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Assessment of Livestock Feed and Fodder in Rajasthan

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Foreword

Rajasthan is rich in agro-ecological diversity and has a wide range of unique livestock production systems that have evolved in different regions in tune with the naturally available resources and needs of the people. This diversity begins with the choice of species reared; breeds that have evolved, management and feeding practices, health care systems that are closely linked to the natural flora and fauna, and local marketing systems. Animal Husbandry in Rajasthan is a major economic activity contributing approximately 10.21 per cent to the total GDP of the state. Agriculture and dairying have always been inter-dependent in the state. The cultivator depends largely on bullock power for tillage, irrigation and carting. Milk and milk products constitute the only source of animal protein for a sizable vegetarian population. Milk is also an item of cultural importance. Milk products are an integral constituent of religious ceremonies. As per the livestock census of 2012, there were 577.32 lakh animals in the State. Rajasthan accounts for around 7 per cent of the country's cattle population while contributes about 11 per cent of the total milk production. Besides, State contributes about 30 per cent of the mutton and 31 per cent wool produced in the country. Rajasthan rank first in wool production while second in milk production. The state has three native cattle breeds, viz. Rathi, Tharparker and Nagori, having great deal of endurance. Rathi cattle breed is reared for dairy purposes in the northern districts of Shri Ganganagar, Bikaner and parts of Jaisalmer which are irrigated or partially irrigated arid zones with alluvial or loamy soil. The Tharparkar cattle breed is native of the Jodhpur and Jaisalmer districts in eastern region of the state which has arid climate characterized by low rainfall and desert soil.

Though India is the highest milk producer country in the World but milk production per animal per year is very low. Deficiency in quantity and quality of fodder is one of the major cause of this low productivity. The animals need proper feeding to meet their nutrient requirement to express their full genetic production potential. Deficiency of green forage is mainly due to non-availability of land for fodder cultivation. India has vast tracts of grazing land, most of which has fragmented or become degraded due to lack of appropriate policy interventions and management inputs. Fodder are cultivated or grown naturally on degraded and marginal lands with minimum inputs, in terms of fertilizers water and operational energy. Moreover, in case of forages, regional and seasonal deficiencies are more important than the national deficiencies, as it is not economical to transport the forage over long distances.

The marginal and small farmers own only 44 per cent of the agricultural land while they own 80 per cent livestock assets. Quite logically, if the income of the farmer is to be doubled by 2022 as per the vision given by the Hon Prime Minister in 2016, then livestock is perhaps the best and most available assets to enhance farmers income due to higher availability of the livestock as compared to land as an asset for income generation. While overall productivity of livestock has been low in past, because of inadequate nutrition from green fodder, along with dry residue and protein concentrate. As per NIANP (ICAR) estimate, there is shortage of up to 36 per cent of green fodder and protein concentrates besides up to 23 per cent shortage of dry fodder. In view of same, the Ministry of Agriculture and Farmers Welfare, Government

of India entrusted this study to our Centre. The study is based on both primary and secondary level data. The study came out with important and relevant policy implications which would help to plan to increase the area under fodder cultivation and milk production in the country and also doubling the income of the dairy farmers.

I am thankful to authors and their research team for putting in a lot of efforts to complete this excellent piece of work. I also thank the Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, Government of India for the unstinted cooperation and support. I hope this report will be useful for policy makers and researchers.

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List of Abbreviations

Av.	-	Average
CAGR	-	Compound Annual Growth Rate
CB	-	Cross Breed
CP	-	Crude Protein
DADF	-	Department of Animal Husbandry, Dairying and Fisheries
DCS	-	Dairy Cooperative Society
DES	-	Directorate of Economics and Statistics
Dist.	-	District
DM	-	Dry Matter
FAO	-	Food and Agriculture Organization
FASR	-	Food & Agribusiness Strategic Advisory &Research
GCA	-	Gross Cropped Area
GDP	-	Gross Domestic Product
GOG	-	Government of Gujarat
GOI	-	Government of India
GSDP	-	Gross State Domestic Product
GVA	-	Gross Value of Agriculture
GVO	-	Gross Value of Output
ha	-	Hectare
HH/hh	-	Household
HYV	-	High Yielding Variety Seeds
IGFRI	-	Indian Council of Agricultural Research
kg	-	kilograms
LRP	-	Local Resource person
LTPD	-	Litres per day
mha	-	Million hectares
MOA	-	Ministry of Agriculture
mt	-	Metric Tonnes
NATP	-	National Agricultural Technology Programme
NCAER	-	National Council of Applied Economic Research
NCDFI	-	National Cooperative Dairy Federation of India

