

## Executive Summary of Project on

### “LIVESTOCK CENTRIC LIVELIHOOD INTERVENTIONS IN SEMI ARID ECO-SYSTEM OF NAGOUR DISTRICT (RAJASTHAN)”

#### 1.0 Project Overview Brief background to the project and a short narrative describing the project's performance and its outcomes.

National Rainfed Area Authority approved a pilot study project to **Gramin Vikas Trust** to look for potential shifts that can help in improvement in livestock production systems Nagaur Rajasthan. The study project was carried out during 2010 to 2014 with aim to demonstrate the viability of livestock production system as a sustainable major livelihood contributor in semi-arid eco-region with effective harnessing of natural resources in an integrated manner.



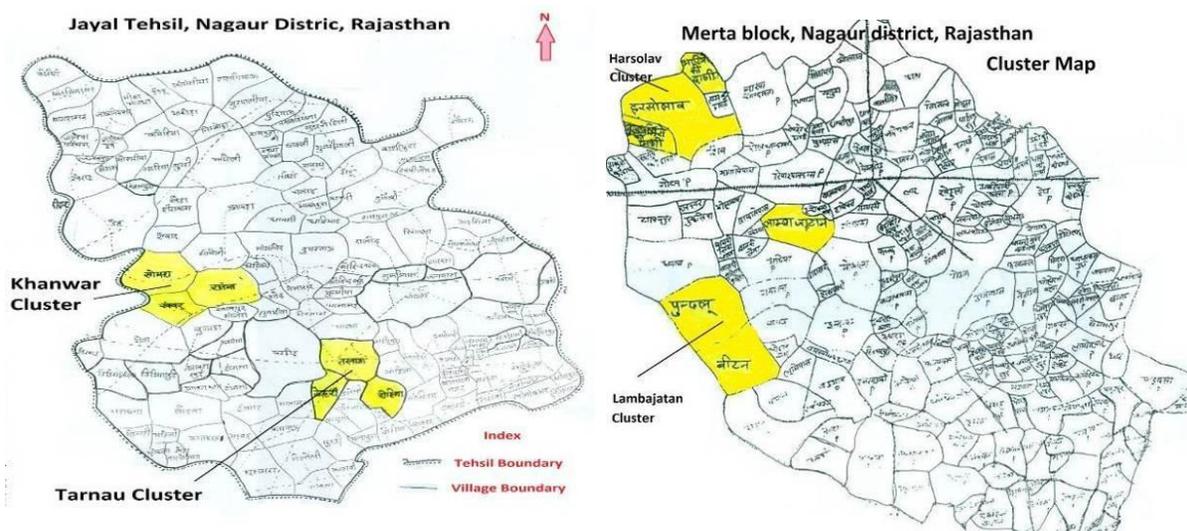
*Location of Nagaur in Rajasthan*

#### 2.0 Project Community and it's livelihood

Based on the agro-ecological, climatic and topographic situation in this arid region livelihoods follow mixed crop-livestock systems and characterized by high variation in production from year to year and place to place. Following are some characteristics of the livelihood of the project community.

- a) Operational holdings in terms of land and cattle are mixed type. 24% families are small and marginal who holds only 4.3% land while 76% large and medium families hold 95.7% lands. General land-holding in the project area is 15-20 bigha with specific land-use as 10-15 bigha rain fed, 4-8 bigha irrigated and 1-4 bigha beed(private pasture land).
- b) Traditionally area was known for cultivating dual purpose crops Bajra, Jwar, Wheat, Gram, Moong, Chawla, Moth, Guar, and Groundnut, but with low productivity. Livestock is important constituent of livelihood therefore farmers cultivate pearl millet, wheat, pulses, sorghum, and groundnut which are also good sources of fodder.

- c) Human-Cattle ratio in the area is 0.94 as against 0.83 of Rajasthan. Animal husbandry is an important source of income and it forms an integrated livestock agriculture production system. It has wide range of milch as well as draught cattle viz: cows, buffaloes, bullock, camel, sheep and goat. Cows, buffalo and goats are the most popular and preferred animals. Average number of livestock is 35 – 36/family with highest number is of Sheep (average 22 – 23 numbers/family).
- d) In Nagaur district 1.3% area is under forest, but Khejari is best fodder tree which can be promoted in pasture and other common areas.
- e) Management of livestock is more or less traditional; 56% households prefer natural insemination; 37% follow castration of local non-descript domestic animals;
- f) In case of animal sickness 67% people ignore or adopt local treatment; 34% families use cattle health and vaccination services; cattle insurance is completely neglected.
- g) Few families use green Lucerne with straws in winter, while in summer, straws was supplemented with leaves and pods of pulses, groundnut and acacia.
- h) For ruminant such as goats, sheep and camels people follow grassland (Oran, Gaucher, Panchayat Pasture, and revenue land) based systems.



