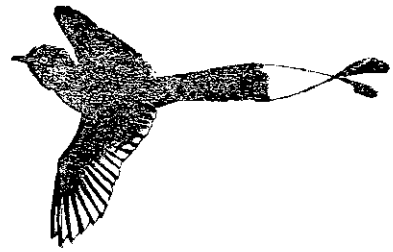
INDIAN INSTITUTE OF SCIENCE
Centre for Ecological Sciences
BANGALORE-560 012, INDIA



WORKSHOP ON MANAGEMENT OF LIVESTOCK RESOURCES OF THE WESTERN GHATS WITH SPECIAL REFERENCE TO UTTARA KANNADA

Compiled by : P. R. BHAT AND MADHAV GADGIL

HELD AT : YADAHALLI, SIRSI, U. K., KARNATAKA

ON : October 18, 1986

January 1987

Technical Report No. 47

WORKSHOP ON MANAGEMENT OF LIVESTOCK RESOURCES OF THE WESTERN GHATS WITH SPECIAL REFERENCE TO UTTARA KANNADA

Livestock constitutes an important component of the farmer's economy. The systems of agriculture and animal husbandry are highly integrated and interdependent. Cows and buffaloes provide milk, bullocks provide power and all animals provide dung which is essential for soil fertility and crop yields. Livestock is sustained on fodder grass, leaves and crop residues.

Today farmers face too many problems in animal husbandry practices like,

1. large herd of low productive, indigenous breeds of cattle and buffaloes

2. degraded grazing lands, depleted fodder resources, absence of organised fodder production; heavy dependency on this purchase of fodder and feeds.

3. absence of economically sound management practices and proper utilisation of dung.

Various scientific work has been going on since our independence in various research institutions, voluntary organisations, Government departments in different fields related to animal husbandry and veterinary sciences. But it rests ultimately with the farmers to adopt the research findings and put them into practice. It is quite essential all exerts to understand the problems together and discuss before suggesting suitable management practices to the farmers.

It was in this context that a one day workshop was organised (on October 18, 1986) to bring this experts and farmers on a same dias and to exchange the views in livestock management.

This workshop was held in the Vidyodaya Composite Junior College, Yadahalli, Sirsi, Uttara Kannada on October 18th, 1986. This workshop was organized by the Centre for Ecological Sciences, Indian Institute of Science, Bangalore, in collaboration with the Sahyadri Parisara Vardhini, Yadahalli, Sirsi.

The participants in the workshop included:

1. The farmers from different parts of Uttara Kannada who own livestock and are facing problems in the livestock management.
2. The officials both at the higher level and at the local level, of the department of Animal Husbandry and Veterinary Sciences, Government of Karnataka.
3. Agriculture and Veterinary scientists from the Universities of Agricultural Sciences, Dharwad, who are working on related subjects like fodder production animal health, nutrition, diseases etc.
4. Officials of Karnataka Forest Department, Bharatiya Agro Industries Foundations, Karnataka Milk Federation.
5. Scientists from ASTRA, Indian Institute of Science, Bangalore.

The participating experts were given well in advance a topic to present during the workshop.

The day's proceedings began with Prof. Madhav Gadgil, Centre for Ecological Sciences, I.I.Sc., welcoming the gathered, farmers and scientists. The proceedings were divided into two sessions. The first session began at 11.00 AM, and was chaired by Dr. L.A. Dixit, Professor of Agronomy, UAS, Dharwad. Each speaker was given fifteen minutes to make his presentation.

The first presentation was by Shri. K.H. Hegde, Animal Husbandry in Uttara Kannada - the present status and scope for Development. The speaker briefed about the importance of livestock in U.K. district; the problems in the livestock management in the different parts of the district and with farmers of different economic levels. A few suggestions were also listed in improving management practices.

Dr. V.V. Adkoli spoke about the "Breeds of livestock suitable for Uttara Kannada". Keeping in mind the climatic conditions of the district, the farming system, needs of farmers, the speaker recommended Jersey breeds of cows, Surti breeds of buffaloes. He also suggested to take up rabbit farming and poultry.

Dr. G.V. Hegde speaking about "the carying capacity of land for livestock and optimum number of cattle" stressed the need to restrict the herd size. He told with a small herd of improved breeds, animal husbandry practice could be very economical one, easy to manage and could meet all the demands of farmers.

Dr. P. Basavaiah speaking about "Shelter, storage structure and silo pits" that these are very important in the livestock management and to maintain good health of animals. The speakers speaking on this recommended the shelters providing

a good air circulation, light; easy access to water. It was told that a loose house for animals would be more useful. Silo pits are useful to store nutrisious fodder for lean seasons.

Dr. K.S. Jagadish, spoke on "low cost building technology for animal shelters' Farmers spend thousands of rupees for animal shelter. A low cost buildings for this purpose will be a boon to small farmers. The speaker gave a very detailed account about cattle sheds constructed with locally available cheap materials and building techniques.

"Management of milch and draft animals"

Dr. Mallikarjunappa told that the farmers lack proper knowledge about the nutritional requirements of good cow and bullocks, which is very essential to get full returns from animals. The speakers enlightened about feeding milch cows with nutritionally good feeds and healthcareof animals in different stages of animal development and age.

"Management of grazing in forests and role of forests in production of fodder" by Shri. A.M. Yellappa Reddy. Fodder is a crucial thing in livestock management. Our forest lands have become non productive almost, due to excessive grazing pressure. The speaker pointed out that our forests could produce enough fodder if they were managed properly. He gave many examples in which minor forests with effective protections have produced a large quantity of fodder grass. He also expressed hope that more fodder could be harvested from forests if improved suitable light yielding varieties of grass were grown.

Another speaker told about plans of Karnataka Forest Department, to establish fodder on atleast 2000 hectares in 325 centres in Uttara Kannada to feed the livestock in this district.

"Package of practices for cultivation of grass, legumes, trees", Shri. K.R. Bhagawat, Shri. Ramesh Babu.

The speakers gave a detailed account on cultivation of various forage crops by utilising all cultivable lands. Different crops can be grown in different seasons of the year to increase fodder availability. This has given a hope to raise nutritious fodder which is a back bone of livestock management.

"Biogas plants" Dr. Rajabappaiah highlighted the potentiality of Uttara Kannada to put up more gobar gas plants, with its animal wealth. Gobar gas plants will serve the farmers both as fuel and fertilizer plants as well. The speaker also informed the use of areca husk in gas plants for gas production.

The afternoon's session was chaired by Shri. A.M. Yellappa Reddy IFS, Conservator of Forests, Canara Circle.

The afternoon session began with a presentation on "Effective use of dung and proper preparation of Farm Yard Manure" by Dr. L.A. Dixit. Cattle provide dung by which farmers prepare valuable manure. But manure will lose lot of nutrients by its improper methods of preparation. The speakers spoke about necessary properties of good manure. He gave a detailed account about layout of pit, method of preparationof manure, by which manure will not loose important nutrients.

"Common diseases of livestock and their control"

Two speakers Dr. Prasanna Kumar and Dr. Parthasarathy spoke on the subject. The first speaker told about the diseases likely to occur in the area caused by micro organisms. He also suggested various preventive measure to be undertaken by farmers.

The second speaker gave an account about the diseases caused by parasites, diseases due to mineral deficiency and also about the remedies for the diseases.

"Milk Marketing" by Dr. B.K. Prakash.

Marketing facility for milk is quite essential in a sound management system of livestock. The speaker spoke about the marketing facility provided by the Government through a network of purchase centres in Uttara Kannada district.

"Economics of livestock Management" by Dr. Ravindra Hegde

The speaker analysed various expenditures incurred by the farmers on various components of animal husbandry. He also suggested how unnecessary expenses could be avoided by proper management.

In the last presentation, the speaker gave a brief account the optimum number of cattle which can be maintained on a farmers land.

The last session was chaired by Dr. R.K. Hegde, Director of Instructions, U.A.S., Dharwad. The session was for discussions. Questions were invited from farmers. A number of questions raised by farmers were answered by the concerned experts a free discussion was held also between the experts. After the discussions, at the end, it was decided to

a. chalk out plans for establishment of fodder plots on

forest lands in different regions of Uttara Kannada. A committee will be formed to chalk out the plan, which will include Dr. P.K. Hegde, Dr. L.A. Dixit from U.A.S., Dharwad, the Conservator of Forests, Canara Circle, Dharwad, representatives from the Department of Animal Husbandry and Vet. Science and local farmers.

b. Set up an editorial board, which would work to bring out a book -A package of practices for Livestock Management. This will be based on the presentations and discussions made in the workshop. The editorial board includes, Dr. L.A. Dixit, U.A.S., Dharwad, Dr. V.G. Shetty, Asst. Director, Sirsi, Dr. C.S. Parthasarathy, Red-dane Project, Dharwad, Shri. K.M. Hegde, Bhairumbe, Dr. G.V. Hegde, MAIF, Sirsi, Shri. Prabhakar R. Bhat, CES, Sirsi.

The workshop provided a common stage for both farmers and experts to exchange their views and moreover the experts could understand better the problems of farmers in livestock management. The papers presented during the workshop will be revised again to include more information and will be brought out in a book which will be a useful package of practices for livestock management. This is a preliminary report for a limited circulation. The recommendations of experts will be applied in this field in microcatchment villages and the results will be recorded.

In 1980, after realising this destruction being caused to forests, the farmers in Uttara Kannada got interested towards re-establishment of forest reserves. Forests are backbone of

farming communities in Uttara Kannada. The Hulgol Co-operative Society Bhairumbe took this lead in taking up Ecodevelopment Programmes in the area. The newly set up Department of Ecology and Environment, Govt. of Karnataka granted a small financial aid to the society in 1982 for three years. During three years, selected fifteen farmers in this programme took up restocking betta lands with useful plants, improved animal husbandry practices, fodder production and better utilisation of leaf manure, mulch, fuel. The project was organised as a field test of various concepts and technologies of Ecodevelopment. The success achieved in the project brought about a good response from farmers in different areas of this district, and paved for further work in the district.

In 1984, to carry out various Ecodevelopment work in Uttar Kannada, a society was set up. This was registered in the same year as Sahyadri Parisara Vardhini. This society has its office at the Vidyodaya Composite Junior College, Yadahalli, Sirsi. It has become a centre of various activities. It has been taking part in Eco-development Workshops. To create awarness in Ecodevelopment this society with the help from Government of Karnataka has been bringing out quarterly newsletter highlighting the peoples' involvement in Ecodevelopment and other related subjects. The society has taken up project on enhancing forest and fodder resources in selected microcatchments in Uttara Kannada.

In this selected microcatchments, Centre for Ecological Sciences and the Sahyadri Parisara Vardhini together have been studying various processes, in which farmers are using natural

AGENDA

First Session

10.10 to 10.25 AM	The current picture of livestock population, their management problems and constraints to development in Uttara Kannada By K.M. Hegde and Shri. Prabhakar Bhat
10.25 to 10.40 AM	Breeds of livestock suitable for Uttara Kannada by Drs.V.V. Adkolli and V.G. Shetty
10.40 to 10.55 AM	Carrying capacity of land for livestock, optimum numbers of cattle for different purposes by Drs. G.R. Hegde and GV.Hegde
10.55 to 11.10 AM	Shelter, storage structures and silage pits by Dr. P. Basavaiah
11.10 to 11.25 AM	Low cost building technology for animal shelters by K.S. Jagdish
11.25 to 11.35 AM	Tea break
11.35 to 11.50 AM	Management of milch and draft animals throughout their life cycle by Dr. S. Mallikarjunappa

11.50 to 12.05 PM	Management of grazing in forest areas and role of forest lands in production of fodder by A.N.Yallappa Reddy and Shri.Praveen Chandra Pandey
12.05 to 12.20 PM	Package of practices for cultivation of grass, legumes and tree forage crops suitable for Western Ghats By Dr. S.K. Gumasthe, Shri. Ramesh Babu and Shri. K.K. Bhagwat
12.20 to 12.35 PM	Biagas plants by Dr. Rajabappaiah
12.35 to 2.00 PM	Lunch break
2.00 to 2.15 PM	Effective use of dung, proper preparation of farm yard manure, utilisation of slurry by Dr. L.A. Dixit
2.15 to 2.30 PM	Common diseases of Livestock and their control by Dr. Prasanna Kumar
2.30 to 2.45 PM	Common diseases of livestock and their control by Dr. Parthasarathy
2.45 to 3.00 PM	Marketing of milk by Dr. H.K. Prakash
3.00 to 3.15 PM	Economics of livestock management by Drs. R.S. Hegde and G.V. Hegde
3.15 to 3.30 PM	Tea break

3.30 to 4.45 PM	General discussion
4.45 to 5.00 PM	Concluding remarks of chairman by Dr. R.K. Hegde

THE BREEDING OF LIVESTOCK SUITABLE FOR UTTARA KANNADA DISTRICT

(BY Dr. V.V.Adkoli, Joint Director Livestock Development and Dr. V.G. Shetty, Asst. Director, Sirsi)

INTRODUCTION

Geographically Uttara Kannada district is in the West Coast belt of India. The climate in this tropical region is super humid characterised by dense rain-forest moderately high temperature. This district is distinctly bifurcated into two regions 6 upper ghat taluks of Sirsi, Siddapur, Yellapur, Mundgod, Haliyal and Supa and five taluks of coastal belt - Karwar, Ankola, Kumta, Honavar and Bhatkal. Among these eleven taluks Mundgod and Haliyal taluks are in subhumid plane area and other nine taluks are in Western Ghat region.