NDDB	-	National Dairy Development Board
NDP	-	National Dairy Plan
NITI	-	National Institution for Transformation India
Nos	-	Numbers
NSDP	-	Net State Domestic Product
NSSO	-	National Sample Survey Organization
RLU	-	Ruminant Livestock Units
Rs.	-	Rupees
SAP	-	State Agriculture Plan
SAU	-	State Agricultural Universities
SC	-	Scheduled Caste
ST	-	Scheduled Tribe
TDN	-	Total Digestible Nutrients
TL	-	Truthful Seeds
VOO	-	Value of Output

Executive Summary

Assessment of Livestock Feed and Fodder in Rajasthan

H. Sharma, S. S. Kalamkar & T. Parihar[1]

1. Introduction:

Animal husbandry in India is closely interwoven with agriculture. It plays an important role in the socio-economic development of millions of rural households thereby contributing importantly in the national economy. Livestock rearing is one of the most important economic activities in the rural areas providing supplementary as well as stable income round the year. This sector has also emerged as a vital sector for ensuring a more inclusive and sustainable agriculture system. Evidence from the National Sample Survey Office's (NSSO) 70th round survey (2014 & 2014a) showed that more than one-fifth (23 per cent) of agricultural households with very small holdings of land (less than 0.01 hectare) reported livestock as their principal source of income. More than 70 million of the reported 147 million rural households depend on dairy, in varying degrees, for their livelihoods. Marginal, small and semi-medium farmers with average operational holdings of area less than 4 ha own about 87.7 per cent of the livestock of India. By controlling 64 per cent of the bovine, 70 per cent of ovine, 73 per cent of caprine and 70 per cent of the poultry population, the small holders contribute substantially to livestock production. Dairying has become an important secondary source of income for millions of poor and rural households and has assumed an important role in providing employment and income generating opportunities particularly for marginal and women farmers. This is the sector where the poor contribute to growth directly instead of deriving benefits from growth generated in other sectors of the economy. This sector has created a significant impact on equity in terms of employment and poverty alleviation as well. It cannot be merely a co-incidence that the level of rural poverty is significantly higher in states where livestock sector is underdeveloped.

2. Need for the study

Dairy Industry in the country has shown spectacular growth during the last few decades. With an expected production of about 188 million MT of milk by the end of 2018-19, it is estimated that annual requirement of green fodder will be to the tune of 1,100 million MT and dry fodder to the tune of 610 million MT. The current availability of green and dry fodder, however, is estimated at 500 million MT and 380 million MT respectively. Efforts to increase livestock productivity / production is constrained by feed /fodder shortages. The shortages tend to be even more serious during natural calamities. To improve the availability of fodder, there is very little scope to increase the area under fodder cultivation, particularly in view of the growing demand of human beings for food, fiber and shelter. It is therefore necessary to increase the availability of fodder by increasing the productivity of available forage resources per unit area, improve the efficiency of fodder utilization and minimize the fodder wastages to increase and thereby reduce the gap between demand and supply. The present average green fodder yield of 40 MT/hectare/year of cultivated land and 0.75 MT/hectare/year for common grazing land are too low and there is huge potential to improve their productivity through adoption of latest technologies.