### 3.0 Issues and problems in prevailing livelihoods

Livelihoods suffers from low rainfall, high temperature, light textured soils with deficiency in humus, nitrogen, low to medium in phosphorous and high in potassium.

- a) Community is unorganized and 85% families are excluded from financial services

- i.e. not linked to any society, cooperative, bank, insurance, and post-office.
- b) Extension services are neglected and community has limited awareness about the livestock-agriculture production system, problems and project components.
  - c) Farming community lacks participation in extension and research due to lack of communication between research agencies, line departments, academic institutions, development agencies and community resulting in limited knowledge and exposure related to modern technologies and approaches.
  - d) Majority farmers do not cultivate green fodder; Feed resources are inadequate; Fodder wastage due to lack of chopping; poor families do not use balance concentrate feed.
  - e) Low organic matter in soil and wide scale wastage of animal excreta, improved technologies for farm yard composting are not commonly followed.
  - f) Poor water use efficiency due to adoption of flooding systems of irrigation leads to limited irrigated area.
  - g) Limited water and moisture retention in sloping lands leading to higher and fast runoff of rain water. Limited water availability period within rainy season only, ground water is limited and not potable due to higher concentration of dissolved solids, resulting in lack of safe potable drinking water for human, and cattle.
  - h) People do not invest resources, money and time in pastureland development resulting in limited fodder availability from common property resources.
  - i) *Khejari* is most common multipurpose tree supporting small and marginal families in the area but some people believe that *Khejari* cannot be planted.

#### **4.0 Project Objectives:**

Specific objectives set for study project were:-

- Develop appropriate livestock production system(s) in a cluster approach.
- Re-orient crop production systems in the study area for enhanced biomass production for livestock feeding.
- Enhance productivity of livestock through better feeding systems and efficient input delivery.
- Develop appropriate water conservation measures for increased water use efficiency.

- Improvement of common grazing areas/ community lands with innovative approaches.
- To provide value addition and suitable market linkages for livestock products to ensure remunerative prices.

## 5.0 Project Activities:

**5.1** The study was carried out by a consortium of three partners Gramin Vikas Trust Central Arid Zone Research Institute, Jodhpur and Rajasthan Livestock Development Board. **Gramin Vikas Trust** interaction with community, motivating participatory families to participate in demonstration trials, maintain records and also help in support components of water resources development, land development, pasture and fodder development initiatives and analyze their findings. Major interventions carried out by Gramin Vikas Trust during the study project are:

- In this study project the first and foremost activity was social mobilization. The activities such as; village meetings; distribution of seed minikit (5680 kits) of cereals, forage and pulses crops; construction of drinking water hose for cattle (12); and construction of diversion drain etc were organized.
- In all the four clusters, communities were organized as common interest groups (48 groups) and 82 Self help groups under NABARD sponsored SHPI Schemes. The 130 local institutions were formed. The groups provided support in the form of revolving funds for maintenance and provision of common implements such as chaff cutters etc.
- In order to study community response on cultivation of green fodder, it undertook 2000 front line demonstrations including major forage crops eg. Lucerne Alamdar -51, Barley RD-2035, Rijka Bajari Harit kranti, Leelari Jwar and Methi RMT-1.
- The component of tree based fodder included establishing orchards of ber, spineless cactus and other fodder plants; distribution of dual purpose vegetable minikit.

**5.2** To establish proper utilization of dung and to ensure availability of quality manure and to study benefits of their application in fodder crops, during project period NADEP (110 nos including 2 in CPR) and compost pit (382) were constructed.

5.3 In semi-arid and arid situations like that of Nagaur district, Livestock-Agriculture Production System mostly faces the issue of water scarcity. Thus, study project included water resources development component and worked on studying effects of water harvesting through Khadins (4), dugout ponds (6) and Roof Water Harvesting Structures with suction nozzle hand pumps (103) for increasing drinking water availability for cattle as well as human.

5.4 The second component was on water saving, which included drip irrigation systems in orchards (100), sprinklers (150) and irrigation pipes for fodder cultivation.