THE EFFECT OF CLIMATE ON LIVESTOCK

Broadly speaking the quality of Livestock depends on the environmental conditioons particularly on rainfall, temperature, humidity. Indian cattle are found well in dry areas. They are small and non descriptive in area of heavy rainfall such as coastal and hilly areas of the country, cattle of good breeds are thus found in Punjab, Rajasthan, Sourashtra and part of Maharashtra, Tamilnadu, Karnataka and Andhrapradesh. Even in this district the cattle in Mundgod and Haliyal are better in size and productivity.

The livestock are affected by the climate in two ways, first by direct influence on the animal and secondly by the indirect affect on the animals environment.

DIRECT EFFECT OF CLIMATE: All domestic animals are homeotherms, that is they attempt to maintain their body temp. Within the

range most suitable for optimal biological activity. In order to do this they must preserve thermal balance between their heat production or gain from the environment and their heat loss to the environment. In case of tropical type of cattle if the environmental temperature is more than 27oC the thermo regulating mechanisms are activated and respiration and vapourisation rates increase. If temperature rises above 35 ^{o}C the thermo regulating mechanism begins to fail. This causes decline in feed intake, decrease in productive process such as growth and milk production. In case of dairy cattle there is also change in milk composition. The temperature type of dairy cattle like Jersey, HF etc., suffer more if climatic temperature is more than 27 ^{o}C. The effect of high temperature is also seen on (1) Grazing habbits (2) on growth (3) on milk and milk solid production (4) on reproduction. The humidity and length of daylight are also directly influenced on the health of live stock.

INDIRECT EFFECT OF CLIMATE: The climate affects the quantity are quality of feed available to the animal. The climatic factor which helps rapid growth of forage in tropical area also affects the quality. This climate favours plant growth, so that forage is plentiful and available all the year round. Because of quick growth the forage mature early so that fibre content reaches higher in early age of the forage.

Under tropical conditions various minerals in sweat or in dribling saliva may be so considerable as to affect the health. Due to heavy rains and type of soil in this district the forage contain in sufficient minerals to substitute the loss so caused.

In these days even this low quality forage is not available to the animals because of over utilisation and over grazing. High temperature and humidity provides favourable breeding environment for internal and external parasites, fungi and disease vectors which indirectly affects on the health and productivity.

SUITABLE CATTLE BREED: Under the back ground of unfavourable climate of Uttara Kannada district let us now discuss about suitable breed of cattle to this district. 80 percent of population here live on the income from land. Majority of them are small and marginal farmers and A.Ls. Since the land holding of the most of the farmers are fragamented and less than acres they have to depend on bullock labour for tillage, irrigation and carting. Therefore bullock power cannot be neglected.

The vegetarian population mainly depend upon milk and milk products as the only source of animal protein in their diets. Even for the non vegitarians those who eat meat and fish to meet minimum physiological requirement; their milk requirement is 500 gms per day. If we calculate at this rate we are far behind in milk production to meet the demand of the people of this district. Keeping in mind the efficient bullocks for cultivation and producing milk for meeting expanding needs for growing ponulation we have to think of suitable breeds of cattle for this district.

The district possesses more than 5 lakhs cattle population which are uneconomic poor in production and working ability. Therefore this district needs one general utility breed of cattle that it should combine in itself draught and milk qualities.

Cross breeding is the only solution to this. Introduction of exotic germ plasm in to our Zebu cattle is inevitable alternate for quicker and more effective solution to our problem. This is by simple exploitation of additive inheritance. There is an ample evidence that tropical environment may support exotic inheritance between 50 to 75% cross breed progeny are alsmost as healthy and hardy as the best of pure bred parents.

To cover about 2 lakhs of breedable cows in the district with natural service with bull of high genetic potantiality is a difficult task. Therefore A.I with chilled or frozen semen is the exclusive tool for quick propogation of superior germ plasm.

Jersey is the most suitable animal for this forest district. Government has also recommended this breed. Jersey is not only hardy but also have the quality of heat tolerance, resistant to parasites and photosensitivity and poor nutritional conditions as compared with other exotic breeds. More butter fat in the milk is another advantage of this breed. 50 to 75 percent cross breed bullocks have proved to be good work animals.

To have adoptability and acclimatization exotic blood level in the cross bred cattle should not exceed 62.5 percent. It is recommended to have 50% for village conditions and 62.5 in case of organised dairies. As purity is higher adoptability is lesser and they are prone to reproductive and disease problems.

SUITABLE BUFFALO BREEDS: From the time immemorial the buffalo has been domestic animal in India. It occupies an important place among the domestic animals of the tropics as provider of dairy produce, and draught power. Its greatest asset as domestic

animal is its ability to subsist on the coarsest fodder and to convert it most efficiently into animal produce. In India buffalo is dairy cow not the cattle. This is true in case of this district also. Among cows and buffaloes of our country, buffalo is about 30% which produce 53% of the total milk produced in India. In other words buffaloes produce annually 112% of the quantity of milk produced by cows.

The buffalo has a remarkable capacity to adapt itself to the most adverse condition of climate. In India high class buffaloes with well defined breed characteristics with good milking efficiency are confined to Punjab and Gujarat states.

In U.K. district nondescriptive buffaloes are found. This is because of the adverse climate. The N.D. buffaloes are small in size. Milk yield is also considerably less. These buffaloes are maintained only because they are better milkers than cows and because of their remarkable endurance in slow but heavy draught, especially in paddy fields, far excels that of local N.D. Bullocks buffalo milk is rich in butter fat and generally contains 7-8%. The butter fat content is characteristic of great economic importance particularly in areas where there is no ready market for liquid milk. In such areas ghee can be prepared and marketted much more economically than butter from cows milk which usually contains only 4-5% of fat ghee can be stored for months.

Surti is the breed recommended for grading with the local buffaloes of this district. Surti is known to be economic milk producer and average lactation yield is reported 1655.5 Kgs. milk with 7. percent fat. This is of medium size having regular breeding ability. The adaptability to this climate is also good.

In this district more than 80% of land is covered by forest leaving less than 20% for cultivation. Therefore farmers have small holdings. These small and marginal agriculturists of this are cannot live with only on their agricultural income. Subsidary occupations based on agriculture like dairying, Goat keeping , rabbit farming, poultry farming are necessary to improve their economical standard.

Jamunapari and Sanen breeds of goat, Newzealand white breed of rabbits white leghon breed of poultry are best suited to the tropical climate of this district.

ANIMAL HUSBANDRY IN UTTARA KANNADA DISTRICT MANAGEMENT PROBLEMS AND SCOPE FOR DEVELOPMENT

1. INTRODUCTION: In the present situation animal husbandry has become both boon and curse for the farmers of Uttara Kannada. In the recent years there is a lot of technological achievements which are helpful to the farmers. Though different types of chemical fertilizers, biofertilizers are available, still the farmers have to depend upon FYM for the supply of organic manures, as well as the source of nutrients to his crops.

Similarly many new types of mechanical and technical devices are available for ploughing, transportation etc., but still for many of our poor tillers a pair of bullock and a cost is the main unit for draft power and transportation.

There is a proverb in Kannada ie. relation with sea, but scaricity of salt. Accordingly our farmers are having more number of cattle than necessary. But there is acute shortage milk even for their family use.

As per the modern animal science, this cattle rearing had to be on additional source of income supplementing his agriculture. But if use condier the financial condition of the farmers this occupation, instead of becoming a source of additional income has become a burden.

It has become a common subject, of discussion in many high level meetings either at centre or in the states to find the ways to minimize the cattle number and to achieve zero grazing in the forests.

The poor farmers even after a quarter of a century is just following the age old traditional practices of animal husbandry;

in spite of several schemes. So far these conferences, discussions, and appeals have failed to bring about significant changes in this direction. Just like the FP Programmes of our country we cannot come out from this situation unless we are able to minimize our cattle heads with very few improved breeds. But unless we are able to manage the cattle of the poor farmers ina healthy condition it would be impossible to reduce the number of cattle. It is very important to convince him about the possibility of satisfying his all needs, with minimum number of cattle. Unless we tackle this problem he will not be bothered about reducing his cattle, force for which he is not spending any amount or loosing any resource base of his own, but totally depending upon the community resource base. The time has come to consider the problem in an integrated way so that the poor farmer can adapt the modern cattle management practices and to switch over to zero grazing from free grazing system. With this background we have attempted present a brief account of different cattle management systems followed in Uttara Kannada district.

2. ANIMAL HUSBUNDRY IN DIFFERENT MANAGEMENT SYSTEMS

In this context we can categorise the cattle management systems of the district into four groups, (1) The management systems followed by poor and landless uneducated farmers(2) A system followed by lower middle class farmers (3) New techniques adapted by the farmers having good financial and technical background (4) Educated poor farmers practices who are undertaking animal husbandry for milk production with proper technical guidance.

3. CATTLE MANAGEMENT IN LOW INPUT SYSTEM

Poor and landless labourers come under this category. Usually they maintain more number of animals of lower quality. In the upghat areas the farmers who are mainly dependents of paddy cultivation will keep on an average more than twenty animals per family. But in coastal tract they keep only four-five animals per family because of acute fodder shortage. Generally cows are maintained for manure, buffaloes for milk and bullocks for draft purposes. In upghat areas the ration of cow to buffalo would be 7:1 where as in coastal areas it would be 10:1. These cattle are not belonging to particular breed but called as "Malnad dwarfs". Because of nutritional defficiency and continues imbreeding these cattle are highly inefficient either for milk yield or for draft purposes.

They obtain their source of food, either from community lands or from neighbouring compounds. Except in the months of September and October they are unable to get sufficient grass even of low quality to fill up their stomach. This under feeding has made them to become semi wild animals. They can easily jump or cross any type of trench or fencing. They have to line in a very pitiable condition in April-May season. During this period they cannot get even a blade of dry grass on the barren hills of Sahyadri. They have to struggle very hard for their very survival. Though the farmers of malnad have not experienced the severity of famine the cattle of this region have to face it, in every summer. These unfortunate animals which have not died in summer will have only skin sticking to their skeleton, before the onset of monsoon. The only duty of poor

owners towards these ill-fated animals is to flush out whatever little quantity of milk is available and use the animals for draft purpose. So they are not at all a burden to the owners.

When they come back to their shelter little quantity of paddy straw in rainy season, or karada the local jungle grass in summer which is also inferior from nutritional point of view is fed to these animals along with some drinking water. If there is only nalah or tank nearby they have to go their to quench their thirst. Even the water there is unheigenic.

Generally Artificial insemination is not done to these animals. Due to malnutrition they are irregular in heat period. In spite of this if they come to heat, because of owners lack of knowledge, or dis interest, or due to his inability to take up AI programme, AI is not doen to those animals. In some cases if any farmer comes forward to get his cow inseminated, it may not conceive in one or two attempts as the animals are very week. In some other cases non castrated bulls may cross on these cows and may make this AI attempt a failure. This situation may lead the enthusiastic farmers to loose his confidence in what breed improvement programme.

Incidentally we can cite an example of Masur village near Kumta where the farmers are now afraid of taking the benefit of moder castration methods for their bulls. But he was not properly advised about post operative treatment. The bull succumed to death by septic of the wound. Now all the farmers are following old castration method only which is very painful to the animal.

If the owner himself is living in a thatched hut one cannot expect him to provide a good shelter for his animals. In these shelters ventilation and light are of scarcity items. In most cases scarcity of pure drinking water is also not uncommon. As the cattle shed floor is not made hard it will be in a semi peddled condition in rainy season and the floor surface will have many small ditches. It is very difficult for the cattle to lie on these grounds. To overcome this problem the green leaves brought either from betta lands or from minor forest, is spread over this ground as used as animal bedding. Next day this removed with dung and urine and used for manure preparation. This system is very common in upghat areas. This practice is also one of the main reasons for degradation of betta and minor forest. The small plants and bushes which have survived from the animal trampling in the betta and minor forest area will be cut down for this purposes. So this practice is seriously affecting the regeneration of the plant species of this area.

Limited light and ventilation and the use of karada which is brought from the forest area and open grazing in daytime has made the ticks a serious problem for these cattle. They suckh the blood from those animals, which are already suffering from anaemic condition. In addition to this flies, mosquitoes and thrips (local name noraju) are also causing havoc to these animals health.