The country's estimated demand for milk is likely to be about 200 million tonnes in 2021-22 (NDDB, 2014 & 2014a). To meet the growing demand, there is a need to increase the annual incremental milk production from 4 million tonnes per year as was the case for the last 10 years to 7.8 million tonnes in the next 8 years (total 210 million by 2021-22). To meet

[1] Agro-Economic Research Centre, Sardar Patel University, Vallabh Vidyanagar, Anand, Gujarat

the growing demand, it is necessary to maintain the annual growth of over 4 per cent in the next 15 years. Quantum jump in milk production is possible through increase in productivity, and linking small holders to dairy cooperatives/producer groups/SHGs with forward linkages having milk processing facilities. Adequate availability of feed and fodder to livestock is vital to increase their productivity and also to sustain ongoing genetic improvement initiatives. The supply of feeds has always remained short of normative requirement. The situation is further aggravated in Rajasthan and Gujarat where considerable area falls in arid and semi-arid zones. Keeping this background, the study examines demand, supply, and a deficit of feed and fodder production in the Gujarat.

3. Data and Methodology:

The study is based on both, the secondary and primary level data. The study is based on both secondary and primary level statistics. The secondary data on livestock population of all selected states are compiled from published sources. To understand and analyze the demand for and supply of feed and fodder, primary data were collected from the field level through a sample survey method. As per the sampling framework, data were collected from three selected districts from three regions of the state, i.e. Ajmer, Barmer and Udaipur represents three regions of the state viz. Central, West and South as well as three different ACZs of the state viz. IIA& IIB; IA; and IVA of the state. The reference period of the study was 2019-20 agricultural year.

4. About Study Area:

Rajasthan is the largest state having about 10.41 percent of the total geographical area of the country. It supports 5.5 percent of human population and about 11 percent of the country's livestock population. Agriculture and allied activities, however, remain the primary and major economic activity in the state providing livelihood to 66 percent of the state's population. Because of the limited water resources, most of the agriculture production is rain-fed and thus, the livestock sector assumes more importance. Animal husbandry is not only a subsidiary occupation to agriculture but it is a major economic activity, especially in the arid and semi-arid regions of the Rajasthan. Livestock sector development has a significant positive impact in generating employment and reducing poverty in rural areas.

Rajasthan is rich in agro-ecological diversity and has a wide range of unique livestock production systems that have evolved in different regions in accordance with the naturally available resources and needs of the people. This diversity is associated with the choice of species reared; breeds that have evolved, management and feeding practices, health care systems that are closely linked to the natural flora and fauna, and local marketing systems. Development of livestock sector therefore is a critical pathway to rural prosperity. This fact in context to Rajasthan is well established where agricultural operations offer less promising prospects due to extreme geo-climatic conditions and uncertainty of rains. As such livestock operations have expressed their superiority over crop farming in terms of growth, stability, resource conservation and uplifting the socio- economic status of the inhabitants.

Animal husbandry and livestock sector contribute a lot in state economy, and has particularly great potential in rural area. The potential of crop production depends upon huge investment, weather and meteorological conditions. In contrast, animal husbandry and livestock is more stable and requires lesser investments. Livestock and poultry have proved to be life saviour in many distressed conditions, especially in case of drought. The livestock population of the state was 577.32 lakh (2012). Rajasthan is considered as 'Denmark of India'. The total milk production in Rajasthan was 22.43 million tonnes in 2017-18, and ranked second in India. Animal husbandry is a major economic activity contributing

approximately 11.19 percent to the total GSDP of the state in 2018-19. The contribution of agriculture and livestock to total GSDP was estimated to be 35.38 percent, while contribution of livestock to agriculture and livestock together was around 32 percent. Thus, one third of the agriculture sector output comes from livestock sector. The share of GVA from livestock to agriculture sector and livestock has been fluctuating over the period of last more than one and half decade and remains between 20-32 percent. However, the contribution of Gross Value Added from agriculture and livestock to total GSDP has increased from 34.55 percent in 2011-12 to 35.38 percent in 2018-19. Rajasthan accounted for 12.97 percent share in value of output from milk (at current prices) in the country during 2015-16, while its share was 11.15 percent in total value of output from livestock in the country during 2015-16 (GOI, 2018, GSDP).

