Dairying through Cooperatives (DTC)

(Referred by JICA as "Project for Dairy Development")

Component B of NPDD

Manual on Productivity Enhancement – through Nutritional Interventions

A. Calf Rearing Programme (CRP)

B. Animal Nutrition Advisory Services

C. Fodder Development

National Dairy Development Board

October 2021

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Annexure

Abbreviations

ANO	:	Animal Nutrition Officer
ANS	:	Animal Nutrition Supervisor
ASMM	:	Area Specific Mineral Mixture
CFP	:	Cattle Feed Plant
CRP	:	Calf Rearing Programme
CRPS	:	Calf Rearing Programme Supervisor
DCS	:	Dairy Cooperative Society
IMC	:	Implementation and Monitoring Cell
INAPH	:	Information Network for Animal Productivity and Health
MPP	:	Milk Pooling Point
MTC	:	Micro Training Centre
NDDB	:	National Dairy Development Board
PC	:	Producer Company
PI	:	Participating Institution
POIs	:	Producer Owned Institutions

Preface

To improve the profitability and income from dairy farming, robust measures are required to be taken. Special attention is required to be paid on animal nutrition activities since feeding accounts for about 70% of the cost of milk production.

Low milk production by Indigenous cows and buffaloes can be attributed to several reasons. However, imbalanced nutrition is one of the major factors responsible for low milk production in both cattle and buffaloes. Thus, there is a need to improve milk productivity of animals in the project area by implementation of Productivity Enhancement Activities – through Nutritional Interventions such as Calf Rearing Programme (CRP), Animal Nutrition Advisory Services and Fodder Development Activities.

This Manual has been prepared for Participating Institutions (PIs) which would be implementing Productivity Enhancement Activities under the project of 'Dairying through Cooperatives - Key to sustainable livelihood' and for those who would be directly or indirectly involved in the project. This would equip the manpower with technical knowledge to implement the activities in a comprehensive manner. The manual describes what one is supposed to do, how one should go about it, when and where and by what means one should execute a particular task, with whom and with whose support should one implement a project etc.

1. Introduction

1.1 Objective of the project

The objective of the component E "Productivity enhancement through nutritional intervention" is to improve the productivity of dairy animals thereby enhancing returns to milk producers in the project area.

1.2 Productivity Enhancement Activities

There are three activities under the Component:

A. Calf Rearing Programme (CRP)

B. Animal Nutrition Advisory Services

C. Fodder Development

1.3 Pattern of funding

This component will be funded as 90% grant (maximum) and rest 10% of the cost has to be borne by Participating Institutions (PIs).

Item wise unit cost approved by Project Sanctioning Committee (PSC) will be used for calculation of financial outlay of the sub-project plans.

1.4 Eligible Organisations

The Productivity Enhancement Activities will be implemented by Participating Institutions (PIs) -State Milk Federations, Multi-state Milk Cooperatives, Milk Unions and Milk Producer Companies.

2. Manpower requirement

- For smooth implementation of Component E: Productivity Enhancement – *through Nutritional Interventions*, the eligible PI should preferably appoint its' one of the existing employee as Sub-project coordinator, who will be responsible for overall coordination of the program, arranging resources for implementation and will liaison with NDDB.
- Implementation of all activities under the component i.e. Calf Rearing Programme (CRP), AN Advisory Services and Fodder Development would be responsibility of one Animal Nutrition Officer (ANO) at the district level.
- Under an ANO, two Animal Nutrition Supervisors will be deployed to provide required support to ANO for implementation and monitoring of all activities in a district.

In those districts, where CRP will be implemented, exclusive CRP supervisors (one for every 10 villages) for calf rearing programme will be placed.

2.1 Selection of Manpower

2.1.1 Animal Nutrition Officer (ANO)

- Animal Nutrition Officers (ANOs) are to be identified amongst the existing manpower of the PI or they may be recruited or outsourced. ANO would be responsible to execute and monitor the project implementation in the target villages. ANO should either be a veterinary post-graduate/graduate or agriculture post-graduate/graduate with relevant field experience.
- Under special circumstances where candidates of the above mentioned qualifications are not available, then post graduate in biology/zoology may be considered after obtaining consent from NDDB.

2.1.2 CRP Supervisor (CRPS)

- PIs would identify or recruit CRPS to implement the programme in identified villages. CRPS can be a village based person, with good communication skills and willing to spend required time for implementation of the programme.
- In case person with graduation is not available, then suitable candidate with Higher Secondary School Certificate (Class 12) may be considered.

2.1.3 Animal Nutrition Supervisor (ANS)

- PIs would identify or recruit two ANS for implementing Animal Nutrition Advisory services and Fodder Development programme in about 100 villages. Preferred qualification for ANS is graduation in veterinary science/ agriculture. However, if such –graduates cannot be found, then candidates with diploma in veterinary science/ agriculture may be preferred. If even such candidates are unavailable then bachelor's degree in any discipline, having field experience, may be selected.

2.2 Roles and Responsibilities

2.2.1 Participating Institutions (PIs)

- Selection and recruitment or outsourcing of required manpower for all the animal nutrition interventions under the project.
- Identify DCS/MPP villages/farmers for CRP, AN advisory services and fodder development activities.
- Ensuring availability of pregnancy feed, transition feed, calf starter, calf growth meal and mineral mixture manufactured strictly as per the guidelines provided by NDDB.
- Organize distribution of fodder seed, planting material, and fodder trees sapling, setting-up of low cost silage making units, purchase and demonstration of mowers at farmers' field and construction of biomass stores/godowns at village dairy cooperative society/PIs' owned or leased land, as per the drawings/ specifications provided by NDDB.
- Organize procurement of crop residues/straws at the time of harvesting of crops and store it in the biomass stores/godowns for sale during lean period at nominal cost.

2.2.2 Animal Nutrition Officers (ANOs)

A. Roles and responsibilities of ANO pertaining to CRP

- Selection of potential villages
- Guide CRPS in selecting beneficiaries having animals at advanced stages of pregnancy.
- Preparation of work plan for CRP Supervisors and ensure implementation of the plan.
- Conducting village awareness programme on Calf rearing, feeds and feeding practices with the help of ANS and CRPS.
- Planning and arranging regular supply of pregnancy feed, transition feed, calf starter, calf growth meal and mineral mixture to the beneficiaries through DCS/MPP.
- Maintaining records on supply of different feeds and mineral mixture to the beneficiaries.
- Monitor the programme by making random field visits, conducting farmer meetings & review meetings on regular interval.

- Collections of feed samples from field and get those samples analysed at CALF laboratory of NDDB to ensure supply of quality feeds and mineral mixture to the beneficiaries.
- Validation of data recorded in the prescribed format by Supervisors and ensuring data entry in Information Network for Animal Productivity and Health (INAPH) at regular interval.
- Data management, generation of periodic reports and sharing it with PIs and NDDB.

B. Roles and responsibilities of ANO pertaining to AN Advisory Services

- Selection of potential villages.
- Provide guidance to ANS in selecting beneficiaries under AN advisory services.
- Preparation of work plan for ANS.
- Conducting village awareness and extension programmes with the help of ANS.
- Arranging regular supply of mineral mixture, transition feed to the beneficiaries through DCS/MPP. ANOs will also maintain records on supply of above mentioned items.
- Monitor the programme by making random field visits, conducting farmer meetings & review meetings on regular interval.
- Collections of feed samples from the villages on a random basis and getting the same analysed at CALF laboratory of NDDB for monitoring of its quality.
- Popularisation of 'Pashu Poshan' mobile application of e-Gopala APP to promote balanced feeding to the dairy animals
- Validation of data recorded in the prescribed format by Supervisors and ensuring data entry in INAPH at regular interval.
- Data management, generation of periodic reports and sharing it with NDDB.

C. Roles and responsibilities of ANO pertaining to Fodder Development Activities

- Selection of potential villages.

- Provide guidance to ANS in selecting beneficiaries under fodder development activities.
- Preparing work plan for seed, planting material, fodder tree sapling distribution, silage making and other fodder activities.
- ANO will also maintain records of above mentioned fodder activities.
- Conducting village awareness and extension programmes with the help of ANS.
- Monitor the programme by making random field visits, conducting farmer meetings & review meetings on regular interval.

- Collections of silage samples from field on a random basis and sending to CALF laboratory of NDDB for testing
- Data collection on fodder activities, adoption, success stories, record keeping.

2.2.3 **CRP Supervisor (CRPS)**

- Identification of beneficiary farmers and selection of advanced pregnant animals.
- Ear tagging and capturing animal and owner details in the prescribed format.
- Registration of animals (both dams and calves) in INAPH and entering relevant details in INAPH.
- Coordination with ANO for supply of feeds and mineral mixture.
- Weekly visits to the beneficiaries and ensuring feeding of pregnancy feed & transition feeds to dams and calf starter & growth meal to the female calves/ heifers as per the standard operating procedure.
- CRPS will provide balanced ration advisories for dams and record the milk on monthly basis.
- Upon calving, CRPS will capture data such as gender, birth weight of calves, body weight at monthly interval, age at sexual maturity, age at first AI, age at first calving (AFC), etc. All the data will be entered in INAPH on regular basis.
- Sharing other important information/ observation with ANO.

- Assist implementation of other nutrition activities in their area including fodder development, as and when needed.

2.2.4 **Animal Nutrition Supervisor (ANS)**

- Identification of beneficiary farmers and selection of animals for AN advisory services. Identification of beneficiary farmers/ DCS/MPPs for fodder development activities.
- Assist in implementation of all nutrition activities including fodder development.
- Registration of animals (both dams and calves) in INAPH and entering relevant details in INAPH.
- ANS will ensure uninterrupted supply of mineral mixture and transition/ early lactation feed to the DCS/MPP as well as beneficiaries.
- Regular visits to the beneficiaries and ensuring feeding of mineral mixture and transition/early lactation feed as per project guidelines.
- Demonstration of 'Pashu Poshan' mobile app for promoting balanced feeding concept.
- Ensuring data on impact of feeding mineral mixture and transition/early lactation feed to the identified animals in a prescribed format.
- Sharing other important information/ observations with ANO.