Owners poverty, ingnorance and the larger number of the animals are the main reasons, for farmers inability to vaccinate his animals in time against common diseases H.S. and foot and mouth diseases are the regular visitors to this area even though

they are not invited.

These communities use very little quantity of milk in their daily life. Most of the milk is used for preparation of tea. Use of buttermilk is not common. Few people maintain buffaloes for milk. As they provide concentrates only in milking period these animals will have more dry period than lactating period.

In this way though they maintain the cattle for milk, manure and draft purposes due to improper management system they are not getting full benefits out of these animals. Many people will take much interest in collecting more green leaves for the preparation of more manure but they are not interested to improve the manure preparation system or to minimise outside grazing by which 2/3 of the will be wasted.

2. In this district there are no Gamal lands. But in each village some forest area is marked as minor forest where people are having the privileges to graze their animals. When there is a question of investment for developments this land belongs to nobody. But when there is a question of utilizing this land every one will come forward to use this. By over utilization encroachment and Eupatorium growth, these lands have become of no use for grazing purposes. Hence the paddy land owners have to depend upon others compound or garden of betta or Bena lands for grazing their animals. A survey conducted in Chipagi village near Sirsi has revealed that the farmers of that village have to spend Rs. 35,000/- per year just for fencing purposes to keep away these semi wild animals from their cultivated lands. And in this amount the cost of opening the trenches around the forest

plantations in that village is not included. In some places the cost of opening the trenches around the plantations to keep away these cattle has become more than the cost of pitting and planting inside the plantations.

3-1 Animal Husbandry- the middle class farmers way- The farmers having less than 2 acres of area gardens coming under lower middle class group are following a little different system in cattle management. Usually these people keep the cattle for manure and buffaloes for milk.

A large sum is spent for cow shed construction. But proper planning is lacking. Therefore, they have not been able to overcome the problems of ticks, flies, etc. Proper lighting and ventilation is also not provided in many cases. Although concrete flooring is provided many are still following the animals bedding system using green leaves in rainy season with an intention to prepare more FYM. Now a days at least a few farmers are maintaining one or two cross breed cows. Still many are having large number of cattle of local breed to prepare more FYM. These local cattle are allowed for free grazing throughout the year. Both cross breed and milking cattle are allowed for open grazing only in rainy season. In summer these animals are stall-fed. The farmers of this category usually spend 4-5 thousand rupees per year either to purchase paddy straw or to collect Karada grass. They are interested in preparing large quantity of FYM using green matter. But not much enthusiastic to follow scientific methods in FYM or compost preparation. Recently many farmers have installed cow dung gas plant by utilising the Government subsidy for gas plant-construction. At programme is

followed. But not regularly. As the only milch animals are fed with concentrates that too only is lactation period, these animals are also nutritionally doficient. As a result of this cattle are irregular in conceiving and having many other malnutritional problems.

3-2 Timely vaccination programmes against common diseases is not done mastatis is a problem for high milk yielding cross breed cows, and buffaloes. Main purpose of animal husbandry for these farmers is to get sufficient quantity of milk and milk products supply to their family who are mostly vegetarian and for manure supply to the gardens and the paddy fields, one or two to pairs of bullocks for ploughing the paddy field and for being used is the gas plants. Now a new trend is being developed to sell the excess milk either through the network of the milk marketting federation or directly to the needy consumers of the nearby city. Still many villages are not covered by the milk marketting net work. So in those areas peoples interest in cattle development is not significant. The animals particularly local breeds have to depend either on soppina betta lands and minor forests or on others gardens and compounds for their grazing needs. In summer the health conditions of the cattle other than cross breed animals is also most pitiable. The conditions of the buffaloes which are maintained mainly for milking purpose is also not better than these cattle. Improper breed and management might be main season for non-profitable condition of buffalo keeping in this region every year large number of buffaloes are imported to the upghat areas of this district from maidan area.

CATTLE MANAGEMENT AS A PROFITABLE BUSINESS

4-1 Very few farmers having good financial and technical background are taking up dairying as a business. By the introduction of milk purchase through village milk producers co-operatives, this is becoming a profitable business and hence becoming more popular.

4-2 One can see the well ventilated and well built cattle sheds which are constructed in a scientific way. The floor of the cattle shed is also made of concrete providing proper slope and drainage. So these farmers need not use green leaves as animal bedding. Many have also raised number of varieties of improved grasses legumes and fodder trees like subabul, calliandra etc. As the animals are getting regular supply of concentrates and green fodder the general health condition of these animals is very good. Mostly cross breed cattle or buffaloes of high milk yielding record are maintained. AI and vaccination programmes are regularly attended. BAIF type AI programme has become popular among these farmers. Here also Mastatis is a common problem for high milk yielders.

4-3 The main purpose of cattle maintenance is for milk marketting manure and gas production are secondary aspects. These farmers have started grass and fodder cultivation. But these crops are not receiving farmers full attention as other horticultural or agricultural crops, grown in this area. Fertilizer is not being used for fodder crops. No proper consideration is given for keeping optimum number of animals according to various household and farming requirements. And in the same way proper attention is not given to grow fodder, to

provide green grass and legumes that throughout the year in a sustained manner. It is also necessary to popularise green fodder selling in the villages. Birth of male calves is posing a problem for these farmers. Because they do not want to have more number of bullocks, for draft purposes, as most of them are having tractors and power tillers for hard works. Usually one pair of bullock is maintained for planking the puddled paddy field and sowing the seeds of leguminous crops in summer.

Therefore many are giving male calves to other poor farmers free of cost. Few buffaloes are also kept. But as they are finding buffaloes are uneconomical their number is decreasing. Many are having the notion that as cow milk inferior in fat content than bufallo milk, former is not suitable for tea preparation.

4-4 As only high yielding cattle are kept they usually do not allow these animals for free grazing. These are either stall fed or allowed in the nearby peddock. And animal number is controlled considering the availability of fodder. Fetching of good market price for these cross breed animals is also a reason for selling out excess animals. Milk production for self employment.

5-1 It is a good sign that another group of farmers is coming forward to take up dairying as a source of employment generation. In this group many are having very small land holding or in some cases they are belonging to landless educated class. They generally passes low cost cattle shed, with firm ground and good ventilation and lighting. Some cattle shed are thatched huts. 1

to 5 cross breed cows are maintained by these farmers, with an intention to market the milk. Here the manure is also a sellable item. Manure is sold on quantity basis but quality of it is not considered. Because of this they are not taking much interest in good quality manure preparation.

5-2 As the owners do not have their own land for fodder production, and as it is risky to allow costly animals for free grazing, these animals are mainly depending upon concentrates and dry paddy straw or karada grass for their nutritional requirements. Male calves disposal is a problem for these people as they are only interested in milk production. Pests and diseases are kept under control. But Mastatis and green fodder deficiency diseases are very common. AI programmes are attended regularly. The number of farmers belonging to this group is very small. But the significance of their achievement is not so small. At least they have proved that dairying would be an alternative source of income to landless and marginal farmers. And they have also shown that it is possible to get a gainful employment with very few cows and allowing them for zero grazing.

- CATTLE REARING AND TRIBAL REHABILITATION -

6. Another special group of tribal community mainly depending upon animal husbandry are there specific to Uttara Kannada district called as 'Dhangar Gavalis'. Their populoation is more in Halyal, Mundgod, and part of Yallapur talukas of Uttara Kannada. They maintain large herds of buffaloes and allow them for free grazing in the forests of this region. Gavlis have to obtain their livelihood by milk sales. Detailed studies are made about their life style and many attractive projects and schemes

are also chalked out for their rehabilitation. But so far nothing has come out in action which would be beneficial to these poor people as well as helpful for the regeneration of the forest areas of this belt.

- COMMON CONSTRAINTS FOR DEVELOPMENTS IS DIFFERENT REGIONS-

7. Many farmers are interested to make animal husbandry as a profitable subsidiary occupation, by following modern animal husbandry practices. But in the different agroclimatical conditions of the district they have to face different types of constraints in this regard. This district can be broadly divided into three major agro climatical zones.(1) Coastal belt (2) Hill region (3) Eastern slopes.

7-1 Coastal Belt: There is high rainfall in rainy season and high temperature is summar, Soil is of lataritic sandy texture. The hills near the coast are of lateritic and mostly barren. Population pressure is also very high. Not only forage grass but which are allowed for open grazing in this area. The soil as well as the crops grown here are very poor in calcium content. Due to severe soil erosion. The growth of grass is also very limited and its nutritional content is also much less. Both in the community lands and in the private lands fodder yielding trees are not being grown. Because of these extreme calcium deficiency the cattle of Masur village have started eating fish.

Owners of these animals are also very poor. So they are unable to provide any concentrates also for additional nutritional supply. The paddy straw grown is kharif and the stems of groundnut crop grown in summer are the only source of

nutrition to these animals. In the knonlands of esturive belt different types of mangroves were growing. Some of the mangrove species which are locally known as "Tegaru" was being fed to the animals. But now this also not available because of over utilization. Nowadays farmers usually collect a landful of "Garaki or Jake" grasses from these kharlands and feed to their animals in summer. There is very good scope for growing salive resistant grass species like para grass is estuarine belt using fertile soil and fish tide and low tide which keeps this soil always is moist condition. But actual field demonstrations are needed to convince the local kharland owners about the possibility of growing nutritionally rich and high yielding grass in this saline condition.

There is acute shortage of milk and milk products in this coastal area. Four of five big projects are coming up within a radius of 40 Km. from Karwar. All the coastal talukas are connected by west coast road. If this situation is properly utilized for milk marketing, there is very good scope for providing an alternative income source to the poorest among the poor of this area.

The climate in this area is hot or hottest except in the two months of winter season. A suitable breed to withstand this extreme climatic condition has to be suggested. Majority of the farmers are very poor and their per capita milk consumption is also very less. In olden days they were setting fairly a large quantity of animal protein from fish. But now fish is sold outside and has become very costly for local people. It would be

helpful if sheep, poultry and rabbit farmings are introduced to get animal protein to the local people at a cheaper rate.

VII-2 Hill region:- In this tract middle of February to middle of June is summer season and June to November is rainy season and the remaining period of the year is winter. All these three seasons are severe. Usually from November to May there will be no rains. In winter shortage of green grass is acute. After the recent introduction of sunhemp cultivation as a fodder crop, green beguminous fodder is available to these animal whose owner is having paddy lands. But the animals of the poor farmers have to suffer more. Even in rainy season it is difficult for them to get green grass because of Eupatorium grown is minor forest and betta lands. And this has enhanced the ticks problem. The animals which were already suffering from malnutrition and lack of blood have become more anaemic. As the number of animals is much more than the carrying capacity of the land the starving of these animals in inevitable.

In olden days watchman was in charge of the entire land of the village. And was moving land from one place to another to get a sort of rotational grazing. But now that system is not in practice in the village. The well to do betta owners have trenched their bettas to keep away others animals. So the animals belonging to landless and poor have no place to graze their animals. Growing of fodder crops in paddy lands in summer has to be popularised among the farmers who are having only paddy lands. Now they are keeping these lands fallow in summer. If

selling arrangement for green fodder is available the farmers of this group would be have fitted very much. Karada grass in summer and paddy straw in rainy season is the main fodder resource for these animals. Concentrates are given only to the milking animals.

There is good scope to grow fodder trees in betta and Bena areas which are relatively open. Subabul, Glyricidia, Erythrina species can be grown to supplement the fodder source in the period of fodder shortage. Now efforts are having made to grow quick growing grass and other fodder yielding trees in mihor forest also by the forest department. In many villages development of minor forest areas are being taken up by the department. As they have kept the stray cattle away from these plantations the grass is growing well in these plots. And the local people are allowed to cut the grass from these areas. The agricultural labourer who is going out daily to work in others farms is getting no time to come to the plantation to cut the grass for his cattle. If the plantation is away from his residence he cannot come to collect the grass more over instead of spending much of his time for cutting grass allowing the animal itself to graze is more convenient from his point of view. In this circumstance if the watchman of that plantation cuts the grass using improved grass cutting devices and sell it to the farmers at reasonable cost it would be of more convenience to the local people. As the growth rate of the local grass is much less the total quantity of the grass available even after cutting for few is much less. And if the grass growth in the

plantation is not cleared there will be a fear of fire hazard in summer. If an equipment or a simple machinery is available to get the grass cut without painful bending. Such equipments or small machines are in use in foreign countries. The possibilities of using such equipments with necessary modifications to own conditions may be considered. If such equipments are available even the ladies and the aged persons can perform this job. This also can be used for cutting fodder crops grown in the cultivated lands. This type of equipment would be of much helpful from the point of zero grazing.

And also the introduction of ever green shrubs or grass species which can withstand the severe drought condition many also be thought of to keep away the forest fire in summer which would be of little help to get at least some dry grass for the animals in this season.