The state of Rajasthan is rich in livestock wealth. State is blessed with the best breeds of cattle, sheep and camels in the country. The climatic conditions are adverse with scarcity of water for irrigation and erratic rains with very low average annual rainfall. These conditions leave a little scope for crop production and enhance the importance of animal husbandry over the crop production especially during recurrent droughts. The Nineteenth Livestock Census (2012) of India placed total livestock population at 512.1 million, out of which, 57.73 million livestock (11.3 percent) population was in the state of Rajasthan. The state accounted for 6.98 percent share in cattle population, 11.94 percent of buffalo population, 13.95 percent sheep population and 16.03 percent goat population of the country. The district-wise share in total state livestock population figures indicate that Barmer district (9.30 percent) had the highest number of livestock population followed by Jodhpur, Jaisalmer, Nagour, Jaipur, Udaipur, Bikaner, Bhilwara and Pali. These nine districts together accounted for 49.21 percent of total livestock population in the state. Jaipur district had the highest number of in-milk crossbreds and buffaloes. Bikaner had the highest number of in-milk indigenous cattle followed by Jodhpur and Barmer district. In milk indigenous cattle like Tharparkar cattle breed is native of Jodhpur and Jaisalmer districts in eastern region of Rajasthan whereas Rathi cattle breed is reared for dairy purposes in the northern districts of Shri Ganganagar, Bikaner and parts of Jaisalmer which are irrigated or partially irrigated arid zones. The highest livestock and bovine animal density was recorded in Bharatpur.

Rajasthan ranks second among the milk producing states in India, achieving 224.27 lakh MT in 2017-18, which has increased from the 41.46 lakh MT during 1985-86. A numbers of initiatives were taken by the government which could help in improving the milk productivity over the period. Despite of increase in milk yield, there is still a wide scope for improving milk yield of milch animals. The reason cited for this is inappropriate feeding as well as inadequate supplies of quality feeds and fodder in addition to the low genetic profile of the Indigenous breeds. It is not possible to achieve higher productivity in milching animal by merely increasing its genetic potential. Due attention needs to be given to proper feeding of milching animals. There is no shortcut to sustain livestock husbandry, without addressing the development of fodder and feed resources. As against the estimated animals' requirements, feed resources available in Rajasthan are lower. It is estimated that against the requirement of 375 lakh MT of dry fodder, state availability was of 368 lakh MT of dry fodder. It can been seen that during the last two decade (1992 to 2011), shortage of dry matter in the State increased from 29.01 percent of the requirement to 51.88 percent during corresponding years.

In Rajasthan, the livestock keepers have traditionally relied on common grazing lands "gochars", scared groves "orans" and forests. With the growth of mining industry and allocation of community wastelands for biodiesel plantation, the permanent pastures and other grazing land has reduced from 1.9 million ha in 1990-91 to 1.7 million ha in 2009-10. Often layers of white marble dust choke neighbouring grazing land. Rajasthan is a leader in crops like sorghum, pearl millet (bajra), pulses, oil seeds, wheat and rice, all of which in some way or other, form parts of compound livestock feed. Rajasthan also produces non-

conventional ingredients, which can be integral part of the feed raw material. Now the dairy farmers are shifting from extensive open grazing system to semi-intensive and intensive stall feeding system. Green fodder is a comparatively economical source of nutrients. However, the availability of green fodder is lower than estimated requirement. In Rajasthan, the area under fodder crop to state gross cropped area increased from 15.93 percent in 2008-09 to 20.26 percent in 2012-13. Bikaner District had the highest area under fodder crops followed by Churu, Hanumangarh and Jaisalmer District.