- Selection of villages & farmers on the basis of resource availability (Land, irrigation etc.) for seed distribution and silage
- Identification of eligible DCS/MPP for chaff cutter distribution
- Selection of appropriate machinery based on cropping pattern and field conditions
- Arranging supply of seed, planting material and machinery within stipulated time
- Advisory services to the farmers for fodder production agronomic practices including disease and pest management
- Assisting silage making by using scientific principles and its popularization on commercial lines
- Preparing reports and upload data in the software

3. Calf Rearing Programme (CRP)

3.1 Overview

Cows and buffaloes in India are robust and resilient and are particularly suited to the climate and environment of their respective breeding tracts. They are endowed with qualities of heat tolerance, resistance to diseases and have ability to thrive under extreme climatic stress.

The potential to enhance the productivity of indigenous as well as crossbred cattle & buffaloes through better nutrition and good management is immense. This could be achieved through better feeding and management of cow & buffalo calves during their early life. It is high time that focus should be shifted to scientific calf rearing of cattle (both indigenous and crossbred) and buffaloes so that healthy animals can be made available to the milk producers.

The performance of any individual animal is dependent on its genetic potential, feeding and management. Cross breeding has increased the yield potential of cows to some extent, but most of cows & buffaloes are unable to express their full potential for milk production due to poor growth rate and inadequate nutrition during their early phase of growth.

Growth phase of the animals is confined to the first two years of its life. Therefore, it is important that the calf is given nutritious feed in the form of concentrates or fodder right from its foetal stage. This will ensure birth of healthy calf, its early maturity and higher milk yield when the calf becomes a cow or buffalo.

On an average, it is expected that the calf will attain sexual maturity at around 20-24 months of age and will become a cow/ buffalo by calving for the first time at around 30-35 months of age, if fed and managed scientifically. However, under field conditions animal's age at first calving is around 40-45 months in cows and 46-52 months in case of buffaloes. Therefore, scientific feeding & management practices for rearing calves needs to be adopted under field conditions to harness the genetic potential and improve the profitability of dairy farmers.

3.2 Objectives of CRP

- The main objective of the calf rearing project is to create awareness amongst milk producers on scientific feeding and management of cow & buffalo calves at various stages of growth, including foetal stage.

- Reducing calf mortality rate through scientific feeding of advanced pregnant animals.
- Ensuring birth of healthy calves by providing essential nutrients during advanced stage of pregnancy.
- To reduce age at first calving (AFC) by improving daily growth rate and achieving early maturity by feeding calf starter & calf growth meal.
- To improve life time productivity & productive life of animals by rearing calf at farmer's doorstep.

3.3 Key features of CRP

- 500 advanced pregnant buffaloes (minimum 8 months pregnant) and cows (minimum 7 months pregnant) will be identified from about 50 villages, depending upon the availability of milch animals. The number may vary depending upon the final approval of the project for a particular PI.
- In addition, 100 animals maintained on traditional ration (as control) would be selected from the same villages (2 animals from each village). The number may vary depending upon the final approval of the project for a particular PI.
- Advanced pregnant buffaloes (minimum 8 months pregnant) and cows (minimum 7 months pregnant) will be identified from project villages, the number of which may vary depending upon the availability of milch animals (about 5 animals per village per year).
- All the identified advanced pregnant animals will be ear tagged and registered in INAPH.
- During advanced pregnancy stage, pregnancy feed will be given to identified animals @ 3 kg per day/animal for 60 days prior to calving. The feed will be made available to milk producers at 50% subsidized rate.
- On calving, CRP Supervisor (CRPS) would ear tag the female calves with 12 digit unique ear tag provided in the project. Female calves will be registered in INAPH using ear tag number and necessary details will be entered in INAPH by CRP Supervisor.
- CRP Supervisor will be given tablet/android phone for data entry in the INAPH software.

- Calf starter (225 kg/animal for 26 weeks i.e.182 days), calf growth meal (1435 kg/animal for 82 weeks i.e. 574 days) would be made available at subsidized rate for each animal to milk producers covered under the project. However, mineral mixture, de-wormer etc. will be made available in the identified villages at an actual cost. Farmer will get 50% subsidy on the feed cost under the project, however, it may change depending upon approval of Project Sanctioning Committee (PSC).
- PI would ensure that specialized feeds (pregnancy feed, calf starter and growth meal) are manufactured or sourced strictly as per the formula provided by NDDB.
- Dams under CRP will also be provided transition feed post calving. 'Transition Feed' will be fed @ 4 kg per day for three months i.e. 90 days, to the animals calved to help the animals for optimum milk production, improved metabolic health status and reproductive performance.
- After calving, CRP Supervisor would balance the ration of lactating dams and record milk yield on monthly basis.
- Pamphlet on "Scientific feeding practices for calf rearing" would be provided to all identified milk producers in local language.
- CRP Supervisor will ensure the feeding of specialized feeds and record body weight measurement of calves every month.
- After completion of six months of project implementation, awareness campaigns will be organized by the Animal Nutrition officer (ANO).

3.4 Implementation arrangement of CRP

The project will be implemented in areas having sufficient number of buffalo and cow population through PIs in a modular approach. Each module will comprise about 50 villages covering 250 female calves. This number may vary depending upon final approval of the project. Every set of 50 villages will be the responsibility of Animal Nutrition Officer (ANO) for field implementation and monitoring including liaison with NDDB for all project related activities. One CRP Supervisor (CRPS) would be identified for every 10 villages to record information of female calves in INAPH till completion of the project work. There will be about 5 CRPSs in one module.

3.5 Selection criteria

3.5.1 Selection of PIs

- PIs having sufficient number of indigenous buffalo and cattle population in the area of operation would be preferred for the project.
- PIs who implemented activities under NDP I successfully would be given preference.
- PIs should ensure availability of pregnancy feed, calf starter, growth meal, transition feed and mineral mixture at village level.
- PIs that are ready to promote the concept in their operational area would be preferred.
- PIs would be identified on first come first serve basis provided they fulfil above mentioned eligibility criteria.

3.5.2 Selection criteria for CRP village

- Villages having functional DCS/MPP, where supply of cattle feed and mineral mixture is regular.
- DCS/MPP management committee should be willing.
- Villages with sizeable population of breedable cattle and buffaloes.
- Villages should preferably be contiguous with internet connectivity.

3.5.3 Selection criteria for beneficiaries/ milk producers

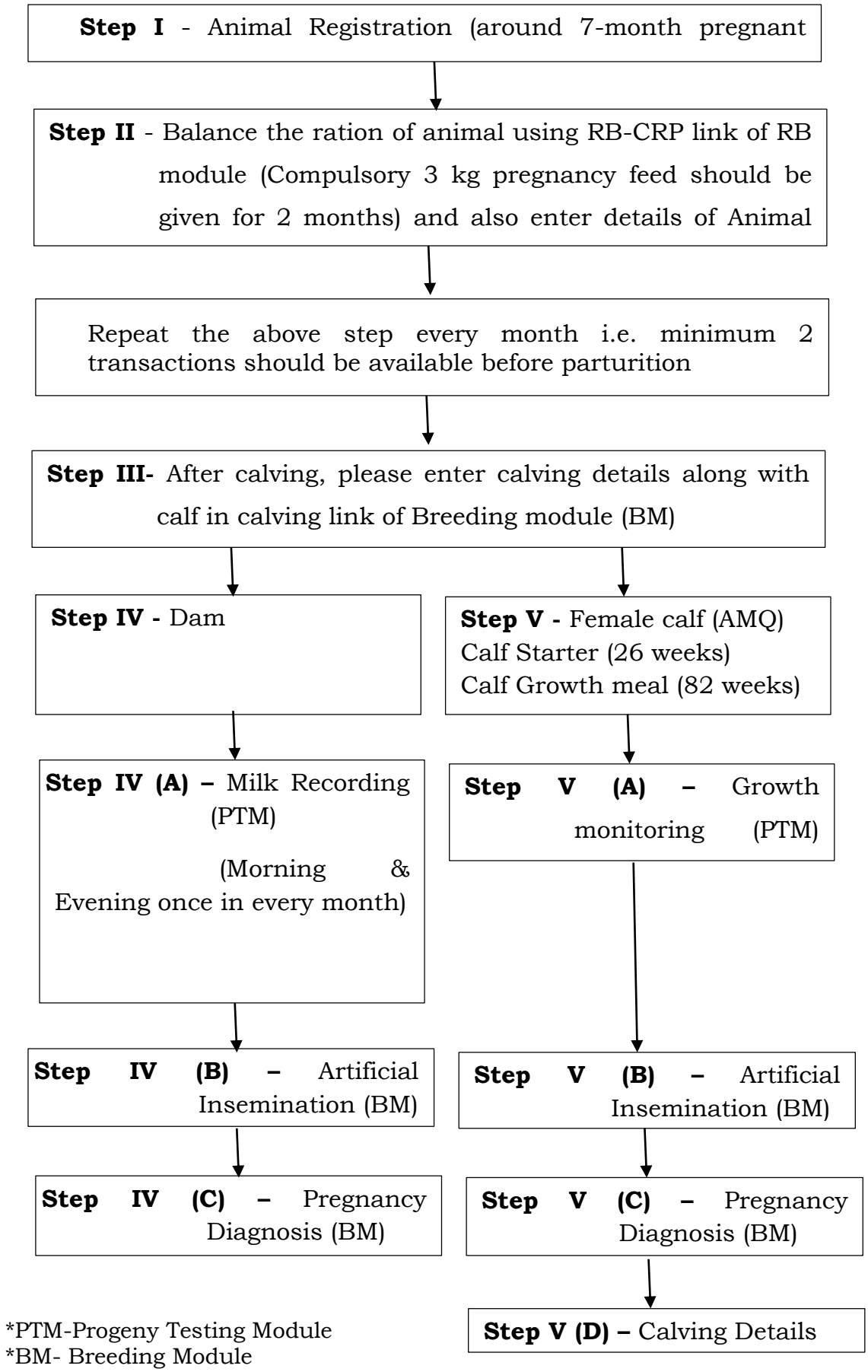
- Progressive milk producers willing to follow the advices of CRP Supervisors and feed the recommended quantity of pregnancy feed/ calf starter/ growth meal/ transition feed to their animals on a regular basis would be selected.
- Willing to contribute minimum 50% price of pregnancy feed, calf starter, growth meal and transition feed.
- Willing to get their animals ear-tagged.
- Willing to share the relevant information at regular interval with the CRPS.
- Willing to carry out vaccination and deworming at their own cost as suggested by ANOs.

3.5.4 Selection of animals

- Advanced pregnant cows (minimum 7 months pregnant) or buffaloes (minimum 8 months pregnant)) will be identified under this programme.
- Animals should be healthy i.e. without history of any major illness like IBR, brucellosis etc.
- In addition, few animals maintained on traditional ration would be kept as control from each village.