VII-3 Eastern Slope:- The conditions in the region of Eastern slope of the district is different. Here the soil is fertile. Land slope is less. Annual rainfall is 70 mm to 1500 mm. In summer water availability is limited. In rainy season fodder crops can be grown very profitably where the land slope is less. Paddy is the main crop for this tract. Drill sowing system of paddy cultivation is followed. Hence the use of bullocks for various field operations and for bullock cart for transportation is very common. The paddy fields can be divided into 3 parts. (1) upland (2) Middle land (3) Low land. Because of water shortage at the state of flowering the farmers

can hardly get an economic paddy crop from the uplands. Once in 10 years in which seasonal rainfall is high. Mostly the lands are rain fed and the farmers have to depend upon the favours of timely monsoon, and because of low yield and low price the paddy cultivators are highly indebted.

There is very good scope to grow fodder crops and fodder yielding tree crops on the uplands and dry lands of this area. Similarly it is also quite possible to grow fodder crops and high yielding grasses, legumes in rainy season without much strain. As there will be moisture deficiency in summer in the paddy fields, it may not be possible to take up fodder crops in summer in all the plots. Introduction of silage system would be of very much use to provide green fodder in summer. Some field demonstrations in fodder preservation would be helpful to these farmers. If dairying is developed properly, in this region this income may surpass their annual income by paddy cultivation alone. And this one would be more regular income source than paddy which is depending upon the vagaries of monsoon.

VIII- While preparing this note we have discussed with many progressive farmers. We are also mentioning some of the suggestions emerged in our discussions for the consideration of the experts about the suitability and practicability of them.

MINOR FOREST MANAGEMENT

8-1 The highly degraded minor forest areas are being taken up for afforestation purpose. This one was the main source of fodder and fuel for landless people. Initially people opposed this programme with a misunderstanding that this would curtail the grazing rights for their animals. But now they are getting

grass from these lands. And they came to know that development of these lands is helpful for soil and water conservation and they may get good quantity of fuelwood and green manure from these lands. Now in many places people themselves pressing to take up the minor forest development programmes in their village. In the present scheme watch and ward will be provided for forest plantation for initial 3 years only. Afterwards there will be no single responsible person for the maintenance of these lands. Instead of this the following suggestions are put forth.

A) Preference should be given to the poor and landless people of the village to use this land for fodder, fuel and green manure.

B) There should be a permanent watchman for these lands in every village or a poor family of the village can be entrusted with this work.

C) The fodder fuel etc should be collected by the watchman only or under his supervison in such a way that the resource base should not be damaged and the benefits should be obtained in a sustained manner by the villagers.

D) The beneficiaries should pay certain amount for the salary of the watchman and the maintenance of these lands. this may be collected from those who get the materials from these lands by fixing some minimum price for them. If the purchaser is very poor DRDS or such other agencies can help him. Anyway the user should be made responsible for the maintenance of the land.

E) To make this system work properly a statutary committee should be formed consisting of the following members.

1) One representative from each of the departments like forest,

revenue, and animal husbandry.

2) 3 members from those communities of the village who are actually benefitted by this land.

3) One lady representative.

4) And one science teacher of the local high school.

This committee should meet at least once in six months and should be responsible for the sustainable use of the land. The work of this committee may be supervised by the concerned Mandal panchayat.

- Policy changes for optimising cattle numbers-

8-2 For the scientific management of the cattle, one should have the optimum number of animals according to ones resource base. Reducing the present number of low grade animals is inevitable. But in the present Indian Social condition it is impossible to dispose off these large number of low grade animals merely advocating to send them to the slaughter house. Instead of this it is suggested as following.

In every village there are few farmers who have received financial assistance in loan melas to purchase cross breed cows. In spite of this noble scheme the poor remained as poor only, as he is not having certain prerequisits to maintain these animals in a scientific way. This scheme may be implimented by certain modifications suitable to the local conditions.

A(a) Instead of encouraging these farmers to purchase high yielding cows, they may be provided with funds to purchase one or two cows of the local breed having good calving capacity. These may be purchased from those farmers who are having excess animals

b) This breed has to be developed gradually by intensive AI

programme and simultaneously fodder development and milk marketting may be taken up.

c) Instead of giving large amount of loan at a time the loan may be disbursed in instalments to purchase animals, for fodder development for health care and for pregnant animal maintanance calf raring etc.

B) By the increase of cross breed animals stall feeding practice is also becoming popular. But poor feel that these animals require constant veterinary supervison and costly food. So they simply feel that this is beyond their reach. Though the Government has spent lakhs of rupees for this breed improvement programmes, the benefits of these schemes are utilized by mainly rich or educated farmers. And the poor farmers are a unable to take up regular vaccination programmes to keep away the contagious diseases. It is therefore necessary to provide some incentives for stall feeding and breed improvement programmes.

A) Animal insurance programmes for cross breed animals may be introduced. The premium amount payable for this may be contributed by the Government.

B) The insurance company may appoint few selected veterinaries to regularly inspect the animals and advise him for health care. The actual cost of the medicine may be borne by the farmer himself.

C) By introducing this Govt. may gain much in forest development by keeping away the strange cattle.

Disposing of invalid animals

VIII-3. The farmers who have reduced the number of animals according to their requirements have to face another problem. The life span of the animals which are managed properly will be longer. In the last 2-3 years of their life they will be unproductive to the farmers. The farmer who is having limitations in both fodder and feeds cannot maintain these unproductive animals properly. Secondly, at the same time hae has to keep more productive animals also for his daily needs. Then the disposal of these aged and unproductive animals will be a problem. As stated earlier slaughtering of these animals cannot be thought of. Instead of allowing these animals carelessly, for open grazing following alternatives are suggested:

1) To maintain these animals cattle camps have to be established near big fodder plots and water source and these are to be managed by "Gorevashramas".

2) 1/3 of the expenditure of maintaining these animals in the Ashramas to be borne by the Govt. and 1/3 by the owner and remaining 1/3 by donations from the "Mathas" or public.

3) 1/3 contribution to be given by the farmer may be paid by the insurance companies by collecting the premiums during the earlier years as in the case of life insurance system.

4) Few years back the dead bodies of the animals were being used by the local cobblers. But now these dead bodies are burried in the soil. But if the carcasses of these animals are properly

processed and sold, that itself may become a good source of income to run these Ashramas.

Conclusion

IX. In this article we have attempted to give a broad picture of the animal husbandry practice, and its economical, social and technical constraints relating to Uttar Kannada District. Now the time has come to join their hands by different segments of the society like technocrats, beaurocrates and the public to achieve the goal of maximum return from minimum numbers of cattle, and to zero grazing from open grazing, so as to save our poor people as well to improve our environment by protecting the forest wealth.

By K.M. HEGDE
P.R. BHAT.

SHELTER, STORAGE STRUCTURES AND SILO PITS

The cheapest and most economical construction of animal shelter is a very important component in organising individual dairy farms. The shelter provident should be most conducive for efficient dairy production.

The three most important factors in dairy production in the order of economic importance are as follows:

1) Air 2) Water 3) Fodder and feeds

Air The dairy animals are ruminant animals which consist of a stomach having 4 parts. They are Rumen, Reticulum, Omasum and Abomasum. The most important part is Rumen, Where facultative anaerobic fermentation of the course fodder takes place. In the process of degradation of ingested plant material, micro-organisms play a very important and vital role. In this process lot of heat energy is liberated in the Rumen.

The dairy animals do not have well developed sweat glands like human beings. The excess of heat energy has to be lost either through body surface or respiration. For this process to occur, free circulation of air is essential which will help in the loss of heat energy produced is the rumen fermantation process. Therefore, it is very important to construct the shelter and housing to provide for free circulation of air.

Water - Water is a very important biologically needed component for efficient production and growth. It is the other component on which man has to spend very less money and efforts to provide abundent free supply of water to the dairy animals at

all times with free access to animals.

Fodder - The next most important component to be provided for the dairy animals is the fodder. After air, water is essential to provide unrestricted free access to fodder at all times to animals. Normally an adult animal requires about 30-40 Kg of green fodder or 10 Kg of dry fodder. It is very essential to provide adequate quantities of fodder which is the cheapest source of nutrients for efficient production of dairy animals.

Feeds - The concentrate supplementation is essential to meet total nutrient requirements of dairy animals. It is not always possible to provide adequate nutrients through fodder alone. This is especially so in high producing animals. The concentrate supplementation should be as for as possible be minimum to meet different production capacity of dairy animals. It is the costliest component which should be supplemented judicially.

In order to provide free access to air, water and fodder at all times, the animals should be kept in loose housing system with adequate protection against excess sun and rain. The flooring should not be damp and free from slushy and muddy conditions. It should be possible for the urine and water to flow freely away the shelters. The roofing can be any material which is locally available, cheap and should be able to give protection against excessive sun and rain. In brief, the housing should be least expensive but providing maximum comfort making use the locally available materials.

The exception to loose house system would be the housing of the calves. Calves below six months of age should be kept in a neat, clean and well protected house with free access to air

water and feed at all times. Therefore, the calves have to be kept in warm place free from dampness.

Silo pits- Conservation of fodder can be carried out either by removing of excess of moisture present in the plant material and converting the same in to hay. But in areas where there is excess of rainfall, it would be difficult to convert green grasses in to hay. The best stage of harvesting of grasses would be when the inflorescence is emerging and the grain formation is in the milky stage. The green grass can be preserved in the form of silage in well protected structures known as silopits.

The silo pits can be of any dimension. They can be pit like circular ones which can be constructed below the surface of the earth or above the ground.

In order to make good silage, it is essential to have silo pits constructed in such a way that they are water proof. Therefore it is necessary that silo pits should be constructed at the highest available place, where there would no water stagnation. At no stage water from outside should enter the pits. Therefore, construction of silo pit should be made water tight.

The silo pits have to be filled with fresh green fodder cut into small pieces, so that the fodder can be packed air tight. This should enable anaerobic perfomation to occur for effective preservation of green fodder. If properly preserved in water tight compartments making the fodder air tight, good silage can be prepared in the lush monsoon season. The good quality silage has a golden yellow colour and fruity smell, it has almost the

same nutrients as in the case of the green fodder. The good quality silage so prepared can be fed to the dairy animals in the off season summer months. This should enable the productivity of the diary animals maintained even during the lean summer season.

For making good silage, additives like common salt or molasses, if available can be added. Silage can also be prepared without any additives at all.

Dr. P. BASAVAIAH
Agricultural College, Dharawad-5.

LOW COST BUILDING TECHNIQUES FOR ANIMAL SHELTERS

Considerable attention has been devoted to cost reduction in house building while it is not easy to find information on low cost animal shelters. Some conceptual approaches to the design of animal (cattle) shelters, with special reference to Uttara Kannada district will be discussed here. It is assumed that purpose of these animal shelters is to switch over to stall feeding as the production of fodder per unit of land is very much restricted under grazing conditions.

Design Criteria

A fews design criteria may be stated, before developing actual designs, in order to have low cost options for animal shelters. The criteria may be listed as:

i) Maximise use of local materials

ii) Maximise use of local skills

iii) Minimise use of energy resources.

It must be pointed out that there are certain traditional solutions like mud walls and thatch roofs which can by and large meet the above criteria. If such solutions are acceptable to a local community, there may not be any need for further research in this direction. However, there is often a desire to look for more durable solutions without increasing costs significantly. If this view point is broadly shared by the user group, a fourth design criterion may be stated as follows:

iv) Enhance the performance (durability) of traditional/ local materials.

The designers challenge lives in harmonising the competing requirements. It may be emphasized here that the concept of maximising use of local materials need not be considered as an invioable doctrine. It is quite possible that the performance of a local material can be enhanced by a marginal use of a non-local material. One need not blind oneself to such alternatives which lead to successful 'combinations' of local and non local solut-ions. The acceptability of the 'combined solution' would then depend on the equation between performance and economics.

The Constraints

A few constraints, specific to Uttara Kannada district (probably) may be considered:

i) Walls and roofs must withstand heavy rainfall.

ii) Shelter should be cool in summer and warm in winter.

iii) A fire hazard should be minimised.

iv) If termites are endemic to the region, termite resistant building methods to be evolved.

Inventory of Local Materials

FOUNDATIONS: Stones | Red Earth | Lime | Laterite Blocks

WALLS: Laterite Blocks | Red Earth | Bricks | Others?

Pillars: Bricks | Laterite Blocks | Stone slabs | Others?

Roofing: Round timber (large size) 8 to 10 cms | Round timber (small) 3 cms | Bamboo split/ whole | Arecanut reepers

Coconut thatch | Woven Bamboo mat | Others if any

WINDOWS: Jali blocks | Bamboo trollies | Others

FLOORING: Stone Slabs | Others

NON-LOCAL MATERIALS

Walls: G.I. sheets/Asbestos sheets for Animal glue
termite barriers for wall protection

Pillars: A.C. pipes, bricks in C.M.