5. Findings from Field Survey

- The various socio-economic factors for instance size of family, education and training of dairy producer, availability of land and off farm income, experience in dairy, etc have direct influence on dairy farmers' decision to whether they want to expand and improve their dairy operations. Average age of the selected household head/respondent was around 47 years of which almost one third of them found to be illiterate. The remaining half of the household respondents were educated mostly up to the highest level of high schools except few of them were found graduated. Out of the total selected respondents, almost 62 per cent were from backward classes, followed by around 18 per cent from open category, 15 per cent from Scheduled tribe and rest of them were from Schedules Tribe. Most of the selected households respondents were male (93 per cent) and very few (7 per cent) were female respondents.

- The selected households had slightly higher experience in farming business (23 years) followed by dairy (22 years) and sheep and goat rearing (11 years). The average family size was found to be 6.7 persons and the highest share of family members were found to be primarily engaged in farming business (39 per cent) followed by 36 per cent in dairy and rest of them were in sheet and goat farming. The main occupation of the selected households was agriculture comprised of cultivation of land as a farmer along with supportive allied activity of animal husbandry and dairying. Agriculture was the primary occupation of 82 per cent households followed by animal husbandry and dairy (13 per cent) and very meagre share of household depends on labour activities. Own farm establishment and self employment were other major sources of occupation. The annual average income of the selected households was estimated to be Rs. 135559/- followed by Rs. 48640/- from dairy, Rs 10102/- from sheep and goat rearing. Around 71 per cent of the selected households were found be a no association with any social and cooperative organisations.

- On an average, operational land holdings was estimated to be small to medium size of holdings having 2.12 ha of which 82 per cent land was irrigated. It was very surprising and pleasant to note that almost 19 per cent of total operational holdings was devoted to fodder crops, while same was slightly higher in case of land under irrigated condition (19 per cent) as compared to 18 per cent land was under fodder by rainfed land holders. The groundwater the main source of irrigation (more than 7 per cent) followed by surface sources such as canal and tank.

- The cropping pattern of the selected households indicates that highest area under fodder crops was recorded during kharif and rabi season. Besides, during kharif seasons, supportive crops which by product can be used as fodder crops such as maize, bajra, moong, urad and lucerne were grown. The fodder cultivation is found to be relatively profitable than other crops.

- The details on fodder and feed fed to the animals indicate that the more than 94 per cent selected buffalo and Cattle had average age of more than 2 years while around three fifth of sheet and goats were of same age. The average value of sheet for the age of 2 years and above ranges between as high as around Rs. 8167in Udaipur and as lowest as Rs. 7100/- in Barmer district while same was for goat of Rs. Rs.6993/- in Barmer and Rs. 5769 in Ajmer district, respectively.

- The average value of the buffalo, crossbreed cattle and Indigenous cattle for the age 2 years and above ranges around Rs. 50000/- , followed by Rs. 44000/- for crossbreed cattle and Rs. 32000/- for indigenous cows. The lowest value of Indigenous cows was reported to be in Ajmer district.
- The details on the fodder and feed fed to the milch animals indicate that the average feed and fodder consumption of milch animals was ranges between 10- 12 kg of green of fodder followed by 8-11 kg of dry fodder, 2-3 kg of concentrates and very few quantity of the supplements were fed to the adult animals. The quantity of feed and fodder fed to the animals were significantly high for milch animals followed by the heifer pregnant, dry animals and rest of them. Besides stall feeding, the animals were also taken out for grazing for few years on each day. The small ruminants were mostly fed outside by taking out for grazing and very few of the households had fed them with the dry fodder and some concentrates. On an average, animals were also taken out for grazing for 4-7 hours on each day.
- The total requirement of feed and fodder using the standards given by the NATP database and as per the available data of livestock census of 2012 was to be 137795 tonnes of green fodder, 132525 tones of dry fodder and 14552 tones of concentrates per day. With respect to green fodder availability, the production is estimated through a potential production per unit hectare from the land classification data of the State of Rajasthan for the year 2016-17 and was estimated to be 225638 tonnes. The main crops residues available for livestock in the state are bajra, paddy, wheat, pulses, oilseeds and sugarcane. The percent gap between the requirement and availability has been computed which indicate that State is severely deficit in green fodder followed by availability of concentrates. The dry fodder availability is relatively better but shot of around 12 per cent of actual requirement.
- The major sources of livestock feed reported by the sample households are crop residues was major source of the livestock feed followed by tree legumes. Half of the respondents depend on the improved forage and pastures, household left over. Very few household have reported use of grazing land and feed preserved feed in storages. Very few households have cattle shed and majority of them are kuccha in nature of which few are within house. While in case of shed for sheep and goat, very few of same of kaccha nature.
- As dairy activities are carried out as complimentary activity to agriculture activities, the labour use pattern by the selected sample households indicate the significant involvement of female in dairy activity (buffalo, crossbred cows and indigenous cows) while in case of sheet and goats, male were engaged may be mostly for grazing them on the field. The time spent on management of dairy business for the stall feed animals was estimated to be around 2-3 hours per day while same was about 3-5 hours for small ruminants. The net returns realised by the sample households shows that the highest milk yield realised by the sample households from crossbred cattle (9.52 lit/day) followed 7.15 lit/day from buffalo and 5.83 lit/day from indigenous cows. While the milk yield of small ruminants animals was reported to be around half a litre per day. Therefore, there is a huge scope to enhance producers' income from dairy by enhancing animals productivity, improving management practise, and ensuing remunerative prices.
- The details on constraints faced by the sample households indicate that the top most constraints faced as expected were non availability of adequate irrigation water, high cost of cultivation/production and low return on fodder production, poor Livestock extension services, land is very less therefore cannot afford to put more land under fodder seed/crop production and High cost of fodder seed. The other major constraints reported are non availability of labour and no provision of quality seed by society on credit and non availability of quality fodder seed in market.