3.6 CRP software and database management

The software, Information Network for Animal Productivity and Health (INAPH), is window based software. INAPH can be loaded in computers, laptops, netbooks and Tablets. The data recorded through software would be stored in the production server of INAPH. Major steps involved in CRP in INAPH are given below:



*PTM-Progeny Testing Module
*BM- Breeding Module
*ARM-Animal Registration Module
*RBM-Ration Balancing Module

Step wise details are given below:

3.6.1 Step I- Animal Registration (AR)

- Usually animal with 7 month pregnancy should be considered for CRP.
- Registration is one time activity. Twelve digit tag number is required for the same.
- Parameters required for AR: Ear tag No., Registration date, Sex, Species, Breed, Age (Year & Month), No. of Calving, Last Calving date, Pregnancy status & it's month, Milking status and lastly Owner details.

3.6.2 Step II- Ration Balancing of pregnant animal using RB-CRP link of RB module

- Enter the registered tag no. and click on 'search' button. System will fetch all the details which were entered during registration. Remaining 'star marked' parameters to be filled up.
- After entering body weight, click on 'View nutrient requirements' option; it will show nutrient requirements of pregnant animal on next screen.
- Enter feed ingredients which are being offered to pregnant animal in current feeding practices.
- Now click on 'View nutrient availability in existing ration' button; it will show about which and to what extent a nutrient is surplus or deficient in existing ration.
- Click on 'Perform Ration Balancing' option.
- Click on 'Formulate least cost balanced ration'; system will formulate least cost ration with same feed ingredients entered above along with pregnancy feed. Put limits on quantity of feed ingredients including pregnancy feed as per requirements to formulate a balanced ration.
- Once ration is formulated, it should be saved by clicking 'Save' button.
- Repeat the step II every month to get at least 2 transactions before parturition.

3.6.3 Step III- After calving; enter calving details along with calf details in Calving link of Breeding module (BM)

- Once animal is calved, enter the details of calving i.e. date of calving, calving type & ease of calving. After entering all details, click on 'Register' button then calf details need to be filled i.e. tag no., body weight (kg) & calf organization detail & lastly click on 'Save' button.

3.6.4 Step IV – Dam related details

Step IV A – Milk Recording (Morning and Evening)

- CRP Supervisor has to measure milk yield of dam (morning and evening) every month and enters the same in morning milk recording and noon/evening milk recording link of Progeny Testing module.
- While entering the milking data for the first time in morning milk recording, it is required to answer some generic question in Yes or No form such as colostrum feeding within 2 hours, retention of placenta, suckling, vaccination given etc. Once all details are entered, click on 'Save' button.
- CRPS will also provide balanced ration advisory services for the registered animals.

Step IV B - Artificial Insemination

- At the time of artificial insemination, details regarding AI should be entered in AI section of PTM i.e. date of insemination, semen/bull ID, no. of wasted semen dose, type of call, etc. After entering all the details, click on 'Save' button.
- If animal do not conceive in first AI, every repeat AI details should be entered in the same section.

Step IV C - Pregnancy Diagnosis

- Pregnancy diagnosis details should be entered in PD section of breeding module i.e. date of pregnancy diagnosis & pregnancy diagnosis result.

3.6.5 Step V - Female Calf

- New born calves should be fed colostrum within 2 hours after birth. After 3-4 days of birth, start feeding calf starter upto 26 week of age, thereafter growth meal for the next 82 weeks.

- Status of calf starter/ calf growth meal purchase and its feeding should be entered in animal management query from time to time.

Step V A - Growth Monitoring

- CRP Supervisor will measure the length and girth of female calf in inches and enter the same in growth monitoring section, then system will calculate the body weight; once all details are entered click on 'Save' button.
- This process needs to be followed every month.
- This female calf turns into heifer and subsequently comes in heat, then date on which first sign of heat exhibited should be entered in Animal management query.
- Now follow the steps of artificial insemination, pregnancy diagnosis and finally calving which are explained in Step IV (B), Step IV (C) and Step III, respectively.

3.7 Feeds for different categories of animals under CRP

3.7.1 Feed for advanced pregnant animals

- Special type of pregnancy feed will be produced at cattle feed plants of PI/ Milk Federation or outsourced only from cooperatives owned cattle feed plants & supplied to milk producers.
- Feed formulation will be provided by NDDB to the CFPs (Cattle Feed Plants).
- 3 kg feed is required to be fed daily for last 2 months of pregnancy.
- This would help in reducing metabolic disorders in dams & calf born will be healthy with higher birth weight.

3.7.2 Calf starter

- Special type of calf starter in 3 mm pellets incorporating certain feed additives, which helps in improving growth rate & rumen development, will be produced at cattle feed plant (CFP) under the respective PI/ Milk federation covered under the programme or outsourced only from cooperatives owned cattle feed plants & supplied to milk producers.
- Formulation will be provided to the CFPs.
- Calf starter would be fed from 4th day onwards up to 26th week of age.

- This would help in early development of rumen, faster growth rate & attaining early maturity weight.

3.7.3 Calf growth meal

- Calf growth meal will also be produced at CFP under respective PI/ Milk Federation covered under the programme or outsourced only from cooperatives owned cattle feed plants & feed formulation will be provided by NDDB.
- Average 2.5 kg of calf growth meal is required to be fed daily to the growing calves from 27th to 108th weeks of age.
- Calf growth meal would help in achieving desirable body weight at an early age and proper development of reproductive organs & mammary tissues.
- Feeding schedule during different stage of calf growth is given below:

Table 1: Calf feeding schedule (birth to 26th of week of age)

Period	Colostrum/ Whole Milk (litre/day)	Calf starter (kg/day)	Good quality hay* (kg/day)	Green fodder* (kg/day)
0-2 days	3-4 litre of colostrum in 2-3 divided doses	--	--	--
3-4 days	3-4 litre of milk	--	--	--
4-14 days	2-3 litres of milk	0.10	0.10	--
3rd week	1.5-2.0 litres of milk	0.20	0.15	0.75
4th week	0.5-1.0 litres of milk	0.25	0.20	1.25
5th week		0.40	0.30	2.0
6th week		0.50	0.40	2.5
7th week		0.60	0.60	3.0
8th week		0.70	0.80	3.5
9th week		0.80	0.90	4.0
10th -11th wk		1.00	0.90	5.0
12th week		1.20	1.00	5.0
13th -16th wk		1.50	1.20	6.0
17th -20th wk	--	1.75	1.50	7.5
21st -26th wk	--	2.00	2.0	8.0
Note: *Requirement of hay and green fodder may vary depending on the body weight of calf. Colostrum feeding is very essential during early life of calf.				

Table 2: Calf/ Heifer feeding schedule (26th to 108th of week of age)

Period	Calf growth meal (kg/day)	Good quality hay* (kg/day)	Green fodder* (kg/day)	Mineral mixture (g/day)
27-40 week	2.5	2.5	10	25
41-60 week	2.5	3.5	12	30

Period	Calf growth meal (kg/day)	Good quality hay* (kg/day)	Green fodder* (kg/day)	Mineral mixture (g/day)
61-90 week	2.5 (3.0**)	5.0	14	50
91-108 week**	2.5 (3.5**)	6.0	16	75
Note: *Requirement of hay and green fodder may vary depending on the body weight of calf. **Feeding of calf growth meal may be adjusted based on the age at conception.				

3.7.4 Transition Feed

- Special type of Transition Feed (early lactation feed) would be produced at CFPs of PIs/federations or outsourced only from cooperatives owned cattle feed plants and will be supplied to the milk producers.
- The formulation for the feed will be provided to CFPs by the NDDB.
- This feed will consist of high quality grains, treated cakes, chelated mineral, vitamins and other feed additives required to combat metabolic stress.
- On an average 4 kg feed per day will be provided to an animal for a period of 90 days post calving. The quantity may vary depending on the milk yield of the animals.

3.8 Testing of feeds and mineral mixture

Samples of different variants of feeds supplied under the project are to be collected at a regular interval for assessing its quality at CALF laboratory of NDDB

3.9 Details and specification of working kit

- CRP working kit includes ear tags, ear tag applicators, applicator pins, measuring tapes (minimum 5 meters), weighing balances (5 and 25 kg), advice booklet and a bag.

3.9.1 Specifications of ear tags

- The ear tag is composed of two parts (Male + Female). The male part is a button with a diameter of 27 mm. The male part should have a metal point. The female part is 55 x 65 mm flat surface with a closed head. The tag should be made from Thermoplastic Polyurethane Elastomer material that should be resistant to ultraviolet light, high and low temperature, impossible to reopen by wrench and should be tamperproof.
- The weight of the ear tag (male + Female) should be 6.5 grams (+10%). Laser printing of number in two rows of

digits with equivalent one dimensional bar code on the first row is must. Numbers and bar code should be big and bold covering full size of the female tag and leaving 2 mm margin on all sides. NDDB will provide the list of twelve/eight-digit ear tag numbers to be laser printed on ear tags. The colour of the tag should be lemon yellow. The ear tag should be packed in batches of 100 pieces in a good quality polyethylene bags indicating beginning and ending numbers and further packed in a corrugated box containing 500 pieces of ear tags i.e. 5 polyethylene bags each containing 100 pieces of ear tags.

3.9.2 Specifications of ear tag applicators & pins

- Universal ear tag applicators and pins are recommended. An animal ear tag applicator has a jaw with a pivotal pin which can hold the male part of an animal ear tag. It should be sturdy and should not be slippery.

3.9.3 Specifications of measuring tape

- Measuring tape should be water proof, wear resistant, non-creasing and minimum of five meter in length.

3.9.4 Specifications of weighing balances

- Weighing balance should be sturdy, accurate, reliable with corrosion protected springs, lightweight, portable and with protected reading scale and should be having 5kg capacity with 25g graduation and 25 kg capacity with 100g graduation.

3.9.5 Specification of bag

- Bag for CRP supervisors should be made of matty nylon cloth of black colour. The bag should be of (16 inch X 12 inch X 7 inch) in size with detachable and adjustable shoulder belt, containing 3 partitions, suitable to carry tablets, booklet, ear tag applicators and other materials. The weight of the bag should not be more than 1 kg.