Roofing: Tar felt sheets, chemicals for thatch treatment

Technological Alternatives

FOUNDATION:

Use stone in mud mortor or lime stabilized mud rammed in place. Use G.I. sheet (28 gauge) at plinth level as termite barrier.

WALLS:

May be built of unburnt bricks or soil blocks. Roof load is supported on A.C. pipe columns. Walls can be protected against rain by roof overhang and coatings of white mock and 15% animal glue solution.

ROOF:

Interior support for roofs is by timber columns. Roof consists of three layers:

i) Closely spaced (8 cms) thin timber (3 cms) reepers which are straight.(split bamboo or arecanut reepers are also feasible).

ii) A layer of tar felt spread across the thin reepers.

iii) A layer of treated thatch on the tar felt held down by bamboo trellis or coir ropes. The thatch may be treated by dipping for two hours in a solution containing copper sulphate (1%), sodium dichromite (1%) and boric acid (1%). Acetic acid may be added till the boric acid is dissolved. A life of four years may be expected for the treated thatch in U.K. district.

WINDOWS:

May consist of jelli blocks made of cement-lime-porcelane mortar. The jelli window may be provided above a height of 1.35 m above ground all round the building.

The overall cost of such a building may be in the range of Rs.120.0 to Rs.150.0 per sqa.m. On this basis, the present dosign for 20 cattle could have a cost in the range of Rs.10,000 to Rs.12,000.

K.S. JAGADISH

MANAGEMENT OF MILCH AND DRAFT ANIMALS

Normally, the milk production follows pregnancy and calving. The duration of pregnancy in cows is around 280 days and in buffaloes around 307 days. Practical experience has determined the desirability of a 6 to 8 week dry period permitting rest and recovery between lactations. The first post-partum heat can be seen around 40-60 days in cows and 40-100 days in buffaloes. Keeping these points in view it could be said that one calf every 12 months in cows and at least 2 calves in every 3 years in buffaloes can be obtained by a farmer for the maximum economic return from dairying.

Farmers should be aware about the reproductive cycling of their animals. Any abnormality in the cycle should be attended immediately.

Government institutions and various other organisations are striving very hard to make arrangements for the door to door supply of best quality germ plasm. In most of these cases, the germ plasm costing very high is being supplied at very nominal cost or even free of cost to the farmers. It is unfortunate that our farmers are not realising the importance of these facilities.

The have to get their animals inseminated, and take care of the cows properly to get a well grown and healthy calf. After the birth of the calf, proper management is necessary to develop and multiply the quality germ plasm.

As we human beings demand the necessary wages and food for the work we put, it is also necessary to provide required quantity and quality of food to obtain optimum production by the

dairy animals.

In any enterprise maintainence of regular and proper recording and accounting is an important tool in management. By providing good air, water, food and proper prophylaetic measures one can exploit the nutral gift to a greater extent.

Dr. S. Mallikarjunappa

MANAGEMENT OF GRAZING IN FOREST AND ROLE OF FOREST IN PRODUCTION OF FODDER

Time has come to think of spatial and temporal combination of plants and animals. Because domestic animals played a detrimental role in creating an ecological stress in the district by destroying the terrestrial ecosystem

Man and his animals not only destroyed the tropical forests and also its soil one which it grows and water it receives. Mainly due to improper management of available land resources, exclusively meant to meet their various needs including forage.

Though late, but every one has realised the consequences of uncontrolled grazing and many other evil practices like fire etc, resulted in total degradation of minor forests, betta lands, and over 60% of reserve forests around habitations. The above areas have been incapaciated and soil has become inanimated. At the same time there is no alternative but to graze in the valuable forest areas. At present over 75% of the cattle in the district solely depend on reserve forests, where some forage is grown.

In this procarious situation the only alternative is forage production which may have to become prime forestry objective, to save forest and to prevent further degradation of forests. Simultaneously, cattle owners have to be induced to reduce cattle strength, and to regulate among themselves the intensity and rotation cycle of grazing in areas where fodder resources are developed.

Site specific stratification of ecosystem (multi-storey cropping) has to be developed and a reasonable combination of

trees, shrubs and herbs as well as other native edible forage species vertical combination is possible, by which required balanced forage can be obtained besides several other benefits.

By planting different native and some suitable exotics primarily fodder species of high nutritional value will supplement the fodder needs, particularly in dry season. For example tree species like Ficus, Albizzia, Sesbania, Calliandra, Spondias, Phylanthus, Terminali-beleria, Pterocarpus, Grewia and Gmelina and several edible shrubs and herbs. This type of combination of tall trees, middle storey trees, shrubs and herbs will protect the soil and enriches the soil, thereby, richer and longer lasting grass cover will establish and total ecosystem improves. Tree crops not only produces forage, but also fuel, timber and other non-wood resources. Therefore minimum tree crop and bush cover is a must in high rainfall hilly terrains to maintain ecological balance of soil, water, etc. Removal of tree cover and other vegetation results in mineralization of natural elements and humus layer disappear in one season due to high radiation of top soil. This also brings in radical changes in soil structure causing severe reduction of productivity of soils. Therefore, an integration of trees, shrubs, and bushes of edible native and exotics is indispensable.

We have to achieve a qualitative improvement of the productivity of land use system to satisfy human needs, by providing protection to crops and soil by planting optimum number of trees. The trees foster the soil and water, besides most of the forest products including fuel and timber is as economical as any other crops.

Field research in this direction is required to demonstrate to people. Few decades back forest produces were having limited commercial uses, but the situation has changed now, there is a demand for every forest produce but forest and several of its products have become scarce. Many industries have to depend on forest products as science is yet to find alternatives to several natural forest resources.

PHYSIOLOGY AND NUTRITIONAL REQUIREMENT OF LIVE STOCK

The available pasture lands i.e., minor forest and betta lands have been made incapacitated and permanently inadequate to meet the requirement. As stated earlier over 7% of heads entirely depend on proper forests. More often than not there is not only scarcity of fodder, even good water and mineral also became acute in dry months.

The growth of forage is sparse during summer, and the animal have to cover large areas and they have to walk long distances for fodder and water. This leads expending of calories in the form of kinetic energy in search of fodder and water.

Fodder grasses and other herbage in overgrazed, grasses in forest areas grow extremely quickly in wet months and also flower, fruit and lignify within 30 to 45 days. During wet months these grasses and other herbage in forest floor provide a balanced feed of proteins and carbohydrates. In places where canopy density is better and soil is slightly rich the fodder and herbage is available over 70 to 80 days. The grass which grows in open and unprotected areas grows fast with little green leaf, contains more of crude fibre and poor in proteins and entire

floor will become barren soon due to overgrazing. Even in wet months in open areas the cattle has to collect the feed with a considerable energy input.

OVERCOMING THE FODDER SHORTAGE DURING DRY PERIODS

The main growth period for fodder plants is June to October. During the rest of the period the forage species nearly dies off. This gives rise to a fodder shortage over 200 days of the year but the demand remains same. In this district hardly any fodder is stored to feed their cattle.

About 30 to 35% of the demand could be ensured if fodder is collected in closed forest areas during rainy season. If the forest areas around villages is spared and grazing is prevented, over 60% of the demand could be met by cutting and storing.

Second alternative to improve fodder growing lands by introducing an economical irrigation during dry months. This could make it possible to feed green fodder throughout the year. For such an intensive cultivation suitable species and strains which can give high yield, high nutritive value and palatable ones have to be raised.

The peculiarity of natural fodder grasses in the forest areas of moist and dry deciduous forests where density of the canopy less than .4 to .5 the grasses grow fast in wet months and attain a height of over one to 2 meters, if closed, if areas are open hardly it attains a height of 20 to 30 cms.

The other important feature observed is, in open areas grass matures fast with little leaf and in closed areas maturity of grass is delayed over 30 to 40 days and good leaf ratio also observed. Whereas in open over-grazed areas stem ratio is high

and crude fibre also very high.

In forest areas there are more than 10 to 15 species of grass are being naturally grown, studies regarding their growth rate, maturity period, yield, nutritive value will help to encourage better species and strains to increase yield in forest areas.

Other edible natural forage species survey, growth rate, yield and nutritive value will also help to encourage them. These shrubs and herbs helps to protect forest floor, enrich forest floor and provide protein rich feed to cattle.

FORAGE SHRUBS AND TREES

Trees and shrubs play a dual role in the forage supply, serving both as shade for grasses and as forage themselves. In dry season shrubs and trees are very precious because pasture grasses die, when upper soil layers loose their moisture, but the trees and shrubs roots exploit deep underground moisture and they remain green and keep growing.

In the critical period trees and shrubs provide green fodder leaves, flowers and fruits rich in protein, vitamins and minerals. In their absence animals have only straw from native grasses. This type of poor feed cause avitaminosis, mineral deficiences and debilitation.

If shrubs and trees interplanted with grasses which increases the yield and supplies forage during scarce days also.

Many of native trees and shrubs are capable of growing even

in barren terrain if protection is given because of rhizobia. The rhizobia fixes nitrogen which benefits grasses and other ground level forages.

Unfortunately no research information is available on forage production of native shrubs and trees. For shrubs and trees no attention is given but more often they have been regarded as weeds and destroyed. In addition to the above deliberate fire also wiped out all forage plants and trees.

Identification and utilization of native edible species is neglected. Even though they have been cut and used during drought seasons.

MANAGEMENT OF GRAZING IN FOREST AREAS AND ROLE OF FOREST LAND IN PRODUCTION OF FODDER

Introduction:

The men and the cattle can not be separated from each other. The survival and the development of the civilization depend upon the cattle wealth which is required for various purposes like production of milk and production of dung for agricultural and horticultural crops. This being the case the production of fodder for the cattle should attract the attention of all concerned including the government to the same extent at which we take care of food grain production for human population. Unfortunately this has not been the case in the practice. Grow more food campaign got top priority from the government, scientists and farmers but almost negligible attempt has been made to increase the production of fodder.

In our country it is presumed that the forest are the inexhaustible source to produce fodder. This is not true. Like any other forest produce the fodder can be harvested on a sustained basis if the forests are managed in a systematic manner. For this one has to assess the carrying capacity of a particular forest and only as many numbers of cattle should be allowed to graze in that particular forest. Further rotational grazing on a rotation of, say, three years is a must to allow the fodder to grow.

But these principles are easier to state than to implement. With uncontrolled growth of cattle population and due to shortage of grass in the forest areas because of heavy biotic pressure the

principles of systematic management of forests for grazing have gone stray. As a result the fodder resource in the forest are over exploited thus increasing the grazing pressure manifold and diminishing the fodder growth in the forest further. With popular governments coming to power the grazing has been made free thereby removing whatever little control could be exercised earlier when the grazing was through fees and grazing permits.

Grazing pressure on the forests of Uttara Kannada

Here, an attempt is being made to quantify the grazing pressure on the forests of Uttara Kannada district to give an idea as a case study. More or less the situation is the same throughout the country.

As per 1983 census, the live stock population in the district is given here in the table. Presuming that the average cattle weighs 200 Kgs and an average buffaloe weighs 260 Kgs. the total animal weight works out to 1047.0 lakh Kg. Taking the daily fodder requirement at 2 of the total body weight, the total fodder requirement is computed. The total geographical area under agriculture in the district is 1.09 lakh hect. Presuming the dry fodder production of one tonne per hectare we get 1.09 lakh tonnes of dry fodder from arable land. Certain progressive farmers in the district have adopted to stall feeding in case of crossbreed animals. Presuming that 0.6 lakh tonnes of fodder is produced separately as fodder crop we are left with a gap of 6.00 lakh tonnes of fodder which is being provided from the forests of Uttara Kannad district.

Kind	Live stock population 1983 census	Body weight per animal unit kg	Total body weight lakh kg	Daily/Fodder requirement 2% of colm. 4 lakh kg.	Annual/ (Dry) fodder require- lakh ton
1	2	3	4	5	6
Cattle	392730	200	785.46	15.71	5.734
Buffaloe	100786	260	262.04	5.24	1.913
			Total		7.647
			or say..		7.650

(a) Availability of fodder from 1.09 lakh ha. arable land	1.09 lakh tonne	
(b) Availability of fodder from improved fodder farms	0.56	"
	1.65	"
Balance requirement to be met from forests	6.00	"

In nearly 50% of 8.29 lakh hectares of forests in Uttara Kannada district either the canopy is closed or the areas are inaccessible or there is no grass. Therefore, the total livestock population has to depend upon the balance of about 4 lakhs hectares of forests. Thus, there is a pressure to produce 1.5 tonnes of fodder from every hectare of the available forest areas. It is observed that in the case of unprotected wooded areas, the fodder production is hardly 0.2 tonnes per hectare, thus, our forest can hardly support 1/7th of the present livestock population of the district. In other words, the grazing pressure on the forests of Uttara Kannada district is more than 7 times of the carrying capacity of the forest. This

has resulted in total depletion of grass and in most of the cases the cattle is underfed.

