB
09.40-09.55	Brief Remarks	**Dr JK Jena** DDG (Fisheries & Animal Sciences), ICAR
09.55-10.10	Brief Remarks	**Dr H Rahman** Regional Representative-South Asia, ILRI
10.10-10.35	Inaugural Address	**Dr Trilochan Mohapatra** Secretary, DARE & DG, ICAR
10.35-10.55	Chairman's Address	**Dr RS Paroda** Former Secretary, DARE & DG, ICAR; and Chairman, TAAS
10.55-11.00	Vote of Thanks	**Dr OP Yadav** Director, ICAR-CAZRI & Chairman, AZRAI
11.00-11.30	***Tea/Coffee Break &Group Photograph***	
11.30-13.30	**Technical Session I: Livestock Production and Land Use System**	
	Co-Chairs *:* **Dr AK Misra**, Chairman, ASRB, New Delhi **Dr JS Sandhu**, Vice Chancellor, SKNAU, Jobner	
	Rapporteurs *:* **Dr. SK Mahanta**, Principal Scientist, ICAR-IGFRI, Jhansi **Dr GK Gaur**, Principal Scientist, ICAR-IVRI, Izatnagar	
11.30-11.50	The Land in Dialogue with Livestock	**Dr ML Madan** Former DDG (Animal Sciences), ICAR, New Delhi

11.50-12.10	State of Land Use System for Livestock Sector: Current Status and Future Prospects	**Dr SK Singh** ICAR-NBSS & LUP, New Delhi
12.10-12.30	Feed and Fodder for Livestock Production: An Overview	**Dr AK Roy** ICAR-IGFRI, Jhansi
12.30-12.50	Trends in Efficient Livestock Management for Successful Dairy Farming	**Dr AK Srivastava** Member, ASRB, New Delhi
12.50-13.10	Discussion	
13.10-14.00	***Lunch***	
14.00-16.00	**Technical Session II: Demand/Supply Scenario for Fodder, Feed and Seed**	
	Co-chairs : **Dr AK Srivastava**, Member, ASRB, New Delhi **Dr Bhag Mal**, Senior Consultant, TAAS, New Delhi	
	Rapporteurs : **Dr Vijayalakshmy Kennady**, ILRI South Asia office, New Delhi **Dr Durgesh Kumar**, Scientist, ICAR-IARI, New Delhi	
14.00-14.20	Demand, Supply and Marketing of Fodder: Status and Future Actions	**Dr PK Ghosh** NAHEP, ICAR, New Delhi
14.20-14.40	Demand, Supply and Marketing of Livestock Feed: Status and Future Options	**Dr Raghavendra Bhatta** ICAR-NIANP, Bengaluru
14.40-15.00	Current Status of Demand, Supply and Marketing of Commercial Complete Feed	**Dr TK Walli** ICAR-NDRI, Karnal
15.00-15.20	Availability and Requirement of Dry and Green Fodder in Different Agro - Climatic Zones of Odisha: Opportunities and Challenges	**Dr Braja Bandhu Swain** ILRI Centre, Bhubaneswar
15.20-15.40	Demand and Supply Status of Fodder Seeds	**Dr D Vijay** ICAR- IARI, New Delhi
15.40-16.00	Discussion	
16.00-16.20	***Tea/Coffee Break***	

16.20-17.50	**Technical Session III: Grasslands and Common Property Resources: Concerns and Opportunities**	
	Co-Chairs *:* **Dr Gurbachan Singh**, Vice Chair TAAS & Chairperson, GSFRED, Karnal **Dr H Rahman**, Regional Representative-South Asia, ILRI, New Delhi	
	Rapporteurs : **Dr D Vijay**, Senior Scientist, ICAR-IARI, New Delhi **Dr DBV Ramana**, Principal Scientist, ICAR-CRIDA, Hyderabad	
16.20-16.40	Grassland Resources and their Restoration in Indian Arid Regions-Current Status and Future Needs	**Dr OP Yadav** ICAR-CAZRI, Jodhpur
16.40-17.00	Non-traditional Fodder and Feed Resources	**Dr Gurbachan Singh** GSFRED, Karnal
17.00-17.20	Integrated Feeding system and Digitization of Feed and Feeding Information	**Dr V Sridhar** NDDB, Anand
17.20-17.40	Role of Agroforestry in Meeting Forage Requirements	**Dr Inder Dev** ICAR-CAFRI, Jhansi
17.40-18.00	Grazing Management in Silvipastoral Systems: Challenges and Opportunities	**Dr SK Mahanta** ICAR-IGFRI, Jhansi
18.00-18.20	Discussion	
19.00	***Dinner***	