3.10 Vaccination and deworming schedule

3.10.1 Vaccination

Table 3: Vaccination Schedule

Sr. No	Name of Disease	Age at first dose	Booster dose	Subsequent dose
1	Foot and Mouth Disease (FMD)	4 months and above	1 month after first dose	Six monthly
2	Haemorrhagic	6 months	-	Annually in

Sr. No	Name of Disease	Age at first dose	Booster dose	Subsequent dose
	Septicaemia (HS)	and above		endemic areas.
3	Black Quarter (BQ)	6 months and above	-	Annually in endemic areas.
4	Brucellosis	4-8 months of age (Only female calves)	-	Once in a lifetime
5	Theileriosis	3 months of age and above	-	Once in a lifetime. Only required for crossbred and exotic cattle.
6	Anthrax	4 months and above	-	Annually in endemic areas.
7	IBR	3 months and above	1 month after first dose	Six monthly (vaccine presently not produced in India)
8	Rabies (Post bite therapy only)	Immediately after suspected bite.	4th day	7, 14, 28 and 90 (optional) days after first dose.

3.10.2 **Deworming:**

- First dose of anthelmintic must be given between 10-14 days of birth and subsequently at monthly intervals till 6 months of age. Thereafter deworming is generally done twice in a year, one before and another after rainy season. Fenbendazole/ Albendazole could be used to treat most commonly found round worm in calves.

3.11 **Stationery / advice booklets**

PI will arrange printing of booklets for capturing animal and owner details. The booklets would be printed in duplicate, one copy of which would be kept with CRPS and the other with ANO. The required stationery items would be arranged by PIs as per the guidelines of the approved project.

3.12 **Expected outcome of the project:**

i. Reduction of age at first calving by at least six months.
ii. Reduction in calf mortality rate by 25%.

3.13 **Sustainability of the project**

The project is for demonstration of scientific feeding practices and management of growing calves of cattle and buffaloes amongst the milk producers. It is expected that farmers in the project area would follow the same practices even after completion of project period and PIs would promote the programme in their milkshed.

4. Animal Nutrition (AN) Advisory Services

4.1 Objectives of AN Advisory Services

- The main objective of AN Advisory Services is to inculcate the practice of feeding of various feed and feed supplements among farmers and generate awareness regarding their importance.

4.2 Key features of AN Advisory Services

The key activities of AN Advisory Services are:

- Popularization of Mineral Mixture
- Promotion of Transition/ Early Lactation Feed
- Popularization of 'Pashu Poshan' application

4.3 Popularization of Mineral Mixture

Dairy cattle and buffaloes require a number of dietary mineral elements for normal body maintenance, growth and reproduction. Minerals that are required in relatively large amounts are called major or macro elements. Those needed in small amounts are classified as micro or trace minerals. The major minerals include calcium, phosphorus, magnesium, potassium, sodium, chlorine and sulphur. Among those needed in trace amounts are iron, zinc, manganese, copper, iodine, cobalt and selenium. Deficiency of minerals in the ration of animals impairs metabolic functions, which affects the growth in young calves and milk production and reproduction efficiency in adult animals. Supplementation of bio-available minerals through mineral mixture is of paramount importance, as minerals are nowhere synthesized in animal's body.

Since very few farmers are aware on benefits of feeding mineral mixtures, there is need to promote this concept in these areas by conducting feeding demonstrations at farmer doorstep.

4.3.1 Objectives

- To demonstrate positive effects of mineral mixture to milch animals among dairy farmers.

4.3.2 Implementation arrangement of AN Advisory Services

- Animal Nutrition Supervisor (ANS) will identify beneficiary farmers and animals in consultation with DCS/MPP management.

- Identified animals will be registered in INAPH by the ANS.
- DCS/MPP will place indent for mineral mixture (ASMM) to PI in advance.
- DCS/MPP will distribute ASMM to the identified beneficiaries.
- ANS will ensure the regular supplementation of mineral mixture to the ration of identified animals.
- ANS will ensure capturing impact of feeding mineral mixture on milk production/composition in a prescribed format developed for this purpose.

4.3.3 **Selection criteria**

4.3.3.1 **Selection of Villages**

- Villages already having cattle feed or any other input supplies may be given preference.
- DCS/MPP should be willing to arrange and supply the mineral mixture in time.

4.3.3.2 **Selection of farmers and animals:**

- Progressive farmers willing to get their animals ear tagged and procure mineral mixture for the envisaged period.
- DCS/MPP or PI may apply any other additional criteria for screening of farmers.

4.3.4 **Expected outcome and sustainability:**

This component under the project is aimed at demonstration on the benefits of regular feeding of mineral mixture to dairy animals among the milk producers. It is expected that farmers in the project area would keep on following the same practices even after completion of project period and PIs would promote the usage of mineral mixture in their milkshed.

4.4 **Promotion of Transition Feed/ Early lactation Feed**

- To maximise profitability in dairy farming, it is important to understand different stages of bovine life cycle and provide special attention to the stages which have highest influence on productivity. Managing cows and buffaloes during transition period is considered as one of the significant activity in the dairy nutrition, which provides major opportunity to improve health, milk production and reproductive performance. However, in the field conditions,

transition phase is most neglected activity due to lack of awareness amongst farmers.

- The transition period describes the change from a non-lactating cow/buffalo to a lactating cow/buffalo after parturition. As such, it is usually considered to extend from about 3 weeks before calving to about 3 weeks post-calving. The peripartum period is the most challenging time for the dairy cows considering the cascade of nutritional and physiological changes associated with the late pregnancy, parturition and onset of lactation. The dry period is considered to be a resting stage between two lactations with low nutrient requirements, but as parturition approaches, marked changes in hormonal status to accommodate parturition and lacto genesis occur. Generally, a reduction in DMI occurs seven to ten days before calving, but the nutrient demand for the growing foetus and initiation of milk production increases at the same time.
- A high incidence of metabolic diseases, like ketosis, fatty liver, hypocalcaemia, retained placenta, lameness and infectious diseases, e.g. mastitis and endometritis, occurs in early lactation. Many of these and other related diseases are attributable to either deficiency or excess of a number of nutrients that occur preceding and/or during the period of parturition. Thus, animals in transition phase needs to be carefully monitored for adequate feed composition, balance between energy and protein, adequate micronutrient supplementation to make the transition from the dry to the lactating stage as smooth as possible. Health disorders during transition phase also have huge economic implications on dairy farming and therefore focused approach to create awareness among farmers is of vital importance.

4.4.1 **Objectives:**

- To increase milk production
- To improve metabolic health status in early lactation so that animals are less prone to metabolic disorders (milk fever and acidosis).
- To improve reproductive efficiency
- Improvement in birth weight of calves

4.4.2 Selection criteria

4.4.2.1 Selection of villages:

- Villages already using cattle feed or any other inputs may be given preference.
- DCS/MPP should be willing to arrange and supply transition feed in time.

4.4.2.2 Selection of farmers and animals:

- Progressive farmers willing to get their animals ear tagged and procure transition feed as per given guidelines mentioned under approved project.
- DCS/MPP may apply any other additional criteria for screening of farmers.
- Animals with previous history of metabolic disorders may be considered.

4.4.3 Implementation arrangement

- Demonstration on feeding of transition feed will be carried out in potential villages covering approved number of buffaloes/cows.
- In addition, some more female animals of same category will be selected and designated as Control Group. Performance of these animals will be observed under traditional feeding and management.
- All the animals under this programme will be tagged with 12 digit ear tags and registered in INAPH.
- Transition feed will have two variants, one for before calving and other after calving.
- Experimental animals will be fed transition feed @ 2-3 kg/day 3 weeks before calving and according to milk production, 4-5 kg transition feed will be provided up to three months after calving.
- Transition feed (pregnancy feed and early lactation feed) and mineral mixture will be manufactured at CFP/mineral mixture plant of the PI or outsourced only from cooperatives owned cattle feed/mineral mixture plants as per the norms decided by NDDB. During the course of the project, samples will be picked up randomly from the field as well as the feed

plant and analysed at CALF to ensure compliance with the standards.

- DCS/MPP will raise indent and PI will supply the desired quantity in a time bound manner.
- ANS will ensure regular supply of transition feed to the beneficiaries.
- ANS will ensure capturing impact of feeding transition feed on milk production/composition, reproductive efficiency and metabolic disorders, if any, in a prescribed format developed for this purpose.

4.4.4 **Expected outcome of the field trial:**

- Improvement in metabolic health in early lactation
- Improvement in reproductive efficiency
- Increased milk production

4.4.5 **Sustainability:**

After successful field demonstrations, it is expected that PI would make efforts to promote transition feed amongst other milk producers of the milk shed.

4.5 **Popularization of '*Pashu Poshan*' Application**

- To promote the concept of balanced ration "Pashu Poshan" android mobile application will be demonstrated to identified farmers. For this, ANS will guide the interested farmers to create required user ID and password. He/she will help farmers to formulate balanced ration using the application.
- Each ANS will cover about 10 animals in each village under the project. The actual number of farmers/ animals may vary and would be finalized during the preparation of individual projects.

5. Fodder Development

5.1 Overview

Green Fodder is basic diet of animal. It is the most economical source of nutrients for livestock. Green fodder availability in adequate quantity is essential to exploit the genetic potential of the livestock and economic milk production. The availability of green and dry fodder is now a days constrained due to following reasons:

- Poor extension activities in the villages.
- Poor availability of inputs like seeds, planting material of improved fodder varieties for cultivation.
- Lack of competent trained manpower for implementation of sound fodder development programme.
- To meet the growing demand of humans for food, fibre and shelter, fodder production was never given due attention.
- The status of permanent pasture and common grazing lands are deteriorating due to huge grazing pressure, lack of adequate institutional arrangement and encroachment of land, etc.
- Poor awareness among the farmers and field staff about various latest and improved fodder production & conservation technologies to improve the availability and productivity of fodder.
- Wastage of fodder due to feeding of un-chaffed fodder to animals by farmers.
- . Due to increased use of combine harvesters, straws are getting wasted/burned in the field because suitable field mowers are not available with the farmers for picking up left out straws. Therefore, to tackle such problems, appropriate range of mowers/reapers and pick up devices need to be introduced.

In view of the above, it is necessary to demonstrate various activities related to fodder development in a focused and strategic way.

5.2 Objectives

Fodder development activities have been formulated with an objective to enhance the fodder availability for the livestock.

Through fodder development activities, focus is to improve the availability of green fodder by increasing the green fodder yield of cultivated fodder from the land already under fodder cultivation. This is important since there is very little scope to expand the area under fodder cultivation.

