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TECHNIQUE FOR GRAZING MANAGEMENT

A demonstration in Shivamogga landscape, Karnataka

ARUN POOJARY

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TECHNIQUE FOR GRAZING MANAGEMENT

A DEMONSTRATION IN SHIVAMOGGA LANDSCAPE, KARNATAKA

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DISCLAIMER
The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

ACU	Adult Cattle Unit
Forest-PLUS	Partnership for Land Use Science
FSI	Forest Survey of India
ICAR	Indian Council of Agriculture Research
ISFR	India State of Forest Report
MoEFCC	Ministry of Environment, Forest and Climate Change
NIANP	National Institute of Animal Nutrition and Physiology
REDD	Reducing Emissions from Deforestation and Forest Degradation
VFC	Village Forest Committee
USAID	United States Agency for International Development

UNITS

DB	dry-basis
ha	hectare
kg	kilogram
kg/h	kilogram per hour
km^2	square kilometre
MT	metric ton
rpm	revolutions per minute

1.0 INTRODUCTION

The Partnership for Land Use Science (Forest-PLUS) Program is a five-year initiative jointly designed by USAID/India and the Ministry of Environment, Forest and Climate Change (MOEFCC). The Program is focused on US–India collaborative scientific and technical research, and exchanges that explore methods and approaches to implement REDD+. The Program aims to reduce emissions from deforestation and forest degradation and enhance sequestration through conservation and sustainable management of forests. Forest-PLUS contributes to USAID/India's development objective of accelerating India's transition to a low emissions economy by providing technical assistance to develop, demonstrate and institutionalize forest management practices that reduce GHG emissions from forested landscapes, increase sequestration of atmospheric carbon in forests, protect forest biodiversity health, and protect and/or enhance forest-based livelihoods, forest ecosystem services and other social contributions of forests in India.

The Program is achieving these objectives through the development of tools, techniques and methods: (1) for an ecosystem-based approach to forest management and increasing carbon sequestration; (2) for measurement, reporting and verification of carbon stocks; (3) for building institutional structures for effective forest resource governance; and (4) for deploying these improved methodologies in selected pilot clusters in the four demonstration landscapes; and is supported by training programs and communication campaigns targeting a variety of audiences. The four demonstration landscapes are Shivamogga Forest Circle, Karnataka; Hoshangabad Forest Circle, Madhya Pradesh; Rampur Forest Circle, Himachal Pradesh; and the state of Sikkim.

With the objective of conservation of forests and sustainable use of forest products, Forest-PLUS is developing strategies and techniques for sustainable management of forests in each of the four landscapes. The improved grazing management technique is one such technique developed for better forest management. This report documents demonstration of the grazing technique, based on the Forest-PLUS experience in Shivamogga landscape, Karnataka.

2.0 CONTEXT

This section discusses the status of livestock and fodder in India, and provides an introduction to the demonstration landscape.

2.1 STATUS OF LIVESTOCK AND FODDER IN INDIA

India supports 15 percent of the world's cattle population despite comprising only 2.4 percent of the world's geographic area, 1.5 percent of the forest area and pasture lands and 4.2 percent of global water resources (Mathukia, Sagarka, & Panara, 2016). Livestock rearing is an important source of livelihood for two-thirds of the rural population in India and is an integral part of India's agrarian economy. It not only contributes 4.11 percent to total Gross Domestic Product, but also provides opportunities for employment generation, asset creation, and additional financial security, and can serve as a coping mechanism when crops fail (Planning Commision, 2011).

In 2012, there were over 512 million livestock (principally cattle, buffalo, sheep, goat, and pigs) in India, up from 470 million in 1992. The National Livestock Policy, 2013 states that along with an increasing livestock population, the gap between fodder requirement and availability is growing primarily due to a decreasing area under fodder cultivation and reduced availability of crop residues for fodder (MoA, 2013). The annual requirement of dry and green fodder[1] is estimated to be 569 MT[2] and 1025 MT respectively, while their availability is 385 MT and 356 MT respectively (Roy & Singh, 2008). The country faces a net deficit of 61.1 percent green fodder, 21.9 percent dry crop residues and 64 percent concentrate feeds (Dutta, 2013). An increase in livestock population, compounded by shrinkage of common property lands in villages has led to a shortage of fodder in India. This situation is further aggravated by increased numbers of genetically improved cattle that require more feed than indigenous species (Kumar & Singh, 2015).