Goats are killers of young plants whatever may be the species. Still goats are often found grazing in the forests and the policy of encouraging goat rearing in the district has added another dimension to the problem of forest pressure.

Regulation of cattle grazing in open areas of forests

As per the Karnataka forest rules, 1969 there is a provision for grazing in the forest areas after obtaining grazing permits from a forest officer not below the rank of a forester. But the grazing has to be regularised in the following manner.

1) Where the number of cattle exceeds the grazing capacity of the area, the divisional forest officer will take steps to limit the number of cattle to be admitted to the maximum, which the area will support, by providing grazing grounds elsewhere for the cattle excluded as being the excess of the maximum number so fixed or by such other means as he may consider suited to the circumstances.

2) The Divisional Forest Officer may divide any particular open area of a forest into grazing blocks, permitting grazing in each block by rotation and closing each block for a definite period to promote the growth of grass and at the same time to achieve better protection of the forest land.

3) Professional graziers and cattle breeders may be permitted to share with the agriculturists and other rearing, cattle, in such grazing as is permitted in the areas of open forests, unless particular areas are reserved exclusively for such cattle.

4) Even in cases where the Government have permitted grazing without payment of the prescribed grazing fee, no cattle shall be allowed to graze without a free grazing permit, and even the free graziers shall abide with all other conditions of the Karnataka Forest Act 1963, Karnataka Forest Rules 1969 and the Karnataka Forest Manual.

But, subsequently these regulations have been given a go by. There is no need for any body to get a grazing permit now. The cattle grazing has been recognised under privileges and concessions granted to general public free of cost. This coupled with steep rise in cattle population (in 26 villages around Sirsi town the cattle population has increased from 2193 in 1911 to 23166 in 1983) has resulted in uncontrolled over grazing in the forest areas. This has not only depleted the fodder resources in the forest areas but has resulted into destruction of natural regeneration thereby degradation of the forest wealth also; as with the depletion of grassess the cattle will have to depend up n the plants specially young ones. The policy of some departments of the Government to distribute goats has played havoc.

Disposal of grass crop in closed areas of Forests:

Once the forests are closed for regeneration the grass growth gets a boost. To give an idea from the closed areas of 600 ha of Sirsi division itself nearly 800 tonnes of dry grass was supplied to scarcity affected areas of the state during 1985-86. Earlier as per rules these closed areas were to be sold to the village panchayats or cooperative bodies or to others but now we are cutting grasses from such areas and supplying free of cost

to the local surrounding villagers. A majority of Soppina bettas also work as closed areas for fodder production.

Role of forests to produce fodder

With the sustained growth in cattle population only grazing can not be thought of as the answer. Specific efforts are required to be made to grow fodder as a plantation crop. Apart from the grasses tree fodder should also be grown on a large scale. There are many fodder tree species, a few being -Leucenia leucocephala, Calliandra Callothrysus, Sesbania grandiflora, Bauhinias, Ficus species Albizzias and Acacia nilotica. A beginning by growing more than 100 ha. of Silvipasture farmer where the tree fodder coupled with grasses and legumes like Desmanthes, D2, CO-1 and Napier have been tried.

But this is not sufficient, a detailed plan has been prepared which envisaged to supply fodder for all the cattle within a radius of 5 to 6 km. of each village. For this at three hundred and twnety five (325) places irrigated Silvipasture farmer are to be established at the rate of one ha for 20 cattle in 23040.23 ha. for Uttara Kannada district. The details of the plan are appended herewith. But, the total financial requirement is Rs. 61 crores in capital investment and Rs. 2.80 crores recurring. The major problem is from where to arrange this huge finance when the fodder production has got such a low priority in overall development planning in our country.

Further, it is presumed that the cattle improvement programme shall go side by side and the growth in cattle population shall be off set by reduction consequent upon the breed improvement.

PACKAGE OF PRACTICES FOR THE CULTIVATION OF FORAGE CROPS IN IN UTTARA KANNADA DISTRICT

Fodder crops hardly find any place in the common cropping pattern. Consequently there is acute shortage of fodder in the state. It is estimated that about three per cent of aerable land in Malnad and Coastal areas is under forage crops.

The shortage of fodder is not only felt in low rainfall regions of Karnataka, but also in Malnad and Coastal areas particularly during summer season. The increasing cattle population in Malnad is causing a threat to the forests as the cattle encroach the frinzes of forest areas for grazing and thus destroy the small growing forest plants by trampling, browsing etc. Therefore, to prevent the destruction of forests and to provide sufficient fodder to the animals, cultivation of fodder crops is a must. But there is hardly any scope to increase the area under forage crops because of increasing pressure on aerable land for the cultivation of food and commercial crops by the increasing human population. Under these circumstances, in the limited available land for the cultivation of fodder crops, the knowledge of selection of crop/variety of fodder crop and technique of cultivation area very important to boost the yield of fodder per unit area. In this paper an attempt has been made to discuss about the cultivation of important annual and perennial crops suited for the cultivation in upghat and coastal areas of Uttara Kannada.

FODDER JOWAR

In Malnad and Coastal area, fodder jowar can be cultivated

in Kharif season under rainfed conditions and in summer season wherever irrigation facilities are available. Fodder jowar J-set-3 is a ruling variety. It is grassy in nature with thin succulent stem with more leaves. the plant is free from most of the leafy diseases. The important features of this variety are listed below:-

1) It is an annual multicut crop
2) It has wider adaptability. Tolerates saline and acidic soil conditions
3) It tolerates waterlogging to some extent as well as the drought situation
4) It can be preserved as dry fodder
5) It attains full flowering in about 70 days and milk stage in about 85 days of sowing
6) It contains 8. to 9.0 per cent of crude protein.

Inputs per hectare:

	Rainfed	Irrigated
Seed rate and spacing	30 kg in 30 cm rows	30 kg in 30cm rows
FYM	8 tons	12 tons
Nitrogen	7 kg.	100 kg.
Phosphorous	50 kg.	60 kg.
Potash	25 kg.	40 kg.

Cultivation practices:

Prepare a firm seed bed to a depth of 15-20 cm. Sow the seeds in 30 cm. rows. While sowing mix 15 kg of cowpea. This will not only improve the quality of fodder but also help in getting higher tonnage. Apply half the dose of nitrogen and all

the phosphorous and potash at the time of sowing. After 20-25 days of sowing, hand weed the crop and apply the remaining 50 per cent of nitrogen. Intercultivate the crop two times before it attains a height of one metre. Under irrigated conditions, irrigate once in 10 to 12 days.

Green fodder yield t/ha:

When only one cut has to be taken, harvest the crop at milk stage. When a ratoon has to be taken, harvest the crop at flowering stage. This will help in getting a better ratoon crop.

	Rainfed	Irrigated
Flowering stage	30-35	35-40
Milk stage	45-50	50-55

FODDER MAIZE

Maize is an important fodder crop which is superior to jowar in its feeding value. Fodder maize South African is an important, high yielding variety which yields about 25 to 30 per cent more green fodder yield than most of the other maize types. The important features of this variety are listed below:

1) It has lactogenic effect. Hence good for milch animals.
2) It retains lower leaves green even at physiological maturity. Hence the harvesting period is more in this crop.
3) It does not withstand waterlogging and salinity. At the same time it is sensitive to moisture stress. Comes up well in well drained soils.

4) It can be grown in any season of the year provided moisture is not a limiting factor.

5) It has to be fed either as green fodder or as silage. The dry fodder becomes coarse and unpalatable.

6) It attains milk stage (harvesting period) in about 90 days after sowing.

Inputs per hectare:

	Rainfed	Irrigated
Seed rate & spacing	60 kg in 30cm rows	60 kg in 30 cm rows
FYM	8 tons	15 tons
Nitrogen	75 kg.	120 kg.
Phosphorous	50 kg.	60 kg.
Potash	25 kg.	40 kg.

Cultivation practices:

Same as that of fodder jowar.

Green fodder yield t/ha:

	Rainfed	Irrigatsed
South African (Milk stage)	35-38	50-57
Other varieties	25-30	45-50

FODDER BAJRA

In recent years, bajra is becoming popular as a multicut green fodder crop. The research work carried out at Fodder Research Scheme, Regional Research Station, Dharwad has given out some cultures from Nigeria and Zambia which are quick in growth, tall and high yielding. Out of these cultures, culture DFB-1 which is in pre-release stage comes up well in heavy rainfall

areas. Important features of this culture are detailed below:

1) Quick growing. Comes up within 60 days for cutting.

2) Two to three ratoons can be expected.

3) Requires well drained soil.

4) Sowing can be done during any part of the year.

5) It can be preserved as dry fodder.

6) At milk stage it contains 8 to 8.5 per cent of crude protein.

Input per hectare:

	Rainfed		Irrigated	
	Main crop	Ratoon	Main crop	Ratoon
Seed rate & spacing	15 kg in 30 cm rows	-	15 kg in 30 cm rows	-
Nitrogen	60	30 kg	75	50 kg
Phosphorous	40	-	50	-
Potash	20	-	25	-

Cultivation practices:

Same as that of fodder jowar.

Green fodder yield t/ha:

	Rainfed	Irrigated
Main crop	25-30	30-35
First ratoon	15-16	20-22
Second ratoon	10-12	14-16

HYBRID NAPIER GRASSES

NB-21 and Co1 are the two hybrid napiers suited for cultivation in Uttara annada district either as rainfed crop or as irrigated crop. These are the crosses between Napier grass and bajra. The important features of these two grass are:

1) Can be kept in the field for a period of three to four years.

2) Since the plant is sterile in nature, it is propogated through rooted slips.

3) Respond well to fertilizers and irrigation

4) Fodder yielding ability is very high

5) Can be grown with success on bunds in heavy and high rainfall regions. It can also be planted along the water ways.

6) Come up well on any type of soil which are well drained

7) Green fodder yield during winter season is usually low

8) Can be planted from March to September i.e. except during winter season

9) Chemical composition:

Crude protein 8.5%

Fibre 26%

10) The fodder contains oxalic acid, which drains out calcium from the body of the animal. Therefore to growing and milking animals it has to be given in small quantity. Otherwise calcium supplimentation is essential

Inputs per hectare:

	Rainfed	Irrigated
Rooted slips	20000	20000
FYM	10 tons	20 tons
Nitrogen	125 Kg	175 Kg
Phosphorus	60 Kg	100 Kg
Potash	40 Kg	60 Kg

Cultivation practices:

These grasses being perennial require firm seed bed to a depth of 20 to 25 cm. Plant one to two slips per hill at a spacing of 90 cm x 60 cm. Before planting incorporate one handful of FYM and mix it well in the planting region. This type of spot application of FYM will reduce the wastage of FYM and also prevents the growth of weeds.

After about 15 days of planting apply 20 per cent of nitrogen and all the P & K in a ring round the plant. Remaining nitrogen has to be given in equal split doses after each harvest.

The grass will be ready for first cut after about 70-75 days of planting. Subsequent cutting have to be made at an interval of 45 to 50 days. The interval between cuttings should not be more than 50 days as the grass becomes fibrous and loses quality and palatability. Normally under irrigation 6 to 8 and under rainfed condition 2 to 3 cuttings can be had.

Depending upon the soil type, irrigate the crop once in 10-12 days.

Yield of green foddert/ha.

	Rainfed crop	Irrigated crop
First year	50-55	75-80
Subsequent years	75-80	170-180

Mixed cropping:

After first cutting of grass, dibble three to four seeds of centrosema, a perennial fodder legume creeper at the base of each clump of grass. The legume creeper will train round the grass shoots and help in increasing the tonnage as well as nutritive value of the fodder.

In case the seeds of centrosema are not available, the legume like cowpea or horse gram can be used. But as these legumes are annual types, seeds have to be dibbled after each harvest of the grass.

GUINEA GRASS

It is one of the most important introduced exotic grass from tropical Africa. In quality, it is superior to hybrid Napiers. The important features of this grass are:

1) Perennial and can be retained in the field for about 7 to 8 years.
2) Comes up well in heavy rainfall areas and responds to irrigation and fertilizer
3) Shade tolerant and can be grown with success in coconut and areca gardens
4) Being drought resistant (compared to NB-21) can be planted on field bunds

5) Has lactogenic effect. Hence forms a good fodder for milch animals

6) Puts on growth even in winter months

7) As the stem portion is very less, there is less effect of stage of harvest on the quality of fodder.

8) It is more nutritious than NB-21 and contains about 8.5 to 9.0 per cent crude protein

9) As it is a shy yielders, has to be fed only to high yielding milch cattle

Inputs/ha:

	Rainfed	Irrigated
Rooted slips	30000	30000
FYM	10 tons	20 tons
Nitrogen	100 Kg	150 Kg
Phosphorous	50 Kg	75 Kg
Potash	25 Kg	50 Kg

Cultivation practices:

Spacing : 60 cm X 45 Cm

The other cultivation practices are same as that of NB-21 grass.