It is therefore necessary to increase the green fodder productivity of cultivated land up to 60 MT per hectare through adoption of latest technologies.

Besides enhancing green fodder yield, there is a need to improve the efficiency of fodder utilization, conservation and minimizing the fodder wastage to increase the overall availability of green as well as dry fodder in the villages.

5.3 Prerequisites for Fodder Development activities

Fodder development activities would be implemented through eligible Participating Institutions such as Milk Unions/ Multi State Milk Cooperatives/ State Dairy Federations/ Milk Producer Companies. (There is also need of officer with Post graduate in Agronomy or Agri. Graduate to successfully implement fodder development activities in villages. Recruitment of officers and supervisor to be done after written test and interview. They may also have skills in computer handling /IT.) The prerequisites for fodder development activities would be as following:

- Eligible PIs should be willing to implement the activity in its operational area.
- PI should identify area for implementation of fodder development activities considering the availability of livestock, green & dry fodder and agro–climatic conditions in the area.
- PI should agree to implement the activities as per norms laid in the technical and operational guidelines of fodder development activities.
- PIs should have sufficient field level manpower to implement the activities.

5.4 Implementation arrangement

The PI will identify one of its employees or new recruitment person having required qualification and experience as ANO to carry out the fodder development activities. ANO will be

supported by animal nutrition supervisor deployed in the field and milk procurement supervisors for effective coordination and implementation of the fodder development activities at village level. The ANO and the required technical staff will be trained on various fodder development activities proposed under the project before initiating the implementation of the activities. The specific roles and responsibilities of the manpower are as given below:

a. Responsibility of ANO for Fodder Development activities:

- Preparation of work plan for seed, planting material, fodder tree sapling distribution, silage making and other activities
- Selection of villages & farmers on the basis of resource availability (Land, irrigation etc.) for seed distribution and silage
- Identification of eligible DCS/MPP for chaff cutter distribution
- Selection of appropriate machinery based on cropping pattern and field conditions
- Arranging supply of seed, planting material and machinery within stipulated time
- Advisory services to the farmers for fodder production agronomic practices including disease and pest management
- Assisting silage making by using scientific principles and its popularization on commercial lines
- Commercial fodder production through participating institution using advanced agronomic practices
- Assisting the end users for basic handling of farm machinery at fieled level
- Coordination and management of trainings at MTC
- Periodic field visits and close monitoring of each activity & addressing farmers issues if any

- Conducting village awareness programme by effective extension methods (farmers meeting, demonstration, audio-visual etc.)
- Collections of silage samples from field and testing for quality parameters
- Data collection, management, record keeping, generation of periodic reports and sharing it with NDDB.

b. Responsibility of Animal Nutrition supervisor pertaining to for fodder development activities:

- Preparation of work plan by providing suitable information from villages/farmers
- Selection of villages/ DCS/MPP & farmers for particular activity of programme
- Arranging supply of seed, planting material and machinery within stipulated time
- Conducting silage making demonstration by arrangement of necessary inputs and its popularization
- Assisting the end users for basic handling of machinery at field level
- Regular field visits and monitoring of given activity in area
- Conducting village awareness programme as per guideline
- Collections of silage samples from field and sending it for testing
- Data collection on fodder activities, adoption, success stories, record keeping, and sharing it with ANO.

5.5 Components of Fodder Development Activities

Various components under the Fodder Development activities are as follow:

A. Green Fodder Production Enhancement

i. Fodder seed support to farmers for TL/ Certified/Hybrid fodder seeds.

B. Demonstration of Crop residues management technologies

i. Promoting usage of mowers of different capacities.
ii. High speed wet biomass management units.

C. Demonstration of fodder conservation technologies

i. Promoting the usage of Chaff cutter.
ii. Establishment of Fodder Storage Godown atvillage or DCS/MPP level.
iii. Demonstration of green fodder conservation through low cost silage making at DCS/MPP level.

D. Demonstration and propagation of modern fodder production & conservation technologies

i. Establishment of Micro Training Centres (MTC).
ii. Commercial fodder production through Participating Institutions/DCS/MPP/Progressive farmers in villages.

5.6 **Details of Fodder Development Activities**

A. Green Fodder Production Enhancement

i. Fodder seed support to farmers for TL/ Certified/ Hybrid fodder seeds.

Rationale

In the project area, small and marginal milk producers/dairy farmers rarely prefer to purchase quality fodder seed at higher prices. To encourage farmers to use high quality seeds for fodder crop cultivation, financial assistance to farmers has been envisaged under the project. This initiative will help in increasing the availability of quality fodder seed with the farmer in rural areas by keeping prices affordable.

Tasks

Fodder seed support to farmers for TL/ Certified/ Hybrid fodder seeds. This activity will be given to the PIs having required technical manpower to execute the activity in the field.

Selection criteria

PIs would identify the dairy farmers having owned or hired land for fodder cultivation with irrigation facility, to whom such support is to be extended with the help of Village level institutions.

Sequence of Activities

- Identification of villages/ DCS/MPP/ PI.
- Selection of appropriate crop/variety as per village conditions.
- CoMPPling demand of fodder seed from the farmers at village level.
- Procurement of good quality seed (CS/TL) from Dairy cooperative seed processing units /Regional fodder station under Department of Animal Husbandry, Dairying and Fisheries, GoI (DADF).
- Supply of quality seed to the members through village based institutions at nominal charges. *(Fodder cultivation as per agro-climatic conditions, may be annual or round the year. Seed demand will be collected and distributed twice a year i.e. Rabi and Kharif)*
- Visit to fields by ANO to advise farmers on cultivation.
- Estimation of fodder yield/fodder production on farmers' field.
- CoMPPlation of fodder seed sale data from village level institutions as per KPI.
- Reporting of data to NDDB on monthly/quarterly basis including online data.

Key Performance Indicator

Quantity of TL/ Certified/ Hybrid fodder seed support to farmers

- Quantity of fodder seed distributed
- Number of villages/PIs/MPPs covered
- Number of famers covered per DCS/MPP/PI

Technical Specification

Fodder seed (hybrids/TL/certified) sold to farmers must meet the minimum seed certification standards as per seed certification norms as given below:

Forage crop	Pure seed (%)	Inert matter (%)	Other crop seed (No./Kg)	Total weed seed (No./kg)	Other Distinguishable Varieties (No./kg)	Germination %	Moisture (%)	Moisture % for vapour proof
Berseem	98	2	20	20	-	80	10	7
Sorghum/ Sudan Grass	97	3	10	10	20	75	12	8
Cluster Beans	98	2	20	None	20	70	9	8
Lucerne	98	2	20	20	-	80	10	7

Forage crop	Pure seed (%)	Inert matter (%)	Other crop seed (No./Kg)	Total weed seed (No./kg)	Other Distinguishable Varieties (No./kg)	Germination %	Moisture (%)	Moisture % for vapour proof
Oats	98	2	20	20	20	85	12	8
Rice Bean	98	2	None	10	20	70	9	8
Maize	98	2	10	None	20	90	12	8
Cowpea	98	2	10	10	10	75	9	8
Teosinte	98	2	10	None	-	80	12	8

B. Demonstration of Crop residues management technologies

i. Promoting usage of mowers of different capacities.

Rationale

Due to shortage of labour, use of combine harvester is increasing in India. Farmers are jumping from manual harvesting to jumbo combine harvesters. Majority of farmers are not aware of cattle friendly smaller version of power reapers for wheat, rice, short height cereals which ensure 100% straw recovery as well as grain at quite reasonable speed and costing.

For recovery of straw, appropriate small mowers with reapers and auto pick up devices are to be demonstrated in selected villages. Live demonstrations of cattle friendly straw management machines are to be arranged in various agro climatic zones. Both auto pick up type as well as combine prevention type mowers are to be demonstrated effectively so as to facilitate mass replication by other farmers & village level institutions.

Tasks

Introduction of appropriate range of mowers in the villages so as to reduce wastage of crop residues. This activity will be given to the PIs having required technical manpower to execute the activity in the field.

Selection criteria

- Villages having combine harvesting practices.
- Villages facing acute shortage of labour for grain harvesting and straw pick up activities.
- Straw surplus zone situated closer to straw deficit pockets.

Sequence of Activities

- Identification of villages/ DCS/MPP/ PI.
- Selection of appropriate machine as per village conditions.

- Procurement of appropriate mower from competent suppliers as per approved specifications.
- Supply of equipment to the end users on rent or lease basis.
- Educating participating farmers on safe operation, key adjustments, minor repairs and maintenance schedules.
- Arrange demonstration to other farmers.
- Field visit to collect data and report preparation.
- Data entry as per project norms.
- Efforts to increase coverage and adoption in nearby villages.

Key Performance Indicator

- Number of mowers demonstrated.
- Number of farmers and villages covered under mower demonstration.

Technical Specification of straw recovery reapers/ mowers

- Depending on local village conditions, two approaches/sets of machines are to be propagated for straw management.
- Easy to Use power reapers cum liners or power reapers cum binders for wheat, rice, short height cereals. This middle course of mechanization will ensure 100% straw recovery at the time of threshing.

Table 4: Specification of straw recovery reapers

No.	Crop residue recovery machine	Mowers hp	Recovery by one machine (MT/Yr)	Area covered by one machine (Hect/Yr)
1	High speed wet biomass management units	Up to 75 hp	500	500
2	Wheat, rice, oat front mounted reaper cum liner	>15 hp	150	150
3	Wheat, rice, oat reaper cum binder self-propelled	5-15 hp power tiller	100	100
4	Wheat, rice, oat reaper cum liner self- propelled	5 hp	50	50

- Mowers/ Reapers after combining

- Harvesting and pick up of wheat straw after combining is very simple, because weather is dry and straw is crisp – easy to crush. Reaper cum thresher cum loader is to be propagated in wheat belts.
- Managing rice straw after combining is rather difficult because weather is humid and the straw is like plastic rope – extremely difficult to thrash / chop

Following range of machines is to be propagated under this category.