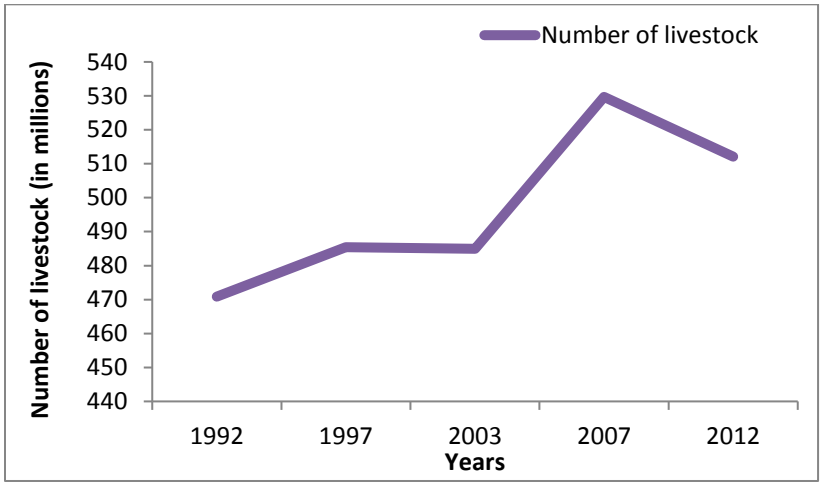


Figure 1: Trend of total livestock population in India during 1992-2012

Source: Livestock Census Reports 1992, 1997, 2003, 2007, 2012

The main sources of livestock fodder supply include crop residues, cultivated fodder and fodder from common property resources such as forests, permanent pastures, and grazing lands. In the absence of

[1] Green fodder includes crops that are cultivated primarily for animal feed. Also, grasses from natural grasslands and pastures are included (whether cultivated or not). When the different crops are either harvested dry or dried after harvesting, it is called dry fodder. Dry fodder is generally fed during the lean seasons.

[2] MT implies metric ton. 1 MT = 1000 kg

sufficient productive pasture lands, forest lands contribute as a substantial source of grazing and fodder. According to the India State of Forest Report (ISFR) 2011, India's forests support 199.6 million livestock partially or completely for feed, either through stall feeding or grazing. Eighty-six million Adult Cattle Units (ACUs)[3] or 22.63 percent of total ACUs in India are completely dependent on forests. These include traditional sedentary village livestock and migratory animals herded by ethnic herders.

Open grazing in the forest is the conventional rearing practice for forest-fringe communities. This has adverse impacts on the growing stock as well as the regeneration capacity of forest when there is over grazing. Almost 78 percent of India's forests are subjected to heavy grazing (World Bank, 2005), often beyond the supported carrying capacity. Further, forest quality is adversely affected due to collection of tree fodder for the large livestock populations in forest-fringe communities.

The demand and supply scenario of fodder and roughage[4], as estimated during the 10th Five Year Plan document is presented in the table below.

Table 1: Supply and demand scenario of fodder and roughage, in million tons (1995–2025)

YEAR	SUPPLY		DEMAND		DEFICIT AS % OF DEMAND *	
	GREEN	DRY	GREEN	DRY	GREEN	DRY
1995	379	421	947	526	568 (60%)	105 (20%)
2000	385	428	988	549	604 (61%)	121 (22%)
2005	390	443	1,025	569	635 (62%)	126 (22%)
2010	395	451	1,061	589	666 (63%)	138 (23%)
2015	401	466	1,097	609	696 (64%)	143 (24%)
2020	406	473	1,134	630	728 (64%)	157 (25%)
2025	411	488	1,170	650	759 (65%)	162 (25%)

* Figures in parentheses indicate the deficit in percentage.