DAY 2: SATURDAY 2 NOVEMBER, 2019

09.30-11.00	**Technical Session IV: Alternate Feed and Fodder Resources, Forage Conservation and Value Addition**
	Co-Chairs *:* **Dr MP Yadav**, Former Vice Chancellor, SVBPUAT, Meerut **Dr CS Prasad**, Former Vice Chancellor, MAFSU, Nagpur
	Repporteurs : **Dr Purushottam Sharma**, Principal Scientist & Nodal Officer, ATIC, ICAR-IGFRI, Jhansi **Dr A Dey**, Principal Scientist, ICAR-CIRB, Hisar

09.30-09.50	Improvement of fodder value of crop residues: New options to improve animal productivity and natural resource uses	**Dr V Padmakumar** ILRI, Bhubaneswar
09.50-10.10	Low cost feed production for livestock: New options	**Dr. K. Giridhar** ICAR-NAINP, Bengaluru
10.10-10.30	Ayurvet ProGreen Hydroponic Production System: Technological innovation in green fodder production	**Dr Anup Kalra** Ayurvet Research Foundation, Ghaziabad
10.30-11.00	Discussion	
11.00-11.20	***Dinner***	
11.20-13.20	**Technical Session V: Role of Institutions for integrated Forage Production** ***Co-Chairs*** **:** **Dr AK Singh**, DDG (Agril Extn), ICAR & Director, ICAR-IARI, New Delhi **Dr OP Yadav**, Director, ICAR-CAZRI, Jodhpur ***Rapporteurs*** **:** **Dr AK Patel**, Head, Livestock Production Management, ICAR-CAZRI, Jodhpur **Dr PC Lailer**, Head, Animal Nutrition Division, ICAR-CIRB, Hisar	
11.20-11.40	Role of NGOs in Feed and Fodder development in India	**Dr Girish Sohani** BAIF Development Research Foundation, Pune
11.40-12.00	Role of Village Communities and Panchayats in Forage Production	**Dr AK Gahlot** Former Vice Chancellor, RAJUVAS, Bikaner
12.00-12.20	Innovative Strategies and Reforms for Enhancing Delivery of Livestock Extension services	**Dr VV Sadamate** Former Advisor, Planning Commission (now NITI Aayog)
12.20-12.40	Role of Private Sector in Forage Production	**Ms Shikha Verma** Advanta Seeds, Hyderabad
12.40-13.00	Forage Production and Grazing Concerns in Forest Areas: Options and Strategies	**Dr RK Pandey** Ex Div Head, SFRI, Jabalpur
13.00-13.20	Discussion	
13.20-14.20	***Lunch***	

14.20-16.30	**Technical Session VI: Enabling Policies for Enhancing Fodder, Feed & Seed Production for Livestock Development-cum-Plenary Session**	
	Co-chairs **: Dr RS Paroda**, Chairman, TAAS, New Delhi **Dr ML Madan**, Former DDG (Animal Sciences), ICAR, New Delhi	
	Rapporteurs : **Dr Sunil Kumar Tiwari**, Head, Division of Crop Production, ICAR-IGFRI, Jhansi **Dr Braja Bandhu Swain**, Scientist, ILRI, Bhubneswar	
14.20-14.40	Policies and Programs for Efficient and Cost- effective Feed, Fodder and Livestock Production	**Dr PS Birthal** ICAR-NIAP, New Delhi
14.40-16.10	**Panel Discussion**	
Panellists :	**Dr AK Srivastava**, Member, ASRB, New Delhi	
	Dr Praveen Malik, Animal Husbandry Commissioner, DoAHD&F, Government of India, New Delhi	
	Dr Suresh Pal, Director, ICAR-NIAP, New Delhi	
	Dr H Rahman, Regional Representative-South Asia, ILRI, New Delhi	
	Dr VK Yadav, Director, ICAR-IGFRI, Jhansi	
	Dr KP Viswanatha, Vice Chancellor, MPKV, Rahuri	
13.20-14.20	***Tea/Coffee Break***	
16.30-17.30	Plenary Session	
16.30-17.05	Presentation of Session Reports	Rapporteurs of Respective Sessions
17.05-17.25	Concluding Remarks by Co-Chairs	**Dr RS Paroda** and **Dr JK Jena**
17.25-17.30	Vote of Thanks	**Dr Bhag Mal**

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