5.5 1.5 Soil Water Conservation like earthen field bunds with grass and legume seeding (3705 ha), loose stone check dam (113) and waste weir (5) were included and studied their effects on fodder production and improvement in water availability.

5.6 1.6 Each project component included capacity building aspect thus 56 exposure visits, 224 trainings and distribution of 4000 project brochures accompanied regular village meetings, farmers field days, interaction workshops and monitoring visits.

## 6.0 Project Outcomes:

Various interventions were carried out under project and major outcomes are:

- 3000 cattle were provided access to safe drinking water in 12 locations of four clusters of Nagaur district, during summer months when there was scarcity of water.



*Drinking water trough constructed*

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Various health check-up and treatment camps were organized under study project, where 6441 animals were attended and provided treatment.



- Project re-established forage crops of Barley, Leelari Jwar, Rijka Bajari and Lucerne-Alamdar within Livestock-Agriculture Production System of the area with all the participating 4000 families which brought approximately 6000 bigha area (300 ha) under green fodder. It added 6000 tons additional production of green fodder in the study project villages. It helped in reorienting production systems in the area from cash crop to forage crop orientation thus strengthening Livestock-Agriculture Production System.



*Forge Crops*

- Beneficiary farmers submitted that average feeding of lucerne per milch cattle was 15-18 Kg per day. Now 1000 project beneficiary families have increased milk yield of 400000 liters per annum, which is worth Rs.1.20 Cr.
- 200 families associated with 110 NADEP structures created during project produced 660 tons of quality Farm Yard Manure which is worth Rs. 13,20,000/- every year @ an average rate of Rs. 2/kg. Similarly 382 Compost pits produce approximately 6112 tons worth Rs. 1,22,24,000.00/- (at the nominal rates of Rs. 2000/- ton). The first year manure production was applied mainly to fodder crops.
- As regards impact of drip irrigation system, farmers reported 15-20 % additional survival and 40% more vegetative growth in wadi with good foliage development.



*Drip Installation*

- Six farm ponds harvested additional 60000 cum water worth Rs. 6,00,000/- annually even at the rate of one paisa/liter. But the main outcome is helping 2155 cattle for accessing safe drinking water for additional three months beyond monsoon season.
- Project treated 3705 ha land of 2343 families and resulted in increased Bajra production.
- Through sprinkler system 1800 bigha additional land was brought under irrigation. During whole cropping season sprinkler system was used and average 6-8 times in comparison to 4-5 times in flooding system. In this regard 75% families observed 25-75% time saving.



*Sprinkler System*

- Four khadins brought 74 *bigha* fallow lands under cultivation producing 3 quintal per *bigha* and produced 222 quintals Bajra worth Rs. 2,66,400/- @ Rs. 1200/quintals. Besides an increase of 31.28 % yield in grain and 27.27% increase in fodder was observed.
- At *Sant Bhera Baba Gaushala* and *Roop Rajat Gaushala* it was observed that integrated approach of protection, e.g. wire fencing and production of forage crops, fodder tree had increased fodder production ranging between 10-20 quintals/*bigha*
- In silvipasture plot of 10 ha, 5000 fodder plants were grown with good foliage and all plants attained an average height of 3-4 feet and supported 60 tons of dried dhaman production which is worth Rs.60,000/- in its 1<sup>st</sup> year itself. It is expected that within a period of 5 years production will reach to 300 tons (worth Rs. 3,00,000 at mere rates of Rs1/kg).
- Soil and Water conservation helped in checking runoff and rejuvenated 3000 plants. But it was difficult to quantify biomass (30% additional) as reported by community. It is proposed to monitor for next three to five years for real estimates of production.
- Overhead sprinklers unit was Rs. 16000.00 (75mm pipe) and 20500 (90 mm Pipe) of which families contribution was respectively 3300.00 and 5500.00. Remaining amount of Rs. 12700.00 (75 mm) and 15000.00 (90 mm) was supported by project. It was noted that nearly 50% of the farmers share was recoverable during two years period only.

- Additional water harvesting of the area to the tune of **243680** cum through various interventions such as roof water harvesting system, dugout ponds, *khadins*, field bunds, contour vegetative strips and other soil water conservation measures had helped to draw significant linkages with livestock and livelihoods in the form of increased productivity of grain from 2.19 to 2.29 quintals/bigha which was 4.81% additional. Of this additional production (23.16quintals/family) 75.13% is added to saleable produce.