Yield of green fodder t/ha.:

	Rainfed	Irrigated
First year	25-30	40-50
Subsequent years	75-80	130-150

PARA GRASS

This grass is indigenous to Brazil, but has now been introduced in many other warm countries as it grows well on all soils. It can not only withstand water logged conditions but actually thrives therin. The important features of this grass are-

1) It is a perennial creeping grass and remains in the field for about 10-12 years
2) It is well suited for wet-land areas where other grasses will not thrive. Comes-up very well under sewage irrigation.
3) Tolerates high salt as well as acidic soil conditions
4) It is stoloniferous creeper and covers the soil surface in a short time and then will not allow any weed to grow
5) There is no necessity of intercultivation
6) It is a shy grower in winter season
7) It is comparitively less nutritious with about 6.5 per cent of crude protein
8) The interval of harvesting should not be more than 45 days as the shoot becomes fibrous and looses palatability.

Inputs/ha.:

	Irrigated/Swampy area
Stem cuttings with three nodes	110000
FYM	10 Tons
Nitrogen	120 Kgs
Phosphorus	60 Kg
Potash	40 Kg

Cultivation practices:

The cultivation practices for para-grass are little different. The land should be laid out in to small plots of five gunthas. Perfect levelling is essential. As the grass prefers swampy conditions. Puddle the soil and drain out the water. Plant the stem cutting of para-grass giving a very close spacing of about 30 cm x 30 cm. No line planting is essential. See that at least one node enters the soil. Apply 20 percent of nitrogen all the phosphorus and potash after about 20 days of planting when new leaves emerge from the cuttings. Remaining nitrogen has to be applied in equal doses after every harvest of the crop.

Two hand weedings i.e. first after about 20 days of planting and the second after 40 days of planting have to be given. Immediately after the second hand weeding, pass a wooden plank on the crop. This will help the grass to cover the soil by rooting at nodal regions which come in contact with the soil.

After 70 to 75 days of planting the crop will be ready for first cutting. Subsequent cuttings have to be made at an interval of 40 to 45 days. After first and second harvest take uphand weeding if found essential. The grass being shy grower in winter it may not be possible to get economical yields during winter months.

Yield of green fodder t/ha:

	Normal water	Sewage water
First year	35-40	50-60
Subsequent years	85-100	125-150

SUBABUL

In recent years su-babul has become very popular with farmers because of its varied use and wider adaptability. When su-babul is grown for production of fodder, to get maximum biomass it needs different cultivation practices. The important features of this crop are:

1) It is a multicut perennial crop

2) Being deep rooted, after establishment less care is required

3) Being evergreen produces green fodder throughout the year

4) It contains very high amount of crude protein (about 20 percent)

5) This crop can also be grown on field bunds.

Input per hectare:

Seed	:	12 kg
Variety	:	K-8, K-28, K-67
Nitrogen	:	25kg
Phosphorous	:	60kg
Potash	:	40kg

Cultivation practices:

Before sowing, soak the seeds in warm water. After 24 hours of soaking select only plumpy soaked seeds for sowing. Treat the seeds with appropriate Rhizobium culture (for acidic soils of Uttara Kannada CB-821).

Prepare the soil to a depth of 20 to 25 cm. Sow the pre-treated seeds in rows 90 cm apart. Apply all the fertilizer in a single dose at the time of sowing in a band about five cm away from seed line and about five cm deep into the soil. Fertilizer

need not be given in subsequent years. After 40 days of sowing thin out the crop within the row to have one plant at a distance of 20 cm. After about four to five months of sowing cut the main shoot at 90 cm height from ground level. This helps the plant to produce more branches and become bushy in nature. Subsequent cuttings have to be made at an interval of 45 to 50 days.

Yield of green fodder t/ha:

	Rainfed	Irrigated
First Year	20-22	25-30
Subsequent Years	50-60	80-100

Note: 1. Leave one plant at a distance of three meters in the row to grow into a tree. Such plants can be harvested once in four to five years to get wood for the preparation of farm implements, construction of huts and also to use as fuel.

SUBHASH GUMASTE; RAMESH BABU AND K.R. BHAGAVAT

EFFICIENT UTILISATION OF BYE PRODUCTS OF CATTLE AND BUFFALOES

People maintain buffaloes as a primary source of milk, cows as a symbol of deity and bullocks for draft purpose in cultural operations and transport. In recent years, people have started raising the cross bred cows as a source of milk for home consumption and for marketing. In addition, people in rural areas do maintain additional heads of cattle possibly because they posses these animals and there are no acceptable means of disposing them off. However, the fact remains that these animals excrete dung and urine and it should be the endeavour of the owners to use these bye products in the most efficient manner.

ESTIMATES OF BYE PRODUCTS

Dung consists mainly of that portion of food that has not been digested by the animals. Dung also contains water, living and dead bacterial cells and these cells comprise of nearly half the quantity of nitrogen of dung. The importance of dung and urine as sources of manure is determined by the percentage of plant nutrients contained in them and the quantity excreted by the animals. The quantity and quality depend on number of factors like type, age, breed and condition of the animal, the purpose for which the animal is maintained, and nature of the feed fed to the animal. For example, buffaloes excrete more dung and urine than cows; animals of different breeds pass out different quantities of excreta; the dung obtained from adult will be more than that of calves. Likewise, the nutrient content of excreta of young growing animal is lower than that of an adult animal. Likewise, excreta of an animal in milk will be poorer in

nutritional value than that of a dry animal. The nutrient content of excreta from cattle and buffalo varies. Therefore, it is difficult to estimate precisely the quantity and quality of excreta of animals. Further, estimation of the actual quantity of excreta per animal becomes more intricate because most of the cattle and buffaloes are away from the stall during day time either for work or for grazing especially in rural area and the quantity of dung and urine excreted during this period is not only lost to the owner and but it also becomes difficult to estimate the quantity so lost.

Notwithstanding the above the following tables furnish useful information for our purpose.

Table 1: Quantity of dung and urine excreted by an adult animal per day (Kg)

Type of animal	Dung excreted - stall fed	Animals in stall during night and early morning(hrs)	Urine excreted stall fed	Animals in stall during night and early morning (hrs)
Cattle	20	13.3	8	5.3
Buffaloes	25	16.7	10	6.7

2. Plant nutrients contained in dung and urine of cattle and buffaloes

Sl No.	Percent of original matter	Dung		Urine	
		Cattle	Buffalo	Cattle	Buffalo
1.	Water	82.40	81.10	92.60	81.0
2.	N	0.30	0.26	1.21	0.62
3.	P20	0.18	0.18	0.01	Trace
4.	K20	0.18	0.17	1.35	1.61
5.	CaO	0.36	0.46	0.01	Trace

Table 3. Quantities of dung and urine excreted by an adult animal (stall fed) per annum and the plant nutrients contained (Kg)

	Cattle			Buffalo		
	Dung	Urine	Total	Dung	Urine	Total
1. Quantity excreted	7300	2920		9125	3650	-
2. N	21.9	35.33	57.23	23.73	22.63	46.36
3. P2O5	13.14	0.29	13.43	16.43	Trace	16.43
4. K2O	13.14	39.42	52.56	15.51	58.76	74.27
5. CaO	26.28	0.29	26.57	41.97	Trace	41.97

Handling of Excreta:

Present Position:

Substantial quantity of the dung is still being used for preparing the cakes which are used as a source of fuel. Small amount of dung is utilised for plastering the floor and the remaining quantity is dumped into the F.Y.M. pit. Similarly,

part of the urine soaks through the floor of the byre and where pucca floor is provided, the urine flows through the gutter and accumulates in a pit for some days before it is splashed out or is poured into the F.Y.M. pit. In general, it may be mentioned that the animal excreta is made use of but with least efficiency. The objective of the owner of the animals should be to use the bye products most efficiently and towards this end he will have to exercise utmost care while collecting processing and utilising the product in crop protection. So that the losses of the material and the nutrients contained therein are kept at minimum. Burning the dung (as cakes) brings about complete loss of organic matter and nitrogen and destroys small portion of phosphorus. This is a collosal loss and hence use of dung cake as fuel is to be completely discouraged. The dung cake as fuel is to be completely discouraged. The dung should be used to produce biogas or be converted along with urine into a good quality manure as an indigenous source of nutrients to plants.

Proper Handling

A. Collection of the Material:

Not only it is necessary to collect the dung and urine completely but it is also essential to take care that the nutrients are not lost from them. Following steps are to be taken towards this end.

1. The flooring of the byre should be hard stone or cement floor is prefered. This prevents the leaching loss of the liquid portion of the excreta. The urine should be lead through a small gutter and stored in a pit. Few drops of mineral oil to the urine in the pit prevents the gaseous loss of nitrogen.
2. Suitable bedding material should be spread on the floor of the byre every day. Straw rejected by animals, dried leaves, dry

moss, peat etc may be used for this purpose depending on the availability. The bedding material absorbs the liquid portion thereby minimises the loss by leaching, prevents the loss of nitrogen from urine by widening the C:N ratio, helps even distribution of the excreta, regulates the decomposition rate in the pit and gives a good physical condition to the F.Y.M.

3. Small quantity of single superphosphate is to be added to the bedding material and this prevents the gaseous loss of nitrogen from the excreta especially fro urea. Nitrogen which is present in urine in the form of urea is converted to gaseous ammonia and is lost to atmosphere when no care is taken. When single superphosphate is added, number of chemical reactions take place and finally ammonium sulphate and tricalcium phosphate are formed which will not be lost so easily. Addition of superphosphate helps to enrich the F.Y.M. of its phosphorus content.

B.Preparation of Pit

The pit for preparing the F.Y.M. should be located at a higher elevation to prevent stagnation of water into the pit through seepage. Entry of rainwater in the pit is to be prevented. The size of the pit may vary but the depth of the pit should be one metre. The length and width may be kept at convenience(say 6-10 metres long and about 2 metres wide). It is advisible to harden the sides and bottom of the pit by ramming, if necessary.

C. Filling the Pit

The dung and the bedding material(and house hold ash wherever available) are to be properly mixed in the byre and spread uniformly in the FYM pit in layers of about 30 cm each. The urine collected in the urine pit is to be sprinkled over the material in the pit. If the material does not become sufficiently moist, water is sprinkled. A thin layer of soil (2 to 3 cm thick) is spread over. The same procedure is repeated till the pit is completely filled and the material rises to about 50 cm above the ground level. The material is plastered with mud or mud and dung mixture and left till the manure is ready in 3-4 months.

Sectional filling of the pit, rather than taking the entire pit at a time is recommended. A temporary moveable partition made of bamboo splits may be used to seperate a length of about a metre at a time, this portion is filled as described above and the partition is moved to the next one metre. This modification minimises the loss of nitrogen which takes place when a large area is exposed for a longer time.

The decompositioon in the FYM pit which takes place due to micro-organisms is partly aerobic and partly anaerobic. The success of obtaining good quality manure is governed by the extent to which the environment in the pit is kept favourable for the decomposing microbes. Following points should be kept in mind.

1. For proper decomposition at a reasonable rate, the decomposeable material should be of the right type. The rate of decomposition proceeds at a normal rate when the proportion of

carbon and nitrogen is in the ratio of about 40:1. This can be achieved by adjusting the nature of the material which is used either as bedding material or is added directly to the pit.

2. Moisture content of 60 to 70 per cent of the material at the start is desireable. If the bedding material is dry and if the quantity of urine is less, it would be necessary to sprinkle sufficient water. Excess water is undesireable. Better to avoid addition of large quantities of fleshy material as well as very fine particled material which get compacted in the FYM pit.

3. Judicious amount of oxygen in the pit is required for proper decomposition of the substance in the pit. Absence of oxygen encourages anaerobic decomposition and this slows down the rate of decomposition and also ends in a bad quality FYM. Liberal supply of oxygen hastens the quick formation of end products and may result in loss of nutrients and reduction of the quantity of organic matter. Oxygen supply can be regulated to a great extent at the time of filling the pit with the material which should neither be compacted too much nor should be packed very loose.

4. Reaction(PH) near neutral point (PH 7 to 7.5) is desireable for proper decomposition. During the process of decomposition, organic acids are formed which may slow down the rate of decomposition. To overcome this difficulty, some alkaline material is to be added to the pit. Household ash is quite useful in regulating the PH by neutralising the acidity developed. If ash is not available, limestone (5% of weight of material) or other liming material may be added.

When the above factors are at optimum level, the temperature inside the pit rises to 50 to 60 and this is desireable since

at this high temperature most of the weed seeds, spares of pathogens, maggols and larvae of insects get destroyed.

When the decomposition is complete the volume would be reduced to around 50 per cent of the original volume.

Characteristic of Good FYM

1. The material should have undergone complete decomposition. Under this condition, the raw materials from which the FYM is prepared are not identifiable.

2. The manure should be brown in colour.

3. The manure should not be lumpy nor should it be dry. It should not have a fowl smell. The manure should be friable.

4. The manure should contain the nutrients in expected amounts. The average analysis is 0.5 per cent N, 0.25 per cent P_2O_5 and 1 per cent K_2O.