- The adoption of post harvest techniques plays important role in conservation of dry and green fodders for long period to be sued during off seasons. It was very strange to note that despite of the fact that fodder availability has direct relation with milk productivity as well as health of the animals, none of the household had adopted any post harvest technique, which indicate failure of the agricultural extension mechanism/department of animal husbandry in training the farmers for such techniques (e.g. hay making, silage, etc). The major reasons for non adoption of these post harvest techniques were highly expensive to adopt the post harvest techniques (28 per cent), followed by considered it inferior in comparison to fresh one (28 per cent); lack of awareness on production and post harvest management (26 per cent) and more laborious (18 per cent)
- It was strange to note that hardly 3 per cent of total households have reported that they have benefited from government and dairy cooperative having availed Cattle facilities, Mineral Mixture, fodder seed while one each household had received support of cattle shed subsidy and seed distribution kit. Around 96 percent of households reported that they did not received any support from the government net or dairy. The top two suggestions made by the selected households were Green Fodder bank should be provided by Govt and Need irrigation facility, while 86 per cent households did not provide any suggestion.

6.Conclusions and Policy Recommendations:

- Animal husbandry and livestock sector contribute a lot in state economy, and has particularly great potential in rural area. The potential of crop production depends upon huge investment, weather and meteorological conditions. In contrast, animal husbandry and livestock is more stable and requires lesser investments. Animal husbandry contributed over 11 percent to the Gross State Domestic Product. More than 80 percent rural families keep livestock in their households. About 35 percent of the income of small and marginal farmers came from dairy and animal husbandry. In arid areas, the contribution was as high as 50 percent. The sector has potential to create employment in rural areas with least investments as compared to other sectors. Milk contributed to around 28 percent to the agricultural GDP of Rajasthan and is one of the biggest sectors for supporting livelihood in the state. This suggests that public investment in the livestock sector should be enhanced to help the smallholder livestock producer, which derives their larger share of income from the livestock sector.
- There is a lack of adequate and genuine data on production and availability of various types of fodder and feed grains. Therefore, competent agencies should be encouraged to generate real time and time-period data on fodder production, feed grain production, land availability for grassland and other pasture grounds, etc. Existing networks involved in data collection for cost of cultivation and other such established sources should be engaged and expanded to collect such real time information as well.
- The fodder crop cultivation was estimated to be more profitable as compared to other competitive or cereals crops grown during kharif and rabi seasons. Therefore, milk union and PDCS need to give more attention of fodder development program.
- Shortage of quality fodder and feed is another major constraint for dairy development. The gap between the requirement and availability of feed and fodder is increasing due to increasing livestock population as against decreasing area under fodder cultivation and reduced availability of crop residues as fodder. Besides common property resources are continuously shrinking due to over grazing of the existing grass land. Therefore, there is a need to frame strategies for sufficient availability of good quality

feed and fodder for efficient utilisation of genetic potential of the various livestock species and thereby sustainable improvement in productivity.