Table 5: Specification of mowers

No.	Crop residue recovery machine	Recovery by one machine (MT/yr.)	Area covered by one machine (Hec.)
1	Wheat straw special reaper, thresher with inbuilt loader	150	150
2	All crop side mounted mower without pick up a) Sickle type or slasher -for straw and green fodder b) Disc/drum type - for flexible straw	 150 200	 150 200
3	All crop liner/collector/swather set	500	500
4	Rice straw/all crop flail mower, chopper with loader	200	200
5	All crop auto pick up baler	500	500

Above machines have cutting width ranging between 1 to 2.2 meters – capacity varying from 50 to 500 MT per year. Selection of Crop residue recovery mowers/ reapers will be guided by the following parameters:

- Type of straw to be harvested
- Crop rotation
- Physical & chemical properties of straw and its age/stage
- Agro-climatic conditions
- Skill level of manpower/operators
- Preference for silage and hay making
- Tractor density in the village/district
- Availability of labour for manual pick up

C. Demonstration of fodder conservation activities

i. Promoting usage of Chaff cutter

Rationale

In spite of severe fodder shortage in the country, dairy farmers keep on wasting huge quantity of fodder in the range of 30 to 40% due to non-availability of appropriate design fodder chaff cutters and mowers in their villages. The shortage and simultaneous wastage of fodder by farmers leads to steep increase in the cost of crop residues/ fodder straw which is being traded in the range of Rs. 8 to 10 Per Kg. Due to this, many young farmers are discouraged to adopt dairy farming as their main profession. It is high time that efforts are made to introduce appropriate design chaff cutters among dairy farmers to minimise the wastage of fodder and reduce the cost of dairy farming.

Advantages of Chaff cutter

- Assured reduction in fodder wastage.
- Improved palatability & digestion due to exposure of large surface area of roughage for microbial digestion in the rumen.
- Stress & trouble free flow of feed material during rumination process.
- It helps in easy handling and storage of fodder due to increased bulk density.
- Chaffing of green fodder facilitates conservation of fodder in the form of silage.
- Animal saves metabolic energy which is otherwise wasted in chopping by teeth & muscle power.
- Enhanced milk production and overall performance of the milch animals.
- It facilitates mixed feeding of roughages and concentrates together in the form TMR.

Task

Distribution of Manual chaff cutters, Power chaff cutters and conveyer fed chaff cutters. This activity will be given to the PIs having required technical manpower to execute the activity in the field.

Selection criteria

Priority will be given to those areas where fodder wastages are high and chaff-cutters are not being used by farmers. Chaff-cutters of following types have been envisaged:

- Manual chaff-cutters may be provided to marginal & small farmers having less than 5 dairy animals.
- Power chaff-cutters may be provided to farmers having more than 5 dairy animals with on-farm fodder cultivation and silage making capacity.

Sequence of Activities

- Identification of villages/ DCS/MPP.
- Selection of appropriate chaff cutter as per village conditions.
- Procurement of appropriate chaff cutter from competent suppliers as per approved specifications.
- Supply of equipment to the end users on rent or lease basis.
- Educating participating farmers on safe operation, key adjustments, minor repairs and maintenance schedules.
- Arrange demonstration to other farmers.
- Field data collection, data entry and report preparation.
- Efforts will be made in field to increase coverage and adoption in villages.

Key Performance Indicator

- No. of chaff cutters distributed.
- No. of farmers covered for chaff cutter distribution

Technical Specification

- Depending on local village conditions, three approaches/sets of machines are to be propagated for biomass management.
- Easy to use manual chaff cutter, motor operated chaff cutter and conveyor fed chaff cutter for chaffing of green and dry fodder of wheat, paddy, sorghum, napier, maize etc. This will ensure reduction of fodder wastage.

Table 4: Specification of chaff cutters

No.	Crop residue recovery machine	Capacity (Kg/hr)
1	Chaff cutter manual	150-200
2	Chaff cutter power	200-500
3	Conveyor fed chaff cutter	500-2500

- Appropriate design for accurate chopping of rigid stem fodder biomass as well as flexible stem biomass like rice straw.
- Flywheel design chopping method to be provided.
- Feed rollers provided for holding fodder in dry or green condition.
- Tension springs provided on rollers for proper fodder straw holding.
- Drive covers provided as per safety norms.
- Strong motor frame of universal design provided on the side of flywheel.
- Specifically approved make motor to be used.
- Manual version drive handle provided.
- Mobile, trailing version complete with cart, axle & tyres etc. as per need
- All human safety norms to be followed strictly.

Selection of chaff cutters will be guided by the following parameters:

- Type of biomass to be harvested
- Availability of power source
- Agro climatic conditions
- Skill level of man power/operators
- Preference for direct feeding, silage and hay making
- Tractor density in the village/district
- Availability of labour

ii. Fodder Storage Godown

Rationale

Cereal grower's paddy and wheat are switching over to jumbo combine harvester which is not a cattle friendly method of crop harvesting. Due to shortage or absence of pick up mowers and proper storage godowns, many farmers are constrained to waste the left out straw right in their fields. Storage of green fodder silage of maize, sorghum, oats etc. will reduce wastage as well as provide fodder to animals during deficit/drought period. For storage of dry and wet

biomass appropriate dual purpose biomass stores/godowns suitable for Indian farm conditions for storage are to be demonstrated.

Task

Establishment of fodder storage godown for dry and green fodder at strategic locations. The programme will be given to the PIs having required technical manpower to execute the activity in the field.

Selection criteria

- Straw and green fodder surplus zone situated closer to fodder deficit pockets.
- Villages having combine harvesting practices.
- PIs/ DCS/MPP having own/ hired land (encumbrance free) for setting up of godown.

Sequence of Activities

- Identification of villages/DCS/MPP/PI.
- Construction of dual purpose biomass stores/godowns.
- Arrange demonstration to other farmers.

Key Performance Indicator

- Number of farmers covered under biomass stores/ godowns.
- Quantity of biomass stored in biomass stores/ godowns (Tons).

Technical Specification

Proposed schematic design for universal bunker/ store for straw/silage is given below:

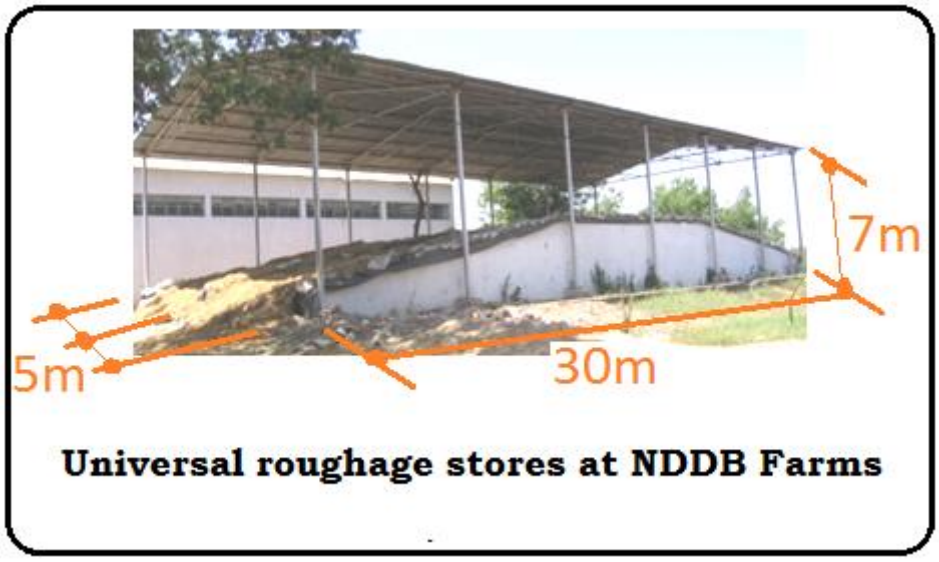


Figure1: Universal bunker/store for straw/silage

Depending on rain fall in the village, side walls could be provided.

iii. Low cost silage making

Rationale

Silage is a preserved green fodder having high moisture around 65-70 percent. It is preserved from the fermentation of sugars available in the green fodder in the absence of oxygen (anaerobic fermentation).

In order to ensure supply of fodder to livestock during lean/ scarcity period, the fodder conservation of any surplus quantity of green fodder is the best option. Among various technologies available for fodder conservation, silage making (fodder ensiling) is most efficient because large quantity of green fodder can be preserved for longer period during any season without any significant loss of fodder quality and palatability.

In India, silage making is not popular among farmers and it is necessary to educate the farmers about silage making by organizing demonstration at the village level. Through establishment of low cost silage making model at DCS/MPP level green fodder will be made available to farmers at nominal price during lean period.

Task

Low cost Silage making (250 MT capacity) demonstration through DCS/MPP involvement. The programme will be given

to the PIs having exclusive technical manpower or ANO to execute the activity in the field successfully.

Selection criteria

In areas where maize, sorghum and oats crops are regularly being cultivated and agro-climatic conditions suits for ensiling. PI's and village based institutions have experienced of cultivating silage making crops and desire to participate in the programme. Presence of progressive farmers in the area.

Presence of DCS/MPP and willingness of its management committee to carry out silage activity on commercial lines.

Sequence of Activities

- Training of ANO and field staff in fodder conservation.
- Identification of suitable village/ farmers.
- Selection of appropriate equipment's/Silo structure as per village conditions.
- Procurement of good quality materials from competent suppliers as per approved specifications
- Design & Construction of silo structure /other ensiling methods as per site conditions.
- Supply of HDPE bags/polythene sheet/equipment's/tools and tackles to DCS/MPP/PI
- Briefing to DCS/MPP/PI about harvesting, chaffing and silage making technology.
- Silage production on commercial lines
- Silage supply to farmers by DCS/MPP/PI
- Data collection, data entry and report preparations on monthly /quarterly basis as per project norms.
- Field visit by ANO and field staff to increase adoption and coverage.

Key Performance Indicator

- Number of farmers/villages covered under silage making.
- Amount of silage produced by PI, DCS/MPP and farmers.

Technical Specification

Procedure of Silage Making

- Training of farmers in silage production.
- As per site condition, select suitable method of silage making, equipment's, crops to be cultivated and storage etc.
- Establishment of storage for silage: One cubic meter space/ silo can store 500-600 kg of green fodder.
- Cultivation of crop for silage purpose.
- Harvest the crop at 30-35 percent dry matter stage.
- Chop the fodder into small pieces of 2-3 cm size, filled in silos, and sealing.
- Open the silo for feeding, minimum after 45 days, as per the need.
- Selling of silage on commercial lines to farmers.
- Continuous estimation of demand of silage, production as per the need.
- Maintenance of records.

Crops suitable for silage making

- The fodder crops rich in soluble carbohydrates, such as maize, oats, barley and sorghum are most suitable for ensiling. The silage of other crops can also be made by using suitable additives.

