- ☆ should help set up a system of registration of innovations/practices so that IPRs of local communities or innovators are not exhausted
- ☆ should set up rules of good conduct and practice by researchers
- ☆ should recognize, support and reward ethical practices in research
- ☆ should set up bioethics committees to protect the rights of researchers, communities and individuals contributing to the conservation of biodiversity.

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In Defense of Grassroots Innovators ...

SRISTI Initiatives for Conservation through Augmenting Creativity at Grassroots

SRISTI

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SRISTI Initiatives for Augmenting Creativity at Grassroots

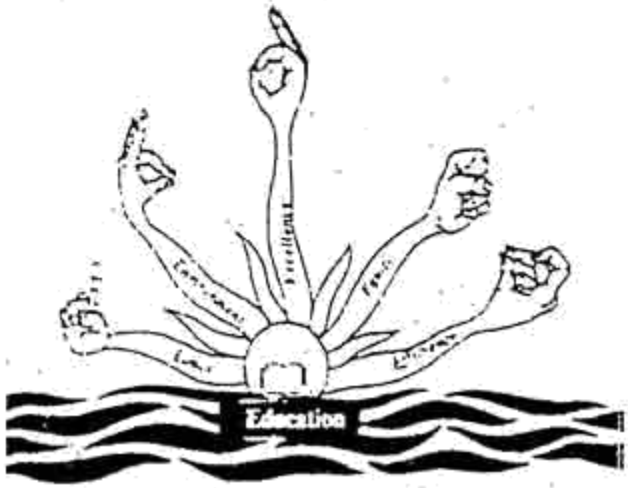
The Society for Research and initiatives for Sustainable Technologies and Institutions (SRISTI) is a developmental voluntary organisation set up in 1993 to strengthen the Honey Bee Network of grassroots innovators engaged in conserving biodiversity and developing sustainable solutions to local problems. The specific objectives include the following:

- ☆ to support people-to-people learning through networking among innovators
- ☆ to document, analyze and disseminate the innovations developed by people themselves to create greater space in polity for building upon civil society initiatives and innovations from below;
- ☆ to pursue protection of the intellectual property rights of grassroots innovations through Honey Bee (INSTAR) registration system, and policy and institutional changes at national and global levels
- ☆ to undertake action research to generate incentive models for recognizing, respecting and rewarding grassroots creativity
- ☆ to validate and add value to local innovations through experiments (on-farm and on-station) and laboratory research
- ☆ to embed the insights learned from grassroots innovations in formal educational systems in order to expand the conceptual and cognitive space available to these innovations

SRISTI believes that value addition in local knowledge can arrest and eventually reverse degradation of natural resources and erosion of knowledge around these. By generating thus, the income earning opportunities for people, a transition towards sustainable livelihoods may be facilitated (see figure overleaf). SRISTI actively supports Honey Bee network (connected through Honey Bee newsletter and its regional language versions), which seeks to identify, recognise, respect and reward innovative individuals or groups who, without outside help, have evolved

sustainable answers for natural resource management.

SRISTI and Honey Bee network have spawned several initiatives for conservation biodiversity and associated indigenous knowledge over the past eight years. SIRSTI's research and action programmes have triggered recently an institutional innovation, viz., GIAN (Gujarat Grassroots Innovations Augmentation Network) by linking innovations, investments and enterprise. However, non-market options also receive special attention, especially for strengthening people's experimental ethic. The spirit of sustainability is sought to be