Source: ICAR, 2011

Due to increasing human population, arable land is mainly used for food and cash crops, thus there is little chance of having good-quality arable land available for fodder production unless milk production becomes highly remunerable as compared to crops. The current fodder deficit has to be met by either increasing productivity, utilizing untapped feed resources, increasing grazing land area or through imports (ICAR, 2011).

2.2 SHIVAMOGGA LANDSCAPE

The Shivamogga Forest Circle consists of three territorial Forest Divisions - Shivamogga, Sagara and Bhadravathi; and two Wildlife Divisions - Shettihalli and Sharavathi. The Shivamogga Circle constitutes a forest area of 3,954.15 km^2 (Ramachandra *et al.*, 2013).

[3] ACU is generally used to compare livestock numbers across various categories on cow equivalent.

[4] Roughage includes fodder with a high concentration of fiber.

The Forest-PLUS grazing management technique demonstration area is in the Shivamogga Forest Division, located between 13°21' to 14°8' N latitude and 75°5' to 75°45' E longitude. The Shivamogga Forest Division covers a total forest area of 870.73 km^2 (Ramachandra *et al.*, 2013) and form the catchment of the Tunga and Tungabhadra rivers. The forests types include tropical wet evergreen, semi-evergreen, moist deciduous, dry deciduous and scrub forests. The majority of the demonstration area lies in the Malnad region of Western Ghats, which covers the eastern and western slopes of Sahyadri mountain range.

The Shivamogga district (covering the three divisions of Shivamogga, Sagar and Bhadravati) has experienced a decrease of grass cover in the forests, mainly due to forest degradation caused by over-grazing, cattle trampling, crop cultivation, and major development projects (Puyravaud, Dufour, & Subramanian , 2003) (The Working Plan for the Shivamogga Forest Division) (Ramachandra *et al.*, 2013).

3.0 PROBLEM ANALYSIS

This section discusses the status of livestock and fodder availability in the Shivamogga district.

3.1 STATUS OF LIVESTOCK IN SHIVAMOGGA DISTRICT

In Karnataka, the livestock sector plays a significant role in the rural economy. As per the 19th Livestock Census Report, Karnataka contributes 5.41 percent of all of India's livestock. The density of livestock in the state was estimated at 151.21 per km^2 and 474,680 per million human population. The total number of livestock in Shivamogga is 844,832. The table below presents the distribution of livestock in Shivamogga district as per the 19th Livestock Census Report.

Table 2: Distribution of livestock population in Shivamogga district

NAME OF LIVESTOCK	NUMBER of LIVESTOCK
Cattle (indigenous and cross-breed)	567,543
Buffalo	178,551
Sheep	36,719
Goat	58,012
Pigs	4,007

Source: MoA, 2012

3.2 STATUS OF FODDER IN SHIVAMOGGA DISTRICT

During the monsoon, there is enough grass in paddy fields and open spaces for cattle grazing in Shivamogga district. Grass is also sourced from these areas for stall feeding. However, after the monsoon season there is not enough fodder to meet the needs of the livestock population. The total fodder production of the Shivamogga district in 2012 was estimated at 190,821 tons, including 103,321 tons from agricultural lands, 51,010 tons from barren and waste lands, and 13,843 tons from the forest areas (Veerendra, 2012). Fodder availability in the district from crop residues has been decreasing due to shifts in crop cultivation away from paddy and to a lesser extent increased use of harvesting mechanization for paddy, along with a decrease in pasture lands.

In the Shivamogga district, the total cultivable area under agriculture is 2,609.61 km^2. Paddy[5] is the major cereal crop grown in the demonstration area, and is sown in an area of 1,326.82 km^2 (CGWB, 2012), while maize is grown in an area of 600 km^2. Ragi, and jowar are the other principal crops cultivated. Over the years, the cultivation of cereal crops such as paddy in the district has been replaced by horticultural crops (e.g. arecanut, banana and spices) and maize due to low maintenance costs and/or more dependable or higher economic returns. The reduction of paddy straw, formerly the main dry fodder used for cattle, is having an impact on the availability of fodder. The problem arises from the fact that while ragi and jowar stems can be used as fodder after harvest, maize stems cannot as they become hard after drying and the cattle do not eat them (Veerendra, 2012). The availability of grass left over as cattle fodder after paddy harvesting has also decreased in the Malnad region in the recent years due to

[5] i.e. wet rice

the mechanization of harvesting operations. In addition, pasture lands in the district have reduced over the years, further contributing to decreasing fodder availability. The reduction of fodder availability is putting more and more pressure on forests as an option for obtaining fodder during the lean season.

The deficit of dry fodder has led to procurement of dry fodder from Punjab by the state government (National Rainfed Area Authority, n.d.). To mitigate the shortage of green fodder in the state, the State Disaster Relief Fund supports training in livestock rearing, fodder production, and fodder seed production. In addition, the various centrally-sponsored feed and fodder development schemes operational in Karnataka are listed in the table below.

Table 4: Centrally-sponsored feed and fodder development schemes in Karnataka

SCHEMES	REMARKS
Development of State Fodder Seed farms for the production of foundation/certified seeds	This scheme is aimed at assisting the state government to build their infrastructure and facilities to help existing farms to produce more fodder seeds.
Establishment of Silvopasture system in bio-mass production	This scheme is designed to make intensive use of waste lands/common lands. It is also aimed at arresting degradation of common pool resources by planting suitable grasses and leguminous trees/shrubs (Gram Vana) to produce bio-mass for farmers.
Development of grass lands and grass reserves	This scheme is aimed at slowly improving degraded grasslands and saline and acidic soils by planting suitable grass species.
Establishment of fodder bank	The main objective of this scheme is preservation and storage of surplus fodder to meet the nutritional requirements of livestock during periods of scarcity.
Supply of mini kit	The Department of Animal Husbandry and Dairy supplies small quantities of seeds of improved fodder cultivars to selected farmers free-of-cost. This is aimed at encouraging the farmers to grow improved fodder varieties on their farms to meet their fodder needs.
Enrichment of straws and cellulose waste	The objective of this scheme is to enhance the nutritive value of crop residues and other cellulosic waste for livestock feeding and minimize the wastage of non-conventional and conventional fodder to narrow the gap between availability and requirement of fodder.

Source: Bhende *et al.*, 2004

Despite these government initiatives, a study conducted by Forest-PLUS on grazing issues in Shivamogga during 2014 observed continued scarcity of fodder in the period from January to May every year. Thus, supporting alternative sources of fodder that could be used in the lean period, was identified as one of the ways to reduce the grazing pressure on forest due to fodder scarcity.

4.0 IMPROVED GRAZING MANAGEMENT TECHNIQUE

In the Shivamogga landscape, efforts have been made to develop suitable local techniques to improve grazing management against the backdrop of reduced fodder availability. Since arecanut is widely grown in the selected demonstration area and produces significant organic matter, there is an opportunity to use areca sheath as an alternative source for livestock fodder. In addition, studies from the National Institute of Animal Nutrition and Physiology (NIANP), Bengaluru and others have shown that consumption of areca sheath by livestock results in increased milk production (Gowda, 2016).

This section discusses qualities of and technique for preparing areca sheath as dry fodder.

4.1 ARECA SHEATH AS DRY FODDER

The feeding system for cattle has three components for meeting their nutrient requirements – green fodder, dry fodder and compound feed. Dry fodder, although low in energy and critical nutrients, is important in providing fiber bulk for the cattle diet. Dry fodder is mostly crop residue in the form of straw (from local crops) and hay prepared from local grasses. The minimum fiber requirement for dairy animals is 25-30 percent of the total dry matter requirement.

Arecanut is a commercially important perennial crop in the region. Karnataka is the largest producer of arecanut in India, with most cultivation occurring in the Chikmagalur and Shivamogga districts. The total production of arecanut (raw and processed) in Karnataka was 457,560 tons in 2013-14. The area under cultivation in Shivamogga is 94,077.50 ha with a production of around 52,781 metric tons (Ramappa, 2013). The dry kernel of arecanut (betel or *supari*) is mainly used for masticatory purposes and religious functions.

CHETNA NAHATA

Plate 1: Arecanut plantation in Shivamogga

Arecanut produces large quantities of organic matter throughout the year. The arecanut tree sheds about 10 leaves (sheaths) per year, and the total production of sheaths per hectare is around 4,380 per year (Bhargav & Gaikwad, 2012). The areca sheath is generally used to manufacture eco-friendly disposable plates and as firewood.

Since arecanut sheath fodder contains less silica and lignin than paddy straw, it is considered a better dry fodder than paddy straw. A comparison of the chemical composition of areca sheath with paddy straw (which is traditionally used as dry fodder) is provided in the table below.

Table 5: Comparison of chemical composition in arecanut sheath and paddy straw

PARAMETER (DRY MATTER BASIS)	ARECA SHEATH	PADDY STRAW
Crude protein (%)	3.5	3.8
Ether extract (%)	0.07	0.10
Ash (%)	6.4	17.1
Silica (%)	3.3	13.6
Neutral detergent fiber (%)	71.3	71.2
Acid detergent fiber (%)	47.7	51.1
Lignin (%)	3.9	5.1
Metabolisable energy (MJ)	7.52	7.31
Total digestible nutrients (%)	49.3	48.2
Oxalic acid (%)	0.34	0.56
Tannin (%) equivalent to tannic acid	0.40-0.89	0.73-1.03
Calcium (%)	0.25-0.60	0.16-0.28
Phosphorus (%)	0.06-0.08	0.06-0.07
Magnesium (%)	0.30-0.49	0.11-0.13
Sulfur (%)	0.61-0.75	0.25-0.35
Copper (ppm)	15-23	5-7
Zinc (ppm)	8-12	6-8
Iron (ppm)	90	211
Manganese (ppm)	45	40
Cobalt (ppm)	2	1.5

Source: Gowda, 2016

Despite its potential, due to its long and wide surface area, the organic waste from arecanut has historically had limited alternate uses and is typically disposed of by burning or dumping. Improper handling and storage of organic waste from areca can cause air and water pollution. During the rainy season, the phenols from heaped wastes may leach into the soil, thereby causing soil pollution.

To reach its full fodder potential, the areca sheath needs to be processed into smaller sizes before feeding to animals. Forest-PLUS supported the design of an areca sheath shredder developed for chopping of the areca sheath to be used as a fodder for cattle. Using the technique, the cost of feed mix for a cattle farmer can be reduced by INR1.5 - 2.0 per kg feed mix, with a 7-10 percent increase in milk yield (Gowda, 2016).

The next section discusses the technique of preparing dry fodder from areca sheath.

4.2 TECHNIQUE OF PREPARING ARECA SHEATH FODDER

After collecting fallen areca leaf sheaths, the first step is to dry them. The thin membrane loosely adhering to the inner side of fresh areca sheath causes indigestion in the animals and can potentially lead to impaction (bowel obstruction). Sun-drying areca sheaths, however, resolves this issue.

CHETNA NAHATA

Plate 2: Areca sheaths left for sun-drying

When dry, areca sheaths are cut into suitable pieces for fodder using a shredding machine. The dry fodder produced by the machine can be fed to all kinds of farm animals including buffaloes, cows, oxen, sheep and goats.

LAKSHMINARAYANA UDUPA

Plate 3(a): Areca sheath shredder machine

Plate 3(b): Shredded areca sheath (Gowda, Areca sheath as an alternate dry fodder for livestock, 2016)

The areca sheath fodder can be stored in an airtight container for 2-3 months or more, depending on its moisture content.

Although NIANP suggests the use of areca sheath in the form of total mixed ration along with a suitable proportion of compound feed, in consultation with farmers and Village Forest Committee (VFC) members, Forest-PLUS adopted the mentioned technique to demonstrate the use of areca sheath alone as an alternate dry fodder to paddy straw in Shivamogga landscape. Areca sheath dry fodder has a higher nutritional content than traditional dry fodder, and as such the improved yield and quality of milk were considered as potential motivational factors to farmer adoption.

5.0 DEMONSTRATION OF IMPROVED GRAZING MANAGEMENT TECHNIQUE

Forest-PLUS demonstrated the grazing management technique in two clusters in the Shivamogaa landscape – Kikkeri and Rechikoppa. Kikkeri is situated in the Mandagadde Forest Range and Rechikoppa is in the Aynoor Forest Range of the Shivamogga Forest Division.

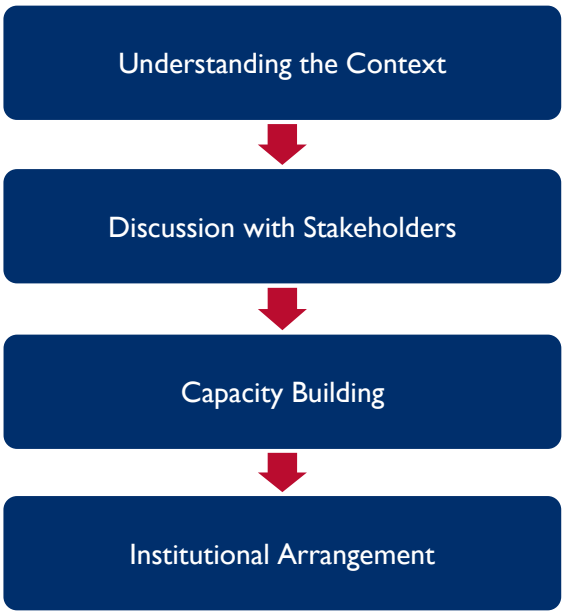
In the two clusters, three VFCs – Kikkeri, Garaga and Rechikoppa – were identified for preliminary survey. These VFCs were identified based on fodder availability and the existence of higher populations of the indigenous breed of cattle, since that is the primary breed involved in open grazing in forests. Based on a field survey conducted in 2015, Kikkeri, Garaga and Rechikoppa VFCs, with a combined 1,156 cattle of indigenous breed were chosen.

5.1 APPROACH

Forest-PLUS followed the subsequent steps for field demonstration of the improved grazing management technique.

5.1.1 UNDERSTANDING THE CONTEXT

In order to identify the current grazing practices in the landscape, a desk-based review was undertaken. A field survey was also conducted to understand the issues related to grazing and fodder availability. The sites for demonstration of the technique were selected on the basis of field survey, site visits and discussions with the villagers in all the three VFCs.



5.1.2 DISCUSSION WITH STAKEHOLDERS

Further consultations and key-informant interviews were conducted in Rechikoppa, Garaga and Kikkeri to understand the issues related to grazing. It was found that fodder scarcity during the period from February to June compels cattle owners to leave their cattle for open grazing, mostly in forest areas.

To compensate for the fodder scarcity, the use of alternatives such as paddy straw and areca sheath were discussed with the VFC members. It was found that villagers occasionally feed their cattle on areca sheath. The VFC members therefore showed interest in the technique that promoted the use of areca sheath as a regular stall feed for cattle. However, there were reservations amongst the villagers due to possible health issues for cattle.

5.1.3 CAPACITY BUILDING

In order to make the local community members aware of the process of areca sheath fodder preparation as well its benefits, Forest-PLUS organized an exposure visit of community representatives to a village where farmers were already using areca sheath fodder.

The community group visited a farm in Harakere village, where the entire process of preparing dry fodder from areca sheath was explained.