Characteristics of good quality silage

- Silage will be produced as per the guidelines provided by NDDB.
- Technical specifications for silage will be provided by NDDB.

D. Demonstration and propagation of modern fodder production & conservation technologies

i. Establishment of Micro Training Centres (MTC)

Rationale

There is need to create awareness/ transfer of new technology/ improved practices among farmers. It can be done through imparting practical training by the progressive/ successful farmer to other dairy farmers on various aspects of milk production including fodder production and conservation.

Task

Establishment of MTCs. ANO must have experience in field of fodder cultivation and conservation and up to date knowledge about latest agronomic practices of fodder crops cultivated in the area.

Selection criteria

The programme will be given to the PIs who have capacity to carry on MTC after project period completion. PI's must be having well experienced ANO to execute the activity and support MTC farmers in the field successfully. MTC will be established on the premises of progressive dairy farms for speedy dissemination of modern fodder production and conservation technologies. MTC operation will be managed by PIs. Farmers will be identified by PIs in advance and brought to MTC for training purpose. Technical manpower of PIs will be engaged to coordinate the activities.

Criteria for selecting farmer / village to start MTC

- Progressive / successful dairy farmer (medium) having few milch animals and land for fodder cultivation.
- Having Good communication skill in local language.
- Willingness to create infrastructure like class room.
- Willing to teach/ share his experience
- His ability to arrange food & snacks to the trainees against charges.
- Availability of animal shed/chaff cutter/vermi-compost etc.
- Practicing innovative modern fodder cultivation technologies as per the local conditions.
- Owned farm Land for fodder cultivation nearby house to set up fodder demonstration unit.
- Ideally, MTC location would be at a successful / progressive dairy farmers' house. However, in case above facilities are available at DCS/MPP level or any other common place in the village, PI may also decide to set up MTC on such venues.

Sequence of Activities

- Identification of progressive farmer at village level with maximum available resources.
- Briefing of programme objective to the selected trainer farmer

- Procurement of capital items and training material
- Setting of MTC for proper training facilities including boarding
- Listing of farmers for training at MTC, assessing their training need identification
- Draft schedule of training at MTC
- Support to MTC farmer on execution of MTC activities.
- Field visit by ANO to support MTC centres.
- Data collection, feedback collection and data reporting /entry as per project norms.
- The trainer farmer to arrange training for other farmers for one day including both classroom and practical session.

Key Performance Indicator

- Number of MTCs established
- Number of farmers trained

Concept - MTC

- One day practical training programme for milk producers (husband & wife) on improved dairy farming by a successful /progressive dairy farmer.
- Practical training is to focus on best dairy farm management practices for enhancing milk production & productivity.

Proposed training (topics) to be covered at MTC

- Green fodder cultivation as per local conditions
- Good agricultural practices to improve fodder yield, soil health and soil fertility.
- Silage making technology.
- Importance of chaffing dry & green fodder.
- Importance of organic fertiliser, compost, vermi-compost, biogas plant for small /medium farmers.
- Use of mowers to recover crop residues.
- Any other aspect as per local need.

Methodology

- PI has to provide infrastructure as per approved provision of MTC.
- PI has to finalise the schedule of different training programme in consultation with MTC and coordinate nominations of the trainees from other DCS/MPP.

- Dairy cooperatives societies have to arrange to and fro transport for their nominated farmers to MTC.
- PI has to arrange note books, pen, and extension material, teaching aids and certificates to MTC and also supervise quality of training.
- PI has to collect data and prepare progress report.

Funds provision & Infrastructure for MTC

- Creation of class room to be arranged by successful dairy farmer identified for establishing MTC.
- Infrastructure support for furniture and other teaching aids required in MTC are to be arranged by PI ***(Refer Table 3)***
- Revenue expenditure incurred for training are given below:

    - To and fro transport for participants is arranged by DCS/MPP to MTC. PI may provide a transport grant maximum of Rs. 100 per participant from project.
    - The food and snacks (Breakfast-1, lunch-1 and tea with snacks-2) are to be arranged at MTC by the progressive farmer. PI may provide a maximum grant of Rs. 100 per participant from Project.
    - PI may pay a facilitation fee of Rs. 100 per participant to trainer from Project.
    - Other revenue expenses incurred on note book, pen and certificate are to be borne by PI.

Table 6: Establishment of a MTC

No.	Particulars	Physical Quantity
1	**Infrastructure Support**	
	Chairs	30
	Table	1
	Cup Board	1
	Black board	1
	Projector	1
	PC/ Laptop	1
	Public address system (mike-1 & speaker-2)	1 set
	Extension material / teaching aids like digital flexi board, posters etc.)	1Set (LS)
2	**Revenue Expenses**	
	Transport support / year to DCS/MPP (@ Rs. 100 per farmer)	2400 farmers
	Food & snack support /year (@ Rs. 100 per farmer)	2400 farmers
	Facilitation fee paid to MTC / year (@ Rs. 100 per farmer)	2400 farmers

ii. Commercial fodder production through Participating Institutions

Rationale

Green fodder is not available in villages round the year due to seasonal cultivation of crops. Due to shortage of fodder during lean period, milk productivity decreases. Landless, marginal and small farmers do not get enough fodder due to less land and unavailability of sufficient fodder from grazing lands in village. Therefore, if commercial fodder production on land is taken up by DCS/MPP with the involvement of farmers in the village then this problem can be tackled. Green fodder produced on fertile land by cultivation perennial and annual fodder crops will help in year round green fodder production in the village and this fodder may be sold to poor farmers at nominal price. This activity may be carried out by village level institution like dairy cooperative societies/ NGOs/ progressive farmers working in that area and through participation of local community. The whole concept is to develop such lands would be based on sound ecological principle and very much nearer to nature.

Task

Use of fallow/CPR/leased land for green fodder production by PI/ DCS/MPP/farmers. This activity will be given to the PIs having required technical manpower to execute the activity in the field.

Selection criteria

- Operational area should have at least 0.5 hectare.
- The DCS/MPP/PI is ready to lease fallow land for fodder production on long term basis.
- Presence of progressive farmers.
- Presence of dairy farmers ready to purchase green fodder.

Sequence of Activities

- Identification of villages.
- Discussion with farmers and DCS/MPP farmers.
- Preparation of implementation plan at village level.
- Hiring of land on lease basis to village level institution/PI.
- Fodder cultivation plan as per agro-climatic conditions.
- Procurement of inputs like seeds, saplings, fertilizers etc.

- Initiate development work before onset of rainy season.
- Arrange planting of grasses, legumes & trees as per plan.
- Arrange demonstration to other farmers at the time of its operation.
- Sale of fodder to farmers on commercial basis.
- Progress data collection and reporting on monthly basis.
- PIs will be provided 90% grant under the project to promote commercial fodder production on leased land/ fallow land.

Duration

Activity season will start in Kharif/ Rabi season. Development will continue for Project period or longer as per site conditions.

Key Performance Indicator

- Farmers covered under commercial fodder production.
- Quantity of Green fodder production (Tons)

Technical Specification:

Fodder crops and varieties suitable to local agro-climatic conditions will be cultivated.

Cereal fodder crops

The following are the characteristics of the cereal fodder crops:

- Rich in carbohydrates and energy
- Most suitable for silage making
- High fodder production capacity

Perennial cultivated grasses

The following are the characteristics of the perennial cultivated grasses:

- Rich in carbohydrates and energy
- Year round green fodder availability
- Low cost of fodder cultivation

The details of package of practices of cultivated fodder crops are enclosed as **Annex I**.

6. Extension activities

- To take forward the concept of scientific calf management, after training of CRP Supervisors, a Village Awareness Programme (VAP) will be conducted in each village.

Beneficiaries would be oriented about the importance of CRP along with its benefits and identification of beneficiaries may be done during these meetings.

- After six months of project implementation PI may also organize awareness generation camps to propagate the concept of scientific calf feeding and management among other farmers.

7. Training and Capacity Building

7.1 Training of ANOs/ANOs/Field staff/farmers

- Six days training for ANOs covering class room sessions and field visits will be conducted at NDDB Anand. The training programme will comprise of different aspects of animal feeding interventions including fodder activities and handling of INAPH software.
- Five days training will be provided to ANOs and field staff working or hired by PI's in area of good agricultural practices in forages & ensiling, resources conservation technologies, farm implements management to improve fodder yields and reduce wastage of green & dry fodder and implementation & management fodder development.
- PIs would need to intimate NDDB on training needs of ANOs in advance. Training would be imparted in batches, preferably 10 participants in each batch.
- Training to progressive farmers ANO and field staff will be executed in batches of 25 to 30.

7.2 Training of CRP supervisors (CRPS)

- Two weeks (10 days) training will be held at NDDB Anand in a batch size of 10-15 participants.
- Training includes classroom sessions on basic aspects of calf management, software handling, field visits and demonstrations. .

7.3 Training of AN Supervisors (ANS)

- Two weeks (10 days) training will be held at NDDB Anand in a batch size of 10-15 participants.
- Training includes classroom sessions on basic aspects of calf management, software handling, field visits and demonstrations. Tentative training template is similar to the training of ANO, as given in **Annex II**.

8. Monitoring Mechanism

Following will be the monitoring mechanism for implementation of the sub project.

i. Sub Project Management Committee

- At the PI level, a Sub Project Management Committee will be constituted for monitoring and reviewing activities under various components being implemented under the project, which will be headed by Managing Director (MD)/ Chief Executive Officer (CEO)/ General Manager (GM) of PI.
- The members of the Committee will be:
    i. Managing Director/ Chief Executive Officer / General Manager of PI (Chairperson)
    ii. Section/Department Heads (Purchase, Finance & Accounts, HR & Admin, Procurement & Inputs, Plant & Engineering, Marketing & Sales, IT/MIS.)
    iii. Sub-Project Coordinators (all components proposed under the project)
    iv. Grievance Redressal Officer (GRO)
    v. NDDB representative
    vi. MIS Officer – who shall be the member convener
- The Committee, if desires, may also call special invitees to attend the meeting. The Committee will meet at least once a quarter to review the progress of sub project activities.
- The roles & responsibilities of the Committee will be:
    - To review the progress of the sub project (component wise) and provide quarterly reports (as may be required) to Implementation & Monitoring Cell (IMC) in NDDB in specified formats.
    - To prepare long term strategies, action plans, take policy decisions related to sub project implementation, including approval of budget, expenditure, reimbursement and release of advances, entering into contracts with agencies and other organizations, etc.
    - Post sanction, timely execution of project agreements and ensure regular utilisation & repayment of loan as per the terms and conditions prescribed in the loan agreements.