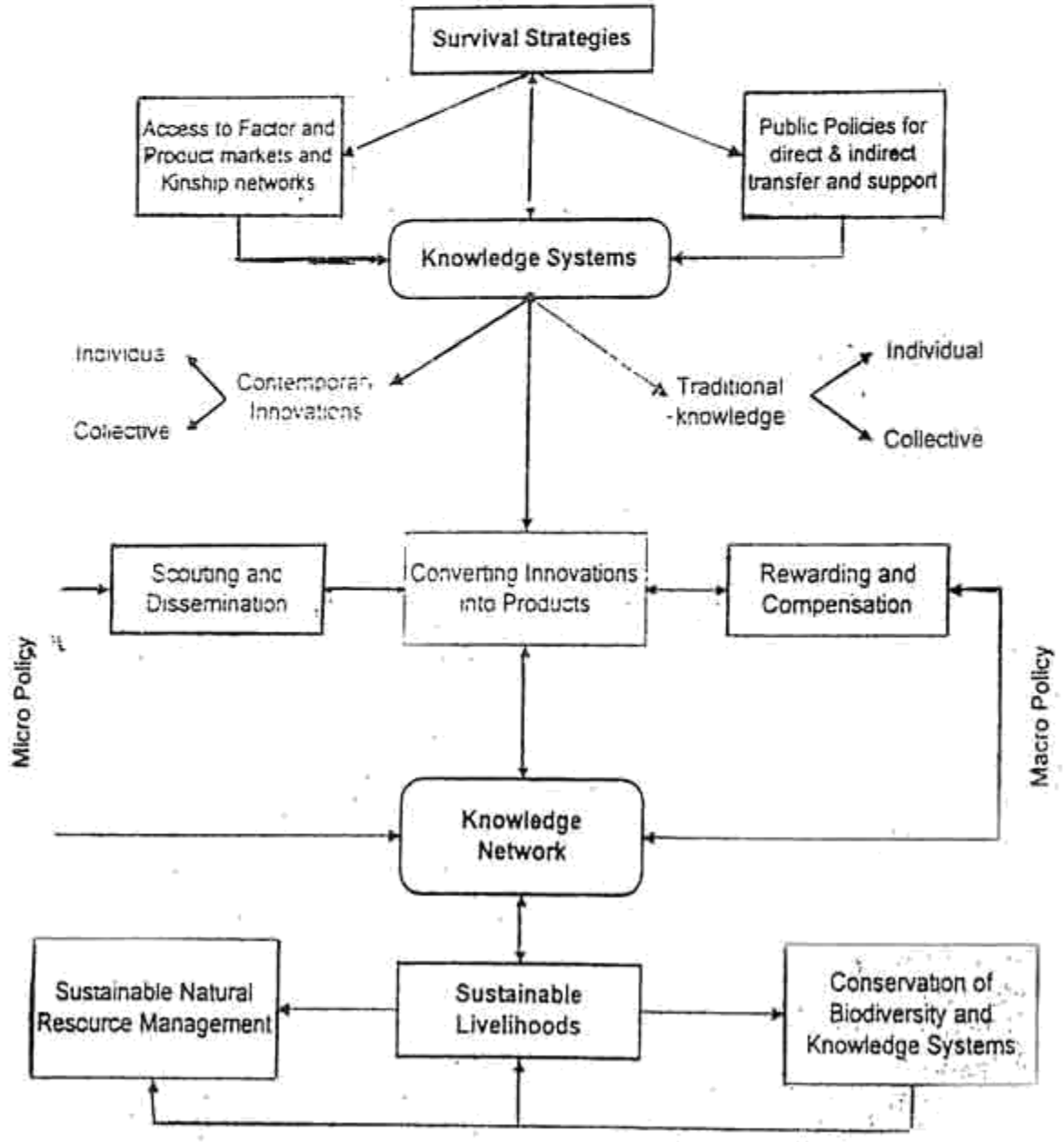


achieved by blending the secular and the sacred streams of consciousness around basically six E's (Ethics Excellence, Equity, Efficiency, Environment and Education).

Towards Knowledge Network

Honey Bee network has inspired SRISTI to set up for a Knowledge Network, which is described as a multi-channel, multi-node and multi-level network of individuals, institutions and social movements engaged in generating alternatives for sustainable development through local creativity and innovations in using natural and other resources. SRISTI launched Knowledge Network during the recent International Conference on Creativity and Innovation at Grassroots (ICCIG)

held at Indian Institute of Management Ahmedabad during last January 11-14, 1997. ICCIG brought about 500 participants from 4 countries including innovative farmers, policy makers, activists and others to discuss educational, institutional and technological innovations, socio-cultural aspects of knowledge systems, models o



Framework for understanding SRISTI's strategy

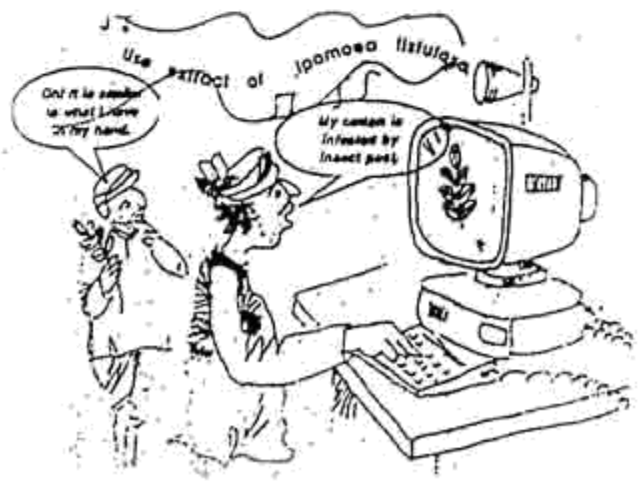
rewarding creativity and market-based incentives for commercialisation of green products and services.

Documentation, Dissemination and Networking

We are trying to stem the knowledge erosion. a threat sometimes as serious, if not more, as resource erosion through documentation.