Use of Dung Slurry from Biogas Plant

The dung fed to the bio-gas plant undergoes anaerobic decomposition producing methane and other gases. The slurry left over comes out of the plant and this slurry can be used as a good source of manure to the crop.

The slurry contains 2 to 2.4 per cent nitrogen on dry weight basis, 10 to 15 percent of which is in the form of free ammonia (0.2 to 0.35%). When the slurry is dried, this free ammonia escapes and the nitrogen content comes down to 1.8 to 2.0 per cent.

The dried slurry nitrifies readily and hence may be applied to the field directly but the process of drying is labour consuming and is not possible during rainy season.

The slurry as and when comes out may be applied to the soil but it is difficult to transport. Further, application of manure is needed once in a season and not everyday.

Therefore, it is recommended that the slurry be used for preparing the FYM or compost and the manure applied to the soil as and when required.

ECONOMICS OF LIVESTOCK MANAGEMENT

With induction of integrated agricultural and animal husbandry practices, in a scientific man, it is high time our farmers to aware about the economic importance of livestock management.

Factors that are economically important in the management of livestock may be analysed as follows-

Capital Investment on Housing of Animals(cattle Shed)

It is the primary component of non-recovering investment on livestock anart from capital investment on cost of animals. Investing more than the required on housing of cattle and storage of forage and feeds is one of the important findings with majority of the farmers(especially so with majority of farmers in upghat of U.K. district and a considerable no. of farmers in lowghat talukas of U.K. District). It is very essential to workout the reasonable investment on construction of cattle house after judging the number of optimum number of animals to be maintained.

Any how it is advised to have a well built cattleshed which should have been provided with a pakka flooring and a pakka roofing as to be safe and provide required floor space and ventilation.

(It is recommended to have cattle house which should provide 25 sq. ft standing space per adult caqttle and 800 cu.ft. air space. Ventilation should be adequately maintained such that 4000 cu ft. of air within the cattle shed should be replaced per hour).

Feeds and Feeding- It is estimated that 65-75% of total recurring expenditure on maintaining the livestock is incurred on feeding them. To bring down the cost of milk production it is very essential to watch the cost on feed and feeding practices adopted.

As we see, a larger section of farmers are using comparitively nutritionally defecient varieties of roughages and are unaware of importance of cultivation of quality green fodder. The cost on feeding can be cut down drastically if the farmer can produce and supply greater quantity of nutritions green fodder all round the year, and bring down the use of concentrates to the optimum required. It is proved that the cost of one kilogram of compound livestock feed (balanced feed) is enough to produce and supply 10-15 kg of good green fodder which can provide nutrients that are in 2 Kg. of compound livestock feed.

India being a tropical country only during monsoon pasture grazing of livestock is possible that too which can provide nutritionally poor grass are harmful with which even a non carrying and non producing cattle can't be maintained on it alone of nurse the pasture grazing land available at present per head of cattle is also negligible and nil in many parts.

Because of nonavailability of all the ingredients at cheaper price and keeping their quality all round the year, it is difficult for a farmer to compute and prepare a balanced concentrate mixture at a lower price than that of compound livestock feed assumed to be balanced available in the market. As such apart from high price, the digestibility and the availability of required nutrients in such commercially available

ready concentrate mixtures has gone unquestionable.

Adopting standard feeding practices livestock especially that of young female calves is of much economic importance for anticipating better production in future and in maintainance of their good health at large. Cost of feeding bullock pair during the non-working period and those of young male calves should be watched with care. Checking the overfeeding or underfeeding of animals at any stage of growth or during any period of the year is of much importance in the attempt of balancing the feed.

Breeding and Health Care- It is very important to maintain the standard breeding practices for milch animals so as to ensure narrow calving intervals with adequate dry period (not more than 14 moonths in case of graded crossbreed cows which includes the recommended 60-70 days dry period), small age at first calving (24 to 26 months in case of cow-heifers and 35-40 months in case of buffaloe heifers), and regulated calving among milch animals so as to maintain a sustained milk production throughout the year. It is rather unwise to maintain a non-castrated adult scrub bull or a graded bull or a he-buffaloe than to make use of aritificial insemination facility.

Regular deworming of animals especially calves as per schedule and control on external parasistism is as important as periodical vaccination of the herd against the prevalent academics and epidemics.

Timely use of veterinary aid and guidance can save a large Hygenic measures for supply of food and water, in maintaining cattle shed too contribute greatly in keeping good health of not

only the herd but also the owner family and hence must be practiced.

Labour - Continuous labour cost has to be incurred on production and collection of fodder and on animals. For a farmer family that affords to maintain not more than 3-5 adult cattle (with or without a pair of bullocks) a single labour is enough to look after upon animals who could be an adult member of the farmer family and an additional labour for production and collection of fodder at an average.

Culling and Replacement- This is one of the important factors in livestock management which almost all farmers ignore to practice.

Culling of unproductive and uneconomical animals is a much necessary practice. Old animals, sterile and infertile females and animals permanantly disabled either for production or for work, animals suffering with incurrable diseased conditions have to be disposed off suitably.

Necessity of replacement or additional induction of animals should be decided according to the availability of sustained fodder, requirement of additional milk or such other factors.

Marketing of animal products- Milk the foremost livestock product should find an all season market and should fetch a reasonable price. At present KMF in Karnataka is commendable in this regard.

It is time, a farmer should receive some revenue out of his deceased animal by sale of hide and skin, blood, bone and meat products, keeping in view the safe disposal of carcass.

Dr. Ravindra Hegde
Veterinary Dispoensary
Bhairumbe

ROLE OF CATTLES IN CHANGING THE ENVIRONMENT

Living beings have spread from abyssial depths of ocean to about 5km in the atmosphere on this earth. This zone is called "Biosphere". Biosphere and its physical components consititute ecosystem.

Biosphere and physical components interact each other, affect each other and work together. This kind of interactions are from time immorial. Due to which every organism in the eco system is changing its physical environment. This phenomenon in nature is called Succession. This sucessin, as it changes due to external factors (forces) carries ecosystem to climax stage. Climax ecosystem does not change due to changes in the external environment e.g. Tropical forests.

External factor's influence is continuous. Due to this influence ecosystem which has to reach climax may deviate be cause for degradation of environment. But this will also be an ecosystem in nature. Of the factors which influence environment "human being" is very important.

Man fills many of his needs from nature and also he is influencing it many ways. He is an indirect or direct cause for many of the changes brought to the environment.

Domestic animals are part of his needs. He is domesticating them for milk, fertilizer, meat and religious practices. Such animals like cattles, buffaloes and sheep are important. Presently their number is also more. Their main fodder is grass and leaves from forests, agricultural by products also used to some extent from cultivated lands. Due to the decreased

production of fodder and (leaves and grasses) and difficulties in getting them, it is easier to graze them in the forest. This is practiced now. Due to grazing in forests the forest environment is changing. Excessive grazing affects structure and function of forest in turn environment will be affected.

There is a difference in influences by wind (herbivores) and domestic animals. Wild animals do not stay in a particular place instead they occupy large area. They migrate from one area to another. Carnivores keep them in equilibrium. But for domestic animals their number and utilisation of forest area is decided by man. It will be concentrated at a point. This leads to excessive utilization of forest which affects the environment. Following are some of the important effects:-

1. Soil erosion
2. Changes in vegetation
3. Effect on wild life

Soil erosion is caused by movement of domestic animals on degraded forest areas litter gives protection to such degraded soil. They not only protect from sun and rain but also increases fertility.

Movement of these animals which are about 200-250Kg spoils this litter. Wet soil when stamped hardens the soil without litter protection, dries up during hot sun carried away by rain. Thus the area looses fertile soil, moisture and nutrients and becomes barren. Gradually there will be change in the physical environment and possibilities of changing in ecosystem also there.

Cattles and buffaloes eat only plants which fit for them. These plants gradually decreases, non edible plants will increase. This causes establishment of different groups of plants due to change in the physical environment. These animals affects growth of plants by grazing the tender shoot. Seedlings are spoiled by movement of these animals. Bird and insects population which depend on vegetation for their food and dwelling decreases. Herbivores migrate to another area due to shortage of food. Hence wild life in that area are affected.

Management of these animals which exerts pressure on environment is essential. As far as possible dependence on forest should be lessened. Animals should be nourished by separately grown fodder. The breeds should be improved. Returns can be expected only with improved breeds by supplying good food. Managing less number animals of improved breeds, financial status of farmers can be improved and destruction of environment can be avoided.

P.R. Bhat
Centre for Ecological Science,
Indian Institute of Science,
Bangalore

LIST OF FARMERS PRESENT

1. Shri. Shankar Ganapayya Hegde, Harpanahalli
2. " Ganapathi V Hegde, Kangod
3. " Narasimha N. Bhat, Yadahalli
4. " Ganapathi R. Hegde, Masheegadde
5. " Ganapathi S. Bhat, Ajjibal
6. " S.V. Hegde, Shivalli
7. " Seetharamayya Hegde, Balegadde
8. " S.K. Hegde, Bhagwat, Sirsimakki
9. " G.G. Hegde, Hulemalgi
10. " Ranjunath D Hegde, Bellikeri
11. " Thirumaleshwar A. Hegde, Bellikeri
12. " Dhananjaya V. Hegde, Billikere
13. " S.G. Hegde, Balegadde
14. " Thukarama Naik, Belale
15. " Seetharam K. Hegde, Hulemalgi
16. " M.P. Hegde, Navanageri
17. " J.R. Hegde, Bisalakoppa
18. " G.V. Hegde, Hangarakhand
19. " R.M. Hegde, Arasikere
20. " M.S. Sheshgiri, Kangad
21. " G.R. Bhat, Tattikai
22. " V.P. Hegde, Hanumanthi
23. " R.M. Kimi, Lecturer, JOC, Sirsi
24. " Kishore R. Hegde, Bellikeri
25. " R.S. Bhat, Siddapur
26. " A.M. Hegde, Mulkinakoppa

27. " R.S. Hegde, Hirekai, Siddapur

28. " S.G. Hegde, Jaganath

29. " N.S. Gayatri, Retd.A.A.O., Sirsi

30. " Yadumandan s. Hegde, Onikere

31. " G.D. Hegde, Onikere

32. " Mahesh S. Hegde, Honnajji

33. " G.M. Hegde, Hulgol

34. " R.V. bhagwat, Sirsimakki

MEMBERS PRESENT

1. Adkoli, V.V.
Joint Director
Dept. of Animal Husbandry and Veterinary Sciences,
Vishveshwaraiah Kendra, III Floor,
Bangalore 560 001

2. Basavaiah, P.
Professor,
Dept. of Animal Genetics, U.A.S.,
Dharwad 580 005

3. Bhat, Prabhakar R.,
Centre for Ecological Sciences,
Field Station, Sahyadri Colony,
Sirsi 581 402

4. Bhagwat, K.R.
Officer on special duty
BIRD, BAIF Office,
Dharwad 580 008

5. Dixit, L.A.
Professor,
Dept. of Agronomy,
U.A.S., Dharwad 580 005

6. Prof. Madhav Gadgil,
Professor,
Centre for Ecological Sciences,
Indian Institute of Science,
Bangalore 560 012

7. Hegde, K.M.
Secretary, Sahyadri Parisara Vardhini,
Yadahalli, Sirsi

8. Hegde, G.R.
Research Programme Coordinator,
BAIF, Tiptur

9. Hegde, G.V.
Research Scientist,
BAIF Officer
Sirsi 581 401

10. Hegde, R.K.
Director of Instructions
UAS, Dharwad 580 005

11. Hegde, R.S.
Veterinary Assistant Surgeon
Veterinary Dispensary,
Bhairumbe

12. Jagadish, K.S.
Associate Professor,
Indian Institute of Science,
Bangalore 560 012

13. Mallikarjunappa, S.
Associate Professor,
Animal Nutrition Dept.
UAS, Dharwad 580 005

14. Pandey, Praveen Chandra,
Deputy Conservator of Forests,
Sirsi Division, Sirsi 5811 401

15. Parthasarathy, C.S.
Superintendent,
Dod-Dane Project, UAS,
Dharwad 580 005

16. Prakash, H.K.
Manager, (Procurement and Input),
KMF, Dharwad 560 002

17. Prasanna Kumar, S.
Research Assistant,
Buffalo Breeding Project,
RRS, UAS, Dharwad 580 005

18. Rajabapaiah, P.,
Technical Officer,
ASTRA, IISc, Bangalore 560 012

19. Ramesh Babu,
Research Assistant,
Fodder Research Unit,
UAS, Dharwad 560 005

20. Reddy, Yellappa, A.N.,
Conservator of Forests,
Canara Circle,
Dharwad

21. Shetty, V.G.,
Assistant Director,
Dept. of Animal Husbandry and Vet.Science,
Sirsi 581 401