***Dugout Pond***



***Field Bund***



***Outcome of Khadins***

- 25-30% irrigation water was saved using overhead type of sprinkler system in compare to conventional irrigation system in case of wheat, lucerne etc.
- This project also established trust in institutions like *Gaushala* and their pasture land development which provided value addition and suitable market linkages for livestock products and ensure better remunerations.
- With the help of rapport building component, 2292 households produced nearly 1100 tons of vegetables during entire project period. Community started growing some new vegetable varieties and provided green vegetable for eight to ten months for 15000 individuals directly and 10000 indirectly through sell of vegetables in villages, same number of cattle were provided with additional green fodder from vegetables.
- In brief we can conclude that project could lay foundation for rejuvenating appropriate Livestock-Agriculture Production Systems in 12 villages of four cluster with the specific components of soil water conservation, forage crops, fodder saving, water saving, animal health care, water harvesting, etc.

## **7.0 Result & Conclusion:**

All the observations made during the project implementation, sample survey and focus group discussions are put against the issues related to problems and project objectives. The findings are presented against the anticipated project objectives.

### **7.1Develop appropriate livestock production system(s) in a cluster approach**

- Common Interest Groups can play critical role in institutionalizing livestock centric development initiatives and their up scaling. Livestock centric livelihood initiatives cannot be undertaken in isolation; rather it should be evolved as part of integrated Livestock-Agriculture Production System.

- An appropriate livestock agriculture production system for arid and semi-arid area includes all short and long term interventions and technologies those can help in natural resources management (land, water, energy, diversity). It should adopt optimizing productivity of available resources and can create employment round the year and also provide sustainable income opportunity.

## 7.2 Re-orient crop production systems in the study area for enhanced biomass production for livestock feeding.

As far as crop production system in the project area is concerned, the component of distribution of seed in the form of minikit and also demonstration of cultivation of fodder crops focused mainly on dual crops (Grain and fodder). Following are some of the results obtained in this study project.

- Traditionally in Jayal block most farmers were cultivating cash crop like cotton, but front line demonstrations on forage crops and subsequent feeding of green fodder to milch cattle, convinced a good number of farmers to spare 0.8 to 1.0 bigha lands towards forage crops. Sample survey and focus group discussion with beneficiaries of forage cultivation; it had come out that participation in forage cultivation, ensured availability of green fodder to participating families and helped in bringing sustainability in production system. Provision of minikits of different forage crops and training on Package of Practices enhanced green fodder production and milk yield.
- Wadi component with improved varieties of Ber (*Gola & Sev*) and seeding of forestry plants like Marwar Teak, *Khejari*, Shisham, Su-babul, Neem, Ardu and Karonda along farm boundary. It laid foundation for leaf based fodder (ber leaf, *Khejari* loom) availability and also fruits like ber, vegetables, sangria generated income for participating families. Study project also helped in establishing importance of technologies like drip and sprinklers as water saving mechanism for adopting irrigation in fodder crops to improve survival of plants.
- **Perennial Alamdar** variety of lucerne proved as good source of natural and balanced diet for cattle. Discussions with communities which were involved in front line demonstration of fodder cultivation reported that feeding of green lucerne to milch animals hence increase an average 10 to 15% milk production. Consequently within project almost all the participating beneficiaries adopted to green fodder cultivation as part of their livestock-agriculture production system.
- The component of seed distribution as rapport building activity also resulted that 2292 marginalized farmers had got an extended period of green vegetables availability. It was concluded that a continued processes of triggering community led discussion is an important aspect for Livestock-Agriculture Production System.
- In arid regions wastage of farm yard manure is not affordable, thus, NADEP and pit technologies of composting were critical element for reviving sustainability of Livestock-Agriculture Production System.

- Both the methods NADEP and Compost pits were promoted under the project. Application of compost in different crops and production enhancement results observed and emphasized that composting was an important and critical step for revival of Livestock-Agriculture Production System in semiarid and arid regions. Its promotion will certainly improve soil texture, addressing productivity gap and improve economic of farmers.
- Comparatively higher increase in crop production was reported due to application of NADEP as compared to application of compost produced in pits, but difference between two could not be quantified in the study.