Collaborative efforts of Honey Bee network members during last eight years in carrying out the documentation of people's knowledge systems have been pursued by following the principles; (i) whatever is learnt from people must be shared with them in their language, and (ii) all practices or innovations must be identified by the names and addresses of the individuals or communities who generated them so that the innovations are recognized as the intellectual property of the innovators.

Honey Bee signifies a discourse which is authentic, accountable and fair and advocates people to people learning: We write in English language which connects us globally but alienates locally. We cannot reach the people from whom we have learnt. Thus while we grow in our careers and achieve wider recognition and professional rewards. the people suffer. often. silently. The ethics of knowledge extraction. its documentation. dissemination and abstraction into theories. institutions of technologies is thus or central concern.



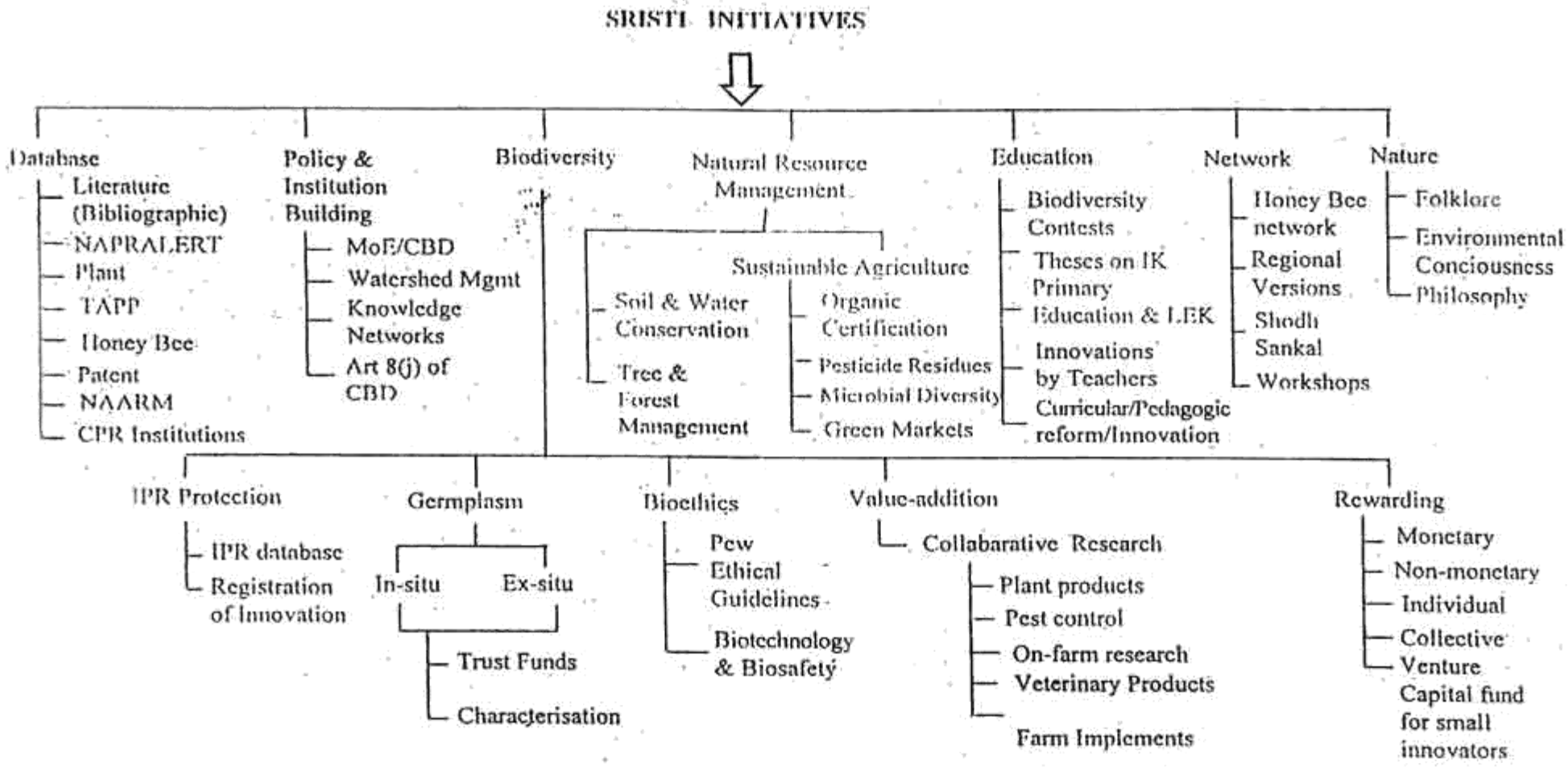
Honey Bee encourages collaborators to initiate local language versions. With the help of regional collaborators we have six language versions in order to facilitate cross-cultural exchange of knowