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# **Entrepreneurship for Quality Fodder Production**



**NATIONAL ACADEMY OF AGRICULTURAL SCIENCES, NEW DELHI**  
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**NATIONAL ACADEMY OF AGRICULTURAL SCIENCES, NEW DELHI**

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## Preface

Indian livestock industry is growing at a fast rate and contributing 31.6% to the national agricultural gross domestic product. India produces nearly 22% of global milk with Cumulative Annual Growth Rate of around 6.35% in the last 5 years. According to NITI Ayog, milk production in the country can go up to 330 MMT by 2034.

Livestock census trend indicates that the number of cross bred female cattle has increased by 43.6% and the female buffaloes have increased by 12.71% in the last 7 years indicating higher demand for quality feed and fodder. In the farm maintenance of a dairy, it is estimated that feed and fodder cost is around 65%. However, the country is facing 23.4% deficit in dry fodder and 11.24% deficit in green fodder.

A number of technologies have been developed for fodder production, preservation and assessment of animal feed requirement. There is a vast scope of private investment and development of small business models in the sector. New ideas, technologies and capitals are required in a mode that can be utilized to cater to the needs of rural business involving SHG, women, youth (male and female) and developing suitable models in the form of start-ups, entrepreneurship, enterprises etc.

This strategy paper is based on the presentations and panel discussions held on 17<sup>th</sup> December, 2021 in a virtual Brainstorming Session organized by the National Academy of Agricultural Sciences on '*Entrepreneurship for Quality Fodder Production*'. It was attended by eminent scholars, leaders of the private sector in the field of forage conservation, production, seed companies, dairy industry and as well as interested entrepreneurs. The paper outlines the scope of the several areas in which the *agri-entrepreneurs* can play significant roles as well as the policy support needed for them. It highlights the importance of capital investment in the Indian fodder and livestock industry. I am optimistic that the policy paper will help the government departments, research organizations and *agri-preneurs* in giving a boost to this sector. On behalf of the Academy I express my thanks to all the participants particularly the speakers and the panellists. I acknowledge the contribution of Convenor Dr A.K. Roy and Co-convenors, Dr D.R. Malaviya and Dr A. Chandra for the initiative to organize the brain storming session and drafting the paper. My sincere thanks are due to the Editors of the Academy, Drs P.S. Birthal and Malavika Dadlani for their efforts in editing the draft policy document.

December, 2022  
New Delhi



**(Trilochan Mohapatra)**  
President, NAAS



# Entrepreneurship for Quality Fodder Production

## 1. INTRODUCTION

Mixed farming system, a well-knit combination of crop production and livestock rearing, has been in practice in India since ancient times. Livestock is the major source of income for about 130 million marginal farmers and also serves as insurance in case of crop failure due to calamities. Grazing-based livestock husbandry plays an important role in the rural economy as around 50% of livestock depend on grazing. Cultivated forage and range grasses and legumes are crucial for the nutritional security of livestock. Furthermore, the crops and horticulture sector alone will not be able to meet the nutritional demand of nearly 1.30 billion human populations. Thus forages constitute the base of a complete food chain and are a source of protein, fat and nutrition to the livestock and poultry.

The area under fodders is around 9.0 million ha, which account for 4.8-5% of the total area under cultivation in the country. The area under permanent pasture and other grazing land is around 15 million ha. At present the country faces a shortage of green fodder, dry fodder and concentrates. Estimates vary from agency to agency and methods of estimation; some agencies put it at a net deficit of 35 % green fodder, 11 % dry forages, and 44 % concentrates. One recent study by the ICAR-AICRP on Forage Crops, considering the factors of the animal census and dry, green and concentrates requirement of animals based on their age, sex, mulching, work nature etc. has estimated 23% deficit in dry fodder and 11% deficit in green fodder (Table 1).

**Livestock Production Scenario:** An analysis of the per capita availability of livestock *vis-a-vis* human population, shows that the livestock production as well as per capita availability is increasing many fold, indicating the need for quality and nutritious forages round the year (Table 2 & 3).

The livestock census of 2019 reveals that nearly 73.5% of cattle are of indigenous breed and 26.5% are exotic or crossbred. The trend in changes from 2012 census to 2019 census indicates that the number of crossbred female cattle has increased by 43.6%, and female buffalo has increased by 12.71%.

Development of the dairy industry supported by the White Revolution 2.0, has led to the rapid growth of the industry. India produces nearly 22% of global milk. Our

**Table 1: Estimates of green and dry fodder availability/demand/deficit scenario ('000t)**

Zones	Green fodder			Dry fodder		
	Availability	Demand	Percent Deficit (-)/ Surplus (+)	Availability	Demand	Percent Deficit (-)/ Surplus (+)
Others/ UTs	334.4	1402.8	-76.20	256.9	627.6	-59.07
NEH Zone	22951.6	29832.2	-23.10	19772.2	17337.3	14.00
Hill Zone	21141	28157.9	-24.90	20876.7	13389.0	55.9
East Zone	80745.4	137381.6	-41.20	43481.3	77480.5	-43.90
West Zone	185087.8	197592.3	-6.33	56739.2	100361.0	-43.47
North Zone	114075.2	48947.8	133.05	31559.1	23955.4	31.74
Central Zone	230023	241654.6	-4.80	105183.9	125770.0	-16.4
South Zone	79835.7	142219.9	-43.86	71498	97966.4	-27.00
<b>Total All India ('000t)</b>	<b>734193.8</b>	<b>827189.3</b>	<b>-11.24</b>	<b>326399.2</b>	<b>426105.0</b>	<b>-23.4</b>
<b>Total ('million t)</b>	<b>734.19</b>	<b>827.19</b>		<b>326.4</b>	<b>426.1</b>	

(Source: Roy *et al* 2019)

**Table 2: Livestock production and per capita availability**

Population and Products	2011-12	2016-17	% increase over 5 years
Human population (million no.)	1210	1275	5.37
Livestock population (million no) *	512.06	535.78	4.63
Fish (Lakh tonnes)	86.66	114.40	32.01
Milk (million tonnes)	127.90	165.40	29.32
Egg (million number)	66450	88139	32.64
Meat (million tonnes)	5.50	7.40	34.54
Milk (g/day per capita) availability	290	355	18.31
Egg (number per annum) availability	55	69	25.45

\*Livestock population is for 2012 & 2019

total milk production has taken a giant leap from 20.80 million metric tonnes (MMT) in 1970 to 79.66 in 2000 and 198.4 million tonnes in 2019-20. The Cumulative Annual Growth Rate (CAGR) of the last 5 years was around 6.35 for milk. The dairy sector in India is growing faster than the other agricultural sectors. Milk has become the largest agricultural commodity and the value of milk is estimated to



**Table 3: Composition of livestock population (million number)**

Species	Population (in million number)		
	2007	2012	2019
Cattle	199.08	190.9	192.49
Buffaloes	105.34	108.7	109.85
Sheep	71.56	65.07	74.26
Goats	140.54	135.17	144.88
Others	13.18	12.22	14.30
<b>Total</b>	<b>529.70</b>	<b>512.06</b>	<b>535.78</b>

be >8 lakh crore rupees. As per NITI Ayog estimates, the milk production of the country can go up to 330 MMT by 2034.

However, if we look at the other side of the spectrum, only around 20% of the milk produced is collected and processed by the organized sector, thus indicating a huge possibility for new business opportunities. With regard to livelihood and employment options, only 17 million farmers (27%) are in the organized sector out of nearly 63 million dairy farmers. Total animal product export has also grown significantly and was valued at INR 30309 crores in 2018-19. In spite of India being the largest producer of milk in the world, the milk productivity remains low; our cattle and buffalo produce less than 1000 kg of milk per lactation as compared to 4500 kg in Europe, more than 7000 kg in the United States and 10,000 kg in Israel. Similarly, milk yield (kg/ animal/ year) is about 1700 in India as compared to 10500 in the USA, 8300 in UK and 8250 in Germany. The major causes of low milk productivity include poor / non-descript breed and inadequate supplies of quality fodder. Nearly 52% of the fodder requirement is met by crop residues which are poor in quality, palatability and digestibility and also needs huge space and means for storage.