### **7.3 Enhance productivity of livestock through better feeding systems and efficient input delivery.**

- Farmers had indicated 15-20 % additional survival and attaining higher vegetative growth by 40% (community reflection) of fruit plants in wadi through precise use of irrigation water, to keep them healthy with good foliage development.
- Observations on income of the farmers indicated that contribution from livestock towards total income had increased appreciably. The increase was mainly due to the increased sale of milk, which is indicative of the additional employment generated by improved livestock Agriculture Production System for participating families.
- Altogether 1800 bigha additional land was brought under irrigation through sprinkler system, while 75% families observed 25-75% time saving.
- Farmers reported an average additional production of 23.16 quintals of food grains, of which 17.4 quintals was sold to market.
- Overall production change was 2.19 to 2.29 quintals/bigha which are 4.81 quintal additional.
- As per discussion with project beneficiaries, in field crops like Wheat, Lucerne etc., 25-30% irrigation water had been saved using overhead type of sprinkler system in compare to conventional irrigation system.

### **7.4 Develop appropriate water conservation measures for increased water use efficiency**

- Tanka as a measure for improved access to safe drinking water for human and cattle is well established. It was again proved by protecting community from saline ground water. Various capacities of tanks from 7100 liters to 49960 liters and water use mechanism emphasized more awareness for using tanka water mainly for drinking purpose and water from other sources to take care of other uses. Need for construction of double chamber storage tank was felt to keep rainwater and ground water separately.



*Tanka at Harsolav*

- In this arid region water was one of the limiting factors in Livestock-Agriculture Production System; works carried out under water resources development provide policy issues for water management in Livestock Centric Livelihood Initiatives.
- Six farm ponds constructed during project harvested 60000 cubic meters additional water worth Rs. 6,00,000/- annually even at the rate of one paisa/liter. These farm ponds helped 2155 cattle for getting safe potable water for three additional months.
- It was observed from this project that dug-out ponds may be planned in Livestock Centered Livelihood Initiatives to fill gap in drinking water demands. Within village integrated water resources management should plan to calculate overall water harvesting capacity in terms of seasonal distribution and gaps with reference to cattle population and drinking water availability to human.
- *Khadins* offered sustainability against climate change induced weather variability but definitely investment on such structure is beyond the capacity of small and marginal farmers.
- In the component of overhead sprinklers; analysis of cost, water saving, increase in production and income due to additional area under irrigation indicated potential for further scaling-up.
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- Fixing of drip irrigation in Ber orchard indicated its worth in the form of higher survival even with 66% less water. According to farmers, 80 percent time/manpower was saved. It had been observed that, in water scarcity regions like Nagaur district, low cost drip technology was very useful for farmers in establishing family and group level horticulture-cum-fodder wadi in arid and semi-arid regions.
- 5160 meter (860 numbers) irrigation pipes were distributed to 53 farmers and it was observed that irrigation efficiency increased and helped in saving losses of water to the tune of 20-25%. These farmers who were earlier using open channels could save water to irrigate 40 ha additional fodder crops.
- Dug-out ponds created during the project, harvested 10000 cubic meter water and provided drinking water to 2155 animals for two to four months beyond monsoon.
- Nadirs which were developed in grazing lands provided drinking water during grazing

and also increased biomass in nearby area.

- It was not possible to establish relationship between dugout ponds and ground water recharge, but it was observed that tube-well in nearby vicinity at two locations had shown increased pumping hours from 2 to 3 hours.
- In gentle slope arid and semi-arid regions khadins helped in maintaining soil properties, fertility, production, productivity and support Livestock-Agriculture Production System. Following were the listed benefits of participating families.
  - Increased crops production in submergence area as compared to other.
  - Better crop yield from the wells/tube well in the close vicinity
  - Runoff of water checked during rainy months
  - pH value of soil is reported to improve from 9 to 8 in two khadins

### **7.5 Improvement of common grazing areas/ community lands with innovative approaches**

- The integrated approach of re-establishing common lands in the form of pastureland through protection, soil water conservation, regular watch, grass seeding and plantation had helped to improve biomass production in common property resources.
- Small and marginal farmers followed goat rearing through free grazing. This study included “Ber orchards” with drip irrigation, proved its worth for quality fodder. Within four years, annual leaf production increased 80-100 kg per plant.
- Distribution of Khejari and its plantation on field boundaries has helped to break community myth that Khejari cannot be planted. It helped in realizing that issue of reduced fodder availability, erosion of fields and low organic matter could be addressed through plantation drives particularly “Khejari Lagao Muhim”.
- The study proved that green fodder cultivation like Lucerne, Sorghum, Bajra are important for feeding to dairy animal cows and buffaloes. They provide better protein and mineral to increase milk yield.
- All the outcome and impacts of this component are reflected through success of major component of forage crops, compost making, soil moisture conservation, water harvesting and water saving ultimately resulted in an increased in milk production.
- The approach of ridge to valley and use of soil and moisture conservation measures increased sub-surface moisture in upper soil strata for extended period of 5-10 days after intermittent rains and one month after rainy season. These bunds checked surface runoff and protected productive soil its nutrients and organic carbon which contributed enhanced crop yields.