LAKSHMINARAYANA UDUPA

Plate 4: Discussion during the exposure visit organized by Forest-PLUS

This exposure visit helped the villagers from Garaga, Kikkeri and Rechikoppa VFCs to comprehend the technique of preparing dry fodder from areca sheath and also to clear their doubts and misconceptions regarding its use.

5.1.4 INSTITUTIONAL ARRANGEMENT

Forest-PLUS conducted several consultations with the VFCs and villagers of Garaga, Kikkeri and Rechikoppa, to plan an effective and efficient institutional mechanism for preparation of dry fodder from areca sheath. Considering its various advantages, the villagers and the VFCs showed interest in preparing the fodder from areca sheath. Forest-PLUS planned to support each VFC with a shredding machine that would be available for use to all the community members. However, due to the lack of appropriate electric power, Kikkeri VFC had to be dropped from the list. Forest-PLUS provided two shredder machines, one each for Garaga and Rechikoppa VFCs.

The operational rules of these shredding machines were developed by the VFC members themselves, with guidance from Forest-PLUS. With common consent, it was decided that the machines will be installed in the house of one of the members. The key criteria for selection of the household were easy accessibility to the majority of community members, availability of a suitable place for installation, and the willingness of the household to take responsibility for operating the machine.

One such household was selected in both Garaga and Rechikoppa VFCs. An agreement was signed between the household and the respective VFC. It was decided to collect a nominal fee of INR 1 per kg of shredded areca sheath from the users. This fee is to be shared equally between the VFC and the household that operates the machine. This institutional arrangement ensures that while the household that operates the machine is adequately compensated for the effort and to cover the operating costs, VFC is also able to generate a fund that could be used for the repair and maintenance of the machine.

This model is cost effective and can be easily replicated in the entire arecanut belt. The machine has an operational cost of around INR 195 per hour (Shashikumar, Anantachar, Veerangouda, Prakash, & Prahlad, 2017) and it can produce around 90-100 kg of shredded sheath fodder per hour. Assuming that the machine is run for eight hours per day and 20 days in a month, and that the life of the machine is five years, the per kg cost of shredded arecanut leaf sheath is estimated to be less than INR 0.50[6]. After

[6] Based on machine cost of INR 45,000.

adding the VFC's fee, the users can get the fodder at INR 1 per kg[7]. This compares very favorably with the paddy straw fodder that is available in the market for INR 4 per kg (personal communication, dairy owner, Bhopal).

LAKSHMINARAYANA UDUPA

Plate 5: Stall feeding using shredded areca sheath

[7] Assuming that the life of the machine is 10 years, the cost of shredded areca sheath fodder further reduces to approximately INR 0.25 per kg and adding the VFC's fee users can get the fodder at INR 0.75 per kg.

6.0 WAY FORWARD

An integrated grazing management technique using areca sheath as dry fodder was demonstrated in the selected VFCs in the Shivamogga landscape. The suggested technique utilizes areca sheath, a by-product from areca plantations for preparation of dry fodder. This technique will not only make arecanut farm ecosystem self-sustainable, it will also reduce the cost of buying fodder from the market.

Using areca sheath, available locally in abundance, as dry fodder will reduce the fodder scarcity in Shivamogga landscape during the lean season from February to June. This technique will also encourage the farmers to stall feed their cattle even when there is a scarcity of paddy straw. The added advantages of higher milk yield and fat content are likely to encourage the farmers to adopt this technique on a regular basis, which would in turn help in propagating the technique to other VFCs. Since it is a VFC-centered activity, it will further strengthen the VFCs and develop a sense of shared responsibility among VFC members.

The feasibility of using this technique however depends to a large extent on village-level institutions *viz.* VFCs in this case. A robust institutional arrangement would be the mainstay for sustaining this approach, the operational details of which would be site-specific.

Since arecanut is a widely grown cash crop in Karnataka, this institutional arrangement for using areca sheath fodder may be replicated in other parts of the state as well.

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