In dairy farm maintenance, it is estimated that feed and fodder cost is around 65%, labour costs around 10% and the rest is on animal maintenance, vaccination, medicine, insurance etc. Thus green nutritious balanced fodder can reduce the cost of production thereby increasing the profitability.

## **2. SCOPE OF ENTREPRENEURSHIP IN THE FODDER SECTOR**

India has >500 million livestock population and at an estimated feeding cost @ INR. 50 per animal per day, it works out to be nearly INR 2500 crore per day spent on feed and fodder alone. An analysis of the livestock population scenario

from 2012 to 2019 reveals a steady growth on two broad fronts: (i) an increase in the number of stall-fed female bovine livestock, and (ii) an increase in the number of small ruminants goats (10.1% increase) and sheep (14.1% increase). This is indicative of the growing demand for quality fodder.

The Indian animal feed market reached a value of INR 942.4 billion in 2020 and is expected to grow at a CAGR of 12.5% during 2021-2026. There is a vast scope for private investment and development of small business models to generate employment and make available the various ingredients, particularly the preserved feed and green fodder for running successful dairy and other livestock based enterprises. New ideas, technologies and capitals are required to cater to the needs of rural businesses involving SHG, women, youth (male and female) and developing suitable models for employment generation and increasing income in the form of start-ups, entrepreneurship, and enterprises.

The livestock industry including fodder sector needs a boost in the form of availability of suitable products at the right price and at the right place and time. There are a number of need based interventions and technologies which have been developed by the NARS, and other public as well as private sector enterprises, which need to be commercialized for making the livestock based industries economically viable and more profitable.

Some of the areas for developing enterprises and entrepreneurship in fodder sector are given below.

**2.1 Green fodder production:** The fodder market size is estimated to be around INR 30000 crores, which is continuously growing especially in peri-urban areas. Varietal interventions and package of practices for improved varieties could help in improving green fodder productivity and production. Various models like round the year fodder production, intensive forage production and intercropping options for nutritious fodder production are available, which can be profitably exploited. The high yielding fodder crops can be grown commercially round the year and supplied to the urban and peri-urban areas, where several commercial dairy farms are situated and there is heavy demand for green fodder.

**2.2 Fodder Bank/warehousing:** These assume greater importance especially in the flood/ drought and other calamity prone areas. Various types of conserved, processed and enriched products can be stored and supplied/ marketed as per need to save livestock and maintain the productivity levels. Scope also exists for other services like fumigation, insurance, weighing and handling, quality testing, logistics etc.

**2.3 Fodder seed:** There is a huge demand for quality forage seeds. The quality seed is in deficit with only 20-25% market being of the cultivated forage and 5-10% of range fodder crops in the organized chain. Rest of the demand is being fulfilled by the unorganized sector where quality is mostly compromised. Indian forage seed market is estimated to be around INR 2000 crore and it is growing at 9% CAGR. Farmers prefer good quality seeds of ICAR/ SAU developed varieties from reputed and trusted sources, whereas spurious or poor quality seed occupy more than 50% of the demand resulting in poor fodder production and less return to farmers. Introduction of improved varieties of fodder crops and their combinations (grasses and legumes) in pasture as well as in cultivated areas may be facilitated by the entrepreneurs, to enhance fodder production.

A lot of opportunities exist in seed production, packaging, certification/ quality control, storage, marketing, networking, and creating e-platforms. Major seed markets are for fodder maize, fodder multi-cut bajra, berseem, lucerne, oats, barley, sorghum etc. Similarly a sizeable market exists for quality planting material of perennial grasses like BxN hybrid, Guinea grass etc. Production and marketing of rye, berseem seed, fodder beet seed etc. can be taken up for import substitution to diversify the production systems. For mass production of rooted slips/cuttings, the concept of “charabeej gram” may be promoted.

As in case of food crops, quality fodder seed can be streamlined utilizing the knowledge and resources. Some FPOs can be identified for promotion of such activities. They need proper training to become successful entrepreneurs. With increasing health awareness, the market is also developing very fast for organic milk and livestock products. Technologies are available for organic fodder cultivation, which can be adopted for organic milk production, thereby improving the economic status of livestock farmers.