- Fodder based cheaper feeding strategies are required to reduce the cost of production of quality livestock since feed alone constitutes 70 percent of milk production cost. To meet the current level of livestock production and its annual growth in population, the deficit in all components of fodder, dry crop residues and feed need to be met by either increasing productivity, utilising untapped feed resources, increasing land under fodder cultivation. In parallel, appropriate veterinary research regarding the sources of cost-effective nutritious feed should also be encouraged, tested and informed to the farmers.
- Due to inadequate rainfall during rainy season, the quality and quantity of fodder production gets affected. Thus, there is a need to develop fodder varieties suitable to agro-climatic conditions of the area.
- Efforts need to be made to increase production of quality fodder seeds through necessary incentives, arranging foundation seeds of different high yielding fodder varieties and modern scientific farming procedures. Accordingly more seed plants should be established and farmers should be incentivized and trained to participate in such programmes.
- Efforts are required to increase area under fodder cultivation, especially through use of barren and fallow lands and silviculture. Appropriate resources and technologies need to be made available to ensure quality fodder seed production. Fodder cultivation in degraded land and forest land need to be taken wherever possible with the help of farming community. Round the year availability of quality fodder through promotion of hay, silage and fodder banks, need to be emphasised. Non conventional sources of feeds such as azolla, processed vegetables and fruits waste, etc need to be promoted.

- While fertile lands with assured irrigation are diverted for growing high value crops, large stretches of marginal and wastelands are lying under-utilised across the country. There are also opportunities to introduce fodder as an intercrop or as a soil binder under the watershed development programme.

- Most of the fodder varieties presently released for cultivation, are not the most ideal for cultivation on such low productive lands. Identification of suitable fodder species for such areas and developing suitable cultivation practices are necessary to boost fodder production on marginal and wastelands in the future.

- The role of institutions in fodder development especially district dairy cooperatives needs to be strengthened and there should be dedicated fodder officer to take up fodder development activity on large scale.

- Cultivation of fodder crop is not considered as main/ regular crop and therefore fodder crop mostly receives less coverage and attention in allotment of land. It is thus mostly grown on waste/inferior soil or sometime on bunds and field boundary. Farmers should be explained the benefits of growing fodder seed and fodder. Fianacial benefits of producting fodder and fodder seed should be explained to farmers and can be demonstrated with the help of some voluntary motivated farmer.

- It was observed that a fodder market has been working in Kota city for fodder growers and fodder consumers, whereas good number of marginal as well as small farmers or fodder growers participated and earned a lot of income from fodder cultivation. This kind of market should be developed at other places which have fodder shortage or are under developed area with regards to fodder cultivation. The supply channels should also be extended.

- During our field visits at the selected study area, we observed that some of the fodder growers had cultivated efficiently the fodder crop and they had keen interest for the

fodder seed cultivation which are specially grown in these area. Such good results were observed because some special variety of fodder had been cultivated in this area and had also provided higher yield.

- Also the support for fodder storage needs to be provided to fodder growers to minimize the fodder losses and to assure timely availability of the same even during off-season.
- Rajasthan is already bestowed with crucial favourable factors related to animal husbandary and dairy business in the form of ownership of huge number of live stock and many of them are high in endurance. Livestock owners face challenges in the form of harsh climate, difficult arid desert topography, scanty rainfall and fierce summers, scarcity of water for irrigation, among others. However, the courageous farmers can perform very well in terms of producing high yields in dairy business with the support of dairy unions and PDCS.