- Resolve issue and bottlenecks during sub project implementation.
- Regularly review the status of grievance redressals under the sub projects and provide guidance/directions, if required.
- Provide required support to auditors appointed under the project.
- Ensure timely submission of required data, information and reports to IMC (located at NDDB).

ii. Sub Project Implementation Cell

- To effectively implement the activities envisaged under the Productivity enhancement component, a Sub Project Implementation Cell will be constituted at PI level.
- The Cell will be headed by Sub Project Coordinator (PE) who will be appointed by MD/CEO/GM of the PI. The members of the Cell will be:
  i. Sub Project Coordinator (Productivity Enhancement) – head of the cell
  ii. AN officer/FDO/ AN supervisor
  iii. Head (Purchase)
  iv. Head (Finance & Accounts)
  v. Grievance Redressal Officer (GRO)
  vi. IT/MIS Officer
- The Cell will be responsible for implementation and monitoring of the PE activities on day-to-day basis and will be accountable for achievement of the targets set under the sub project.
- The Cell would meet every month and will manage implementation of the sub project under the supervision, direction and control of the Sub Project Management Committee.
- The roles & responsibilities of the Committee will be:
  - Define sub-project Key Performance Indicators (KPI) in line with Project Operation Manual and set monthly targets under each KPI
  - Arrange required resources to implement the project

- Monitor the physical and financial progress of the Sub project
- Document success stories.
- Periodically report the progress of sub project activities to the Sub Project Management Committee.
- Provide required suggestions/ recommendations to Sub Project Management Committee to take necessary policy decisions for smooth implementation of the sub-project.
- Resolve and respond to all grievances received under the sub project.
- Maintain record and accounts of all transactions.
- Identification / recruitment of requisite manpower & arrange their training

iii. Implementation in the field

The PI will identify one senior officer as Project Coordinator (PC) from the existing manpower for overall project coordination and monitoring. ANO will report to PC. ANS and CRPS will directly report to ANO. PC/ANO will liaison with NDDB for technical and other supports.

9. Procurement arrangements

PIs to procure various items required for the project by following purchase procedures described in Procurement (Purchase) Guidelines.

10. Maintenance of Documents and Information

- The PI would maintain a stock record of capital items and kit/accessories indicating item wise receipt, issue and stock balance details.
- PI would document reports of physical progress indicating numbers of villages covered, animals covered, and trainings imparted to each category of manpower. PI would also document reports of impact of the programme.
- Store and accounts records will be maintained separately for capital and consumable items in separate registers as per requirements of the funding authority.
- All items procured would be entered in stock registers as per audit requirements.
- Separate project accounts to be maintained by the PI.

- PI will maintain the list of milk producers who have availed benefits under the project.
- Details of the capital item provided shall be clearly tagged and location at which it has been installed/ set up will be maintained by PIs.
- Project MIS will capture relevant information about the transactions related to the sub-component.

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Annex I: Details of package of practices of important fodder crops in India

Summer/ Kharif

Crop	Soil	Varieties	Sowing Time	Seed Rate (Kg/Ha)	Spacing	Fertilizer (Kg/Ha)	No. Of Irrigation	Cutting Time (Days)	No. of Cuts Per Crop /Year	Green Fodder Yield (Ton/Ha)
Sorghum (Single cut)	Sandy Loam to Clay Loam	PC – 6,9 HC – 136,308 Pant Chari 5	June – July (North India) Feb to Nov (South India)	25-30	30-40	N – 60 P- 30	3-4 in summers	80-90 for late varieties and 65-57 for early ones	1	30-50
Sorghum (Multi-cut)	Sandy Loam to Clay Loam	Proagro-855 ProagroX-988 UPMCH-1101 Pant Chari 6	March – July (North India) Feb to Nov (South India)	25-30	30-40	N – 60 P- 30 & N – 30 kg after every cut	5-6	First cut at 50 days and rest at 40 days interval	4-5	50-80
Maize	Sandy Loam to Clay Loam Good drainage	African Tall J-1006	March – August (North India) Feb to Nov (South India)	40-50	30-40	N – 80 P- 40 & N – 30 kg after every cut	3-4	75-90	1	35-55
Pearl Millet	Sandy Loam	AVKB-19 GFB-1	April to July	8-10	30-40	N – 40 P- 20	2-3	60-75	1	25-50
Teosinte	Sandy Loam to Clay Loam	TL – 1	April to July	30-40	40-45	N – 60 P- 30	2-3	60 days interval	2	45-60
Cowpea	Sandy to	UPC 9202	March to July	30-35	30-45	N – 30	2-3	60 -80	1	30-35

Crop	Soil	Varieties	Sowing Time	Seed Rate (Kg/Ha)	Spacing	Fertilizer (Kg/Ha)	No. Of Irrigation	Cutting Time (Days)	No. of Cuts Per Crop /Year	Green Fodder Yield (Ton/Ha)
	Loam	UPC – 8705 CL – 367				P- 40				
Rice bean	Sandy Loam to Clay Loam	Bidhan 1 KRB – 4	April to August	25-30	30-35	N – 30 P- 40	2-3	70-90	2	20-30
Cluster bean	Sandy to Sandy Loam	HFG-156 Guara-80 Bundel Guar – 2,3	April to August	25-30	30-35	N – 30 P- 90	2-3	60-75	1	20-30
Berseem	Loam to Clay Loam	Wardan, JB-1,2,3,4 BL – 1,42	October to November	25	20-25 cms or by spreading	N – 30 P- 80	10-15	First cut at 60 days and rest at 30 days interval	5-6	70-110
Lucerne	Sandy to Loam	Anand – 2 RL – 88 and Anand 3 (Perennial)	October to November	25	20-25 cms or by spreading	N – 30 P- 80	10 (Annual) 15 (Perennial)	First cut at 60 days and rest at 30 days interval	Annual –(5-6) Perennial (7-8 cut)	60-80 (Annual) 80-110 (Perennial)
Oats	Sandy Loam to Loam	Kent UPO 212 Harita (RO19) Bundel Jai 2004	October to November	80-100	20-25 cms	N – 80 P- 40	3-4	First cut at 60 days and second cut at 50 % flowering	1-2	30-45)
Mustard	Sandy Loam to Loam	Chinese Cabbage	September to November	6-8	30-40	N – 60 P- 20 K-20	2-3	AT 50 % flowering	1	25-30

Crop	Soil	Varieties	Sowing Time	Seed Rate (Kg/Ha)	Spacing	Fertilizer (Kg/Ha)	No. Of Irrigation	Cutting Time (Days)	No. of Cuts Per Crop /Year	Green Fodder Yield (Ton/Ha)
Sugar beet Or Fodder beet	Sandy Loam to Clay Loam	Cauvery LS -6 IISR composite – 1	October to December	3-4 kg	50 X 15	N – 80 P – 40 K – 40 at sowing and N – 40 after 35-40 days after sowing	8-10 irrigation	Harvesting starts after 100 days of sowing	1	90-110

Perennial Grasses/Legumes/Tree legumes

Crop	Soil	Varieties	Sowing Time	Seed Rate (Kg/Ha)	Spacing	Fertilizer (Kg/Ha)	No. Of Irrigation	Cutting Time (Days)	No. of Cuts Per Crop /Year	Green Fodder Yield (Ton/Ha)
Hybrid Napier Bajra Grass	Sandy Loam to Clay Loam	CO 3, 4 PBN – 233	March to October in North India Year Round (South India)	40000 root slips/ stem cuttings	100 x 50	N – 50 P- 80 K – 60 at planting N 40 kg/ha after every cut	Every 15 days interval	I cut at 90 days after planting Rest cut at 45 days interval	7-8	200 to 250
Guinea Grass	Sandy Loam to Clay Loam	CO 2,3 PGG-518, 616 Bundel Guinea – 1	March to August in North India Year Round (South India)	40000 root slips or 3-4 kg per ha	50 x 50	N – 50 P- 80 K – 60 at planting N 40 kg/ha after every cut	Every 15-20days interval	I cut at 75 days after planting Rest cut at 45 days interval	7-9	100 to 150

Crop	Soil	Varieties	Sowing Time	Seed Rate (Kg/Ha)	Spacing	Fertilizer (Kg/Ha)	No. Of Irrigation	Cutting Time (Days)	No. of Cuts Per Crop /Year	Green Fodder Yield (Ton/Ha)
Dhaman Grass	Sandy to Sandy Loam	Bundel Anjan -1, 3	March to September in South India June-July in North India	5-6 kg /ha	45 x 45	N – 40 P- 30 K –30 at planting	Rainfed	I cut at 60 days after planting Rest cut at 50 % flowering stage	2	10-12
Para Grass	Loam to Clay Loam	-	February to August in North India Year round in South India	5-6 quintals of stem cuttings	50 x 50	FYM – 50 ton N – 25 kg after each cut	Rainfed	I cut at 90 days after planting Rest cut at 45 days interval	6-8 in North India and 8-10 cuts in South India	180-250
Stylo	Loam to Sandy Loam	Verano, Scabra	June-July in Noth India and March to September in South India	4-5	45 x 20	N – 25 P – 60	Rainfed	I cut at 60-70 days after sowing second cut at 45 days interval	2	15-35
Siratro	Sandy Loam to Clay Loam	-	June-July in Noth India and March to September in South India	4-5	45 x 15	N – 25 P – 60	Rainfed	I cut at 70-80 days after sowing second cut at 60 days interval	2	15-25
Hedge Lucerne	Sandy Loam	-	June-July in Noth India and	2-3	45 x 10	N – 25 P – 60	Rainfed	I cut at 70-80 days after	4-5	40-70

Crop	Soil	Varieties	Sowing Time	Seed Rate (Kg/Ha)	Spacing	Fertilizer (Kg/Ha)	No. Of Irrigation	Cutting Time (Days)	No. of Cuts Per Crop /Year	Green Fodder Yield (Ton/Ha)
	to Clay Loam		March to September in South India					sowing second cut at 45 days interval		
Gliricidia Spp	Loam to Clay Loam	Sepium	June to August in rainy season	2m x 50cm	4-5 kg/ha Or 10000 stem cutting (7cm thick)	N – 25 P – 60	Rainfed	After 5-6 months of planting lopping of tree branches as per need	2 -3 times	25-30