**2.4 Value addition in fodder seed:** The fodder seed especially for range grasses and legumes suitable for pasture lands etc suffer from poor germination, very light weight, fluffy and empty seeds. These factors hamper their establishment in the wastelands and pasture lands. Suitable seed coating technologies, seed pellets etc can be the answer to solve such problems. The technologies are available and can be exploited.

**2.5 Development of grassland / pastureland / wasteland for fodder production:** Pasturelands over an area of 10.26 million ha constitute the main grazing resources. Cultivable wasteland (12.47 million ha) / miscellaneous tree crops and groves (3.1 million ha) also provide grazing area during the rainy season. Most of the pastures are monsoon based and provide sufficient green fodder

for 4-5 months during monsoon and additionally one to two months as dry fodder or fodder from trees or shrubs. With availability of suitable technologies for rejuvenation of such lands, entrepreneurs can be encouraged to develop fodder production farms for marketing. There is potential to introduce silvi/horti pasture technology in Joint Forest Management (JFM) areas for enhancing total forage production. Various developmental projects like NWDPPRA, JFM, Rural Development programmes etc. have inbuilt opportunities for forage resource development. Entrepreneurs can capitalize on such opportunities.

**2.6 Post-harvest technologies, fodder conservation and marketing:** For attaining optimum livestock productivity in a sustainable way, there is need for round the year feeding with a balanced nutritious diet. For this conservation of surplus green fodder with minimum nutrient loss and value addition needs to be adopted. Such products are usually naturally preserved, without external preservatives, are highly nutritious and available at affordable and competitive price. These are easy to store, transport, and economical; it saves labour, energy and storage cost; and also can be air dropped in inaccessible areas during calamities.

Opportunities exist for such enterprises and many successful entrepreneurship models are available in India and abroad. Some of the products to work on include hay, urea enriched straw, silage (drum silage, baled silage, Pit silage), leaf meal (subabul, alfalfa, moringa etc), complete feed block, TMRs based blocks, pellets, enriched densified feed blocks (formulated properly with easily available local ingredient with grains, cakes, straws, dried fodder, minerals etc.) etc. Such products have a shelf life of 1-2 years and can be fed as per need.

- **Silage:** Silage is fresh green forage produced by natural fermentation by microbes in anaerobic condition. It has huge potential and is the best way to ensure nutrient availability during lean months. Entrepreneurs can ensile the fodder in polythene bags of different sizes and market them as per needs of clients. Silage made from excess forage in the flush season (during and following rains) could be a solution for fodder scarcity in the lean season (dry season). Baled silage is an area, which has been successful in Europe and western countries. Now it is also growing fast in the country with the advent and development of high tech and high producing dairies with high yielding livestock. One such example is 'Cornext', which has successfully developed an enterprise following 'Rural Fodder Entrepreneurship Model' and also offers training and resources for attracting new investors and entrepreneurs.

- **Hay preparation enterprises:** Hay is another form of preserved green fodder, which is made by converting the green forage into dry form without affecting the quality of original material. During the flush season when fodder prices are low, these can be preserved in the form of hay as well. And during the lean period (especially summer), the hay can be sold to the dairy farmers at attractive prices, which can fetch additional returns to the commercial fodder growers.
- **Enriched and densified straw bales:** As smallholding farmers often suffer from the scarcity of green fodder during lean period and do not possess facilities for straw treatment, there is a business opportunity to take advantage of huge straw produced on the farm and is being burnt. Straw can be chaffed, sprinkled with deficient nutrients and can be compressed and baled with the machine. Other additives like molasses, urease enzymes, minerals etc could be added in proper proportions for further enrichment. These would add value and fetch higher price in the market.
- **Commercial feeds:** Indian feed industry started as a micro scale, backyard type manufacturing units around the 1960s. Livestock feed industry is a largely unregulated industry in India with loose definitions, regulations and guidelines, often leading to products of inferior quality. Further, price sensitivity of the Indian consumer has made this market a cost driven rather than quality driven market. The feed industry is able to cater only to about 10-12% of total demand. This demand- supply gap can be fulfilled by enterprises with regional focus. Compound cattle feed market is estimated to be around INR 20000 crores in India. INR 1200 crore market exists for feed supplements like mineral mixture, liquid calcium supplements, probiotics, vitamins, etc.
- **Speciality feed/ designer feed:** The feed requirement for different categories of animals vary as per the gender, age, breed, work nature, growth stage, milching status, etc. There is a need to develop 'Designer Feed Products' for different categories of animals for different stages like lactating females, meat producing males, growing heifers, service bulls, pregnant animals, early lactation phase females etc. Similarly import substitution and export promotion of feed ingredients like rice bran, can be taken up. Scope also exists for promotion of environmental feed supplements for methane mitigation by production and marketing for example patented technologies named Haritdhara and Tamarin Plus of ICAR-NIANP, Bengaluru.
- **Area specific mineral mixture unit:** Area specific mineral mixture is vital for animal health especially for increasing milk production and body weight