## 7.6 To provide value addition and suitable market linkages for livestock products to ensure remunerative prices

- Organizing project farmers as common interest group and linkages with marketing facilities like formation of primary milk cooperative at village level could help them to have access to remunerative prices.
- Four non-functional milk-societies were re-activated.
- Installation of 4 numbers bulk coolers at four cluster location by Rajasthan Livestock development board also helped farmers to get linked to state owned marketing channel in the form of “*saras dairy*”

## 8.0 Recommendations:

Based on the findings made by the study, following recommendations would be beneficial for replication and improving livelihood of community not only in the district of Nagaur but also for strengthening overall livestock-agriculture production system in arid and semi-arid areas.

- a) Integrating livestock with crop production, it provides a better risk coping strategy, continuous flow of income and employment throughout the year for small land holders in rain fed areas. Therefore it is recommended that state should promote Integrated Farming Systems in rain fed areas.
- b) In Semi-arid and arid regions water scarcity was one of the limiting factors for livestock-agriculture production system. Therefore it is recommended that khadins, dugout ponds, roof water harvesting, should be included as support component in all livestock development programs.
- c) The village community raised issue of “**safe drinking water for livestock**”. **It is recommended that all states should consider drinking water need of livestock. Plans must be developed in consultation with state animal husbandry department to provide drinking water to livestock at each Panchayat level.**
- d) Low cost sprinkler systems demonstrated better water efficiency in fodder crop and produced more green fodder, for additional two to three months. Therefore it is recommended to promote sprinklers and drip irrigation in rain fed areas. Incentives or subsidy should be given to small and marginal farmers for purchasing of micro irrigation system.
- e) Wadi should be promote *as homestead orchard* with dual purpose plants in which main outputs would be fodder, while by-product might be fruits or timber etc.
- f) State should develop special package or incentivized programs focusing on forage crop cultivation in rain fed areas.
- g) Other programs and projects like integrated watershed management should also be targeted to strengthen livestock-agriculture production system. Additional funds need to

be allotted for fodder development interventions within watershed programs.

- h) The state should facilitate extensively the propagation of fodder trees e.g. *Khejari*, *Ardu* etc. in desert and rain fed areas with association of local community based institutions, civil society organization etc.
- i) Activities such as dairy, goat husbandry, usage of compost manure in crops, agro-horticulture, pasture development etc. assumes critical importance in supplementing the farm income of small and marginal farmers.
- j) There is a need to organize villagers in cluster mode so that resource limitation can be managed in better way and will be used for holistic development of farming system.
- k) Study finds that cluster formation can result in efficient and effective utilization of common resources. It can facilitate organizing interested stakeholders for common planning, implementation, utilization, value addition and marketing of products etc.
- l) Seeding of improved grasses for bund stabilization and vegetative barriers proved best for grass production, but seed availability is a constraint. Therefore, it is suggested that government should establish network of producer societies for supply of hybrid grasses and fodder seeds.
- m) It would be appropriate to promote the usage of compost and organic manure to increase fodder yield which is cost-effective for small and marginal farmers.
- n) Provisions should be made for availability of credit at low interest rate to small livestock holders for purchase of chaff cutters, micro irrigation systems, seeds of improved varieties of grasses and fodder crops, cemented pit for compost manuring and cemented tanka construction etc.
- o) Improved seeds of grasses and fodder trees should be made available at Panchayat level before onset of monsoon season. The farmers should also be provided adequate training in local languages regarding fodder crop production technique in rain fed areas.
- p) Farmer's local institutions should be promoted in rain fed areas. Training programs on micro irrigation such as drip and sprinkler irrigation, improved varieties of dual purpose fodder plants and pasture grasses, improved fodder production technology etc. should be imparted to such institutions by state governments for integrated / cluster villages.
- q) There is need to formulate district irrigation plan as per guidelines of PMKSY in rainfed areas.
- r) The small and marginal farmers in rain fed areas lack latest technical knowledge about integrated farming systems; therefore the state should disseminate the knowledge through mass media such as radio, mobile phones, television, local newspaper and distribution of pamphlets in local language.

***(Complete report can be access on this website under publication section)***