in young animals. Only the minerals, which are deficient in a particular area, are used to make the mixture, which makes it a profitable venture and technology is available with the National Agricultural Research System. It will be a very good option to establish a unit and start commercial production after proper market survey.

- **Commercial dry fodder enrichment unit (Preparing urea-treated straw):** Enhancing the nutritional quality of the crops residues / straw/ kadvi/ etc. will raise the market value of the poor quality roughages which are available in plenty. Suitable machinery with appropriate technologies can be used to develop commercial units and the enriched products can be packed and sold to livestock owners at a premium price.
- **Densified complete feed:** Densified Complete Feed Blocks (DCFBs) or Total Mixed Ration Blocks (TMRBs) or pellets are an innovative technology to supply balanced feeds to the dairy and other livestock. The composition can vary as per need of livestock and different formulations can be developed using need based ingredients including minerals, vitamins, additives etc.
- **Bypass protein:** The protein requirement of ruminant livestock can be classified into rumen degradable and undegradable. Degradable protein sources are broken down in the rumen leading to poor utilization of protein feed and more loss due to change into ammonia and other gases. Chemical (formaldehyde/ tannins) or physical treatment (heat) can reduce the degradability in rumen and thereby help in better utilization of digestible protein at the intestine. Such bypass protein can be sold as such or can be added to concentrate mixture to prepare fortified marketable products for high yielding animals. Entrepreneurship can be developed and run successfully in this area with technical backstopping of the concerned research institutions.
- **Bypass fat:** Specialized fat containing products that bypass the ruminal environment and become available at intestinal level are available. Bypass fat is used to increase the energy density of the feed. Fat is either converted to salts by alkali treatment or is coated with fat or formaldehyde treated protein. An entrepreneur can set such a bypass fat manufacturing unit.

**2.7 Export oriented quality fodder and fodder product:** There is a huge demand especially in gulf and middle-east countries for good quality fodder and fodder products like oat hay, breakfast oat flakes, alfalfa hay, silage etc. Hence enterprises can specifically target the international markets and build

value chains that might benefit even the farmer producers with small/marginal holdings.

- 2.8 Non-conventional fodder:** This is another area where enough scope exists for enterprises for production, packaging and marketing of non-conventional fodder from Hydroponics, Azolla, Moringa, subabul leaf meal, Sugarcane top, lathyrus products, fodder sugarcane, thorn less cactus, silage from horticultural waste, etc. Azolla, a protein rich green fodder, can be made easily as it provides round the year green supply at very low cost. The portable unit can be made at very low cost, and the dried and conserved azolla products can be marketed as such or as ingredients of fodder blocks or concentrates. Similarly, hydroponic units can produce grain sprouts to provide nutritious fodder to the livestock especially during lean period and also in inaccessible areas.
- 2.9 Mechanized fodder cultivation:** There is a huge demand of machineries for various specified operations in fodder cultivation, such as green forage harvest, grass seed collection, forage grass seed pelleting, feed pelleting, complete feed block making, baling and densification of crop residue and grasses etc. There is also scope for custom hiring centers where such machines can be made available on rental basis to the stakeholders. Drones and sensor based technologies also have a scope for grassland survey, seed pellet sowing, etc.
- 2.10 Knowledge sharing/ e-platforms, database generation and sharing:** Since green forage is a highly perishable material, the market availability and assured lifting is of much concern to the fodder growers. Improving market knowledge, e-markets for better prices to farmers and products to consumers, operational decisions to optimize yield and boost revenue, better quality inputs, product designing as per consumer demand etc. are required for marketing of quality fodder. For knowledge sharing at village/ tehsil/ block levels by trained personnel, their connectivity through e-services, mobile platform etc. is the need of the hour. One such successful example is 'e-GOPALA' - a platform for dairy entrepreneurs by NDDB.
- 2.11 Human resource development:** Educated youth from villages or blocks can be trained and connected through mobile/ e-platforms to give need based seasonal advisories to farmers/ livestock keepers on various aspects as followed by different departments. Consortium of farmers' association, marketing professionals, FPOs can be made. Suitable examples are 'pashu sakhi' or ration advisories of NDDB who act as community resource persons. Facilities/

laboratories like testing for quality and anti-quality factors like aflatoxin B1 etc of silage, feed blocks, on site quality checks through handheld equipment are needed for quality control.

### 3. ENTREPRENEURSHIP SCENARIO AND NEED

India is the home of young and aspiring minds having tremendous potential to contribute significantly to the economy and employment generation. India ranks third in technology driven production start-ups (4200-4400) next only to the USA (47000-48000) and the UK (4500-5000). There are 450+ agri tech start-ups in India of which 25 have global presence. More than 50% of the agri-tech start-ups are into supply chain, market linkage and access to inputs segment. Fodder production could be one of the potential areas for start-up in different ecologies of the region for the youth including women.

#### Role of different agencies

- ◆ **ICAR institutes/ SAUs/ NARS system** - Technological mentoring, training and capacity building, products/ prototype development licensing on pilot scale, public testing, IP protection and branding management. Preparation of business plans and Detailed Project Report (DPR).
- ◆ **Private partners/ entrepreneurs** - Investment, advertisement and marketing, large scale production, subsidiaries or allied business solutions, linkages with various stakeholders.
- ◆ **Cooperatives/ organizations like milk federations/ NDDB/ NSC/ SSC / IFFCO** – Assessment of block wise/state wise need, market survey, product popularization, raw material management for large scale production, problem solving mechanism.
- ◆ **Government departments like DAC and DAHD** - Policy on feed security/ subsidy, incentives for entrepreneurs in feed and fodder, scheme formulation and implementation with budgetary provisions, centrally sponsored schemes, credit flow management with bank loans etc., popularization of technologies, export of products, quality control with suitable legislation, referral labs for quality testing, need based research funding/ warehouse for fodder storage.

In general, agribusiness companies / start ups, commercial dairy owners/ milk cooperatives, village based self-help groups/ Gram Panchayats/ FGPOs/ FPOs are clients for feed and fodder technologies. There are several central as well as state government policies, which can be utilized for enhancing the capital inflow



for entrepreneurship and start-ups in the sector. National Livestock Mission of the Department of Animal Husbandry and Dairying (DAHD), Government of India provides incentives to the potential entrepreneurs for setting up fodder and feed related enterprises, fodder seed production chain etc. Other schemes in favour of the sector include E-PashuHaat, Livestock Insurance Scheme, Rashtriya Gokul Mission, and National Livestock Mission etc.

#### 4. RECOMMENDATIONS

Animal feed and fodder is needed for nationwide ruminants living in >700 districts of >6600 blocks with >2.5 lakhs gram panchayats, >6.6 lakh villages, and >10 crore households. We also need to feed crores of stray animals sheltered in nearly 3200 registered and nearly 20000 unregistered gaushalas/ temporary sheds/ pinjara-poles.

However, entrepreneurship for quality fodder production is a multi-stakeholder venture; hence any strategy designed in isolation may not be successful. Suitable policy formulations are needed for viable and thriving entrepreneurs and enterprises/ start-ups in the feed and fodder sector to cater largely the need of livestock sector for the betterment of human and environmental health as well as for rural economy.

The common hitches affecting the entrepreneurship in feed and fodder items are the lack of interest of entrepreneurs due to high volume-low value products, seasonal demands, laborious practices, and low grade-low value roughages. However, fodder and livestock scenario clearly indicates that the technologies are needed for better animal management, productivity improvement, health management, input saving, nutrient balancing, processing and value addition. For this, entrepreneurship development and capital investment is highly relevant.

Proper assessment of the feed and fodder demand is the starting point, which follows production, storage and marketing. Not only the commercial dairy owners, the livestock farmers are currently facing challenges in getting sufficient quantities of nutritionally superior fodder and feed to maintain economically viable livestock production. There exists a bright future for the feed and fodder industry to make available certified and balanced feed that eases the most difficult and financially critical task of animal feeding for the farmer. Further, the Indian hinterland and rural farmers still unorganised and in desperate need for technological intervention are slowly and steadily transforming owing to the proliferation of dairy-tech start-ups. Comprehensive fodder mission involving various stakeholders is, therefore, need of the hour.

- ◆ There is a need for **National Grazing Policy and Common Property Resources (CPR) management** along with suitable grassland and pastureland

rehabilitation initiatives at state and national level. Wasteland/ rangeland development for higher fodder production by introducing suitable government policies/ funding with local participation and management is required. **Grassland Rejuvenation Plan** should be developed and implemented jointly by the government, farmer organizations/societies and local communities.

- ◆ To overcome the natural calamities and meet the demands in the lean period, there is a need of **Fodder bank** at block level. It can be 'live' with fodder trees, bamboos, perennials as well as value added conserved dry forage and edible crop residues.
- ◆ **Fodder seed:** A '**National Fodder Seed Grid**' should be developed involving multiple stakeholders. Block level "Seed Producers Club"/Seed village hubs should be formed by giving support in terms of seed quality control, processing, guaranteed marketing, packaging and storage. Presently fodder seed production is not remunerative as the demand-supply chain is not assured. Policy initiatives are needed to encourage entrepreneurs and farmers to take up the production of improved varieties by providing incentives, assured procurement, remunerative price and assistance of inputs. A consortium of forage crop improvement Institutes and SAUs with NSC and State Seed Corporations in liaison with NDDDB and State Dairy development boards holds the key to planning quantum of seed to be produced in regional clusters and to provide better access to quality seeds (Fig.1).
- ◆ **Frontline demonstrations on fodder crop technologies:** In other crops like cereals, pulses, oilseeds etc. DAC&FW, GOI is providing funds to agencies for conducting frontline demonstrations for popularizing the new technologies especially new varieties. Similar funding needs to be allocated for the demonstration of new fodder varieties and technologies as well. Awareness among farmers about new varieties through live demonstrations/ village awareness programmes through KVKs and other means is the need of the hour.
- ◆ **Incentives for fodder production and preservation:** Cultivable land in India is mostly used for food and commercial crops and fodder crops are restricted to degraded and marginal lands. Preservation practices of fodder in different forms such as silage, bales, fodder blocks, etc., are minimal among farmers mainly due to lack of awareness. Similar to fodder bank, preserved-product warehousing are needed to adequately store and meet lean period demand as well as to overcome natural calamities like flood, drought etc. These need policy support as well as incentives.

- ◆ **Value chain in the feed sector:** There is a need for strong forward and backward linkages to build successful value chain. Lack of such a strong chain is often resulting in the lack of availability of required feed and fodders for livestock due to various factors like absence of technological inputs, lack of proper data on seasonal demands, unavailability of ingredients locally at lower cost etc.
- ◆ **Biofortified/ enriched crop residues:** There is a need to develop biofortified forage varieties either through agronomical practices or by breeding. Balance of trace elements like zinc and selenium are essentially required to maintain the immune system and overall health of the animal. A consortium of forage, pulse, millets and maize research institutions can be formed for precise estimation of micronutrients, enrichment and development of marketable technologies and training for potential entrepreneurs to develop biofortified crop varieties and fortified crop residue bales, blocks, TMRs etc.
- ◆ **Regular Interface meetings:** There should be a regular interface meeting involving various stakeholders such as DAHD, ICAR, IGFRI, NDDDB and State AHD & Milk Cooperatives once/ twice in a year. An effective functional monitoring team may be formed to upscale seed indents of improved varieties from various State AHDs & Milk cooperatives. National Seeds Corporation has to play a proactive role at national level not only for production but also marketing of forage seed through their network across the country.
- ◆ **Digital platforms for fodder, feed and seed:** Development of digital platforms to link farmers, feed manufacturers, dairies, cooperatives, fodder seed and other input providers is needed to help the demand-supply chain to operate effectively in order to supply fodder at affordable prices and avoid wastage of products. Such platforms can be managed by ICAR or DAC or DAHDF. Digital platforms are to be used for precision fodder cultivation, monitoring of tree fodder species etc.
- ◆ **Public private collaboration for promoting fodder varieties:** NARS system has developed a lot of superior high yielding, nutritive, multicut and single cut fodder varieties; however, engagement of the private sector in partnership with the public institutions for promotion of such varieties is very poor. It is causing hindrances in wider adoption of varieties and availability of sufficient quantities of quality seeds. Entrepreneurship development in feed and fodder needs higher levels of private and public investment.
- ◆ **Need of reliable statistics:** National and state level planning regarding fodder and feed requires proper data. There is a need for mapping areas for commercial fodder and fodder seed production with necessary infrastructure. The Central

and State Animal Husbandry departments as well as the knowledge institutions have to join hands to work on these aspects.

- ◆ **Crop residue utilization policies:** Suitable policy is needed to regulate export of protein sources like cotton seed and promote diversion of crop residues for animal feed blocks.
- ◆ 'Quality control standards' and 'Referral testing laboratories' should be developed for feed, silage, mineral mixture and other products.

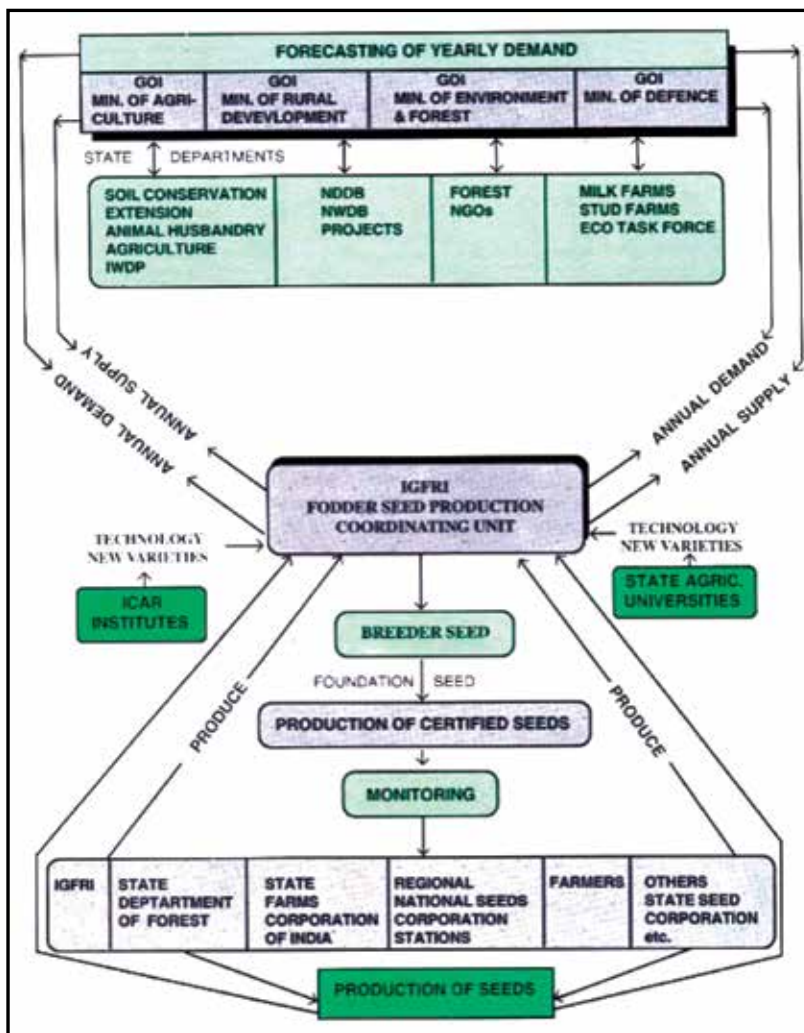


Fig. 1: Seed Resource Networking (Adopted from IGFRI Vision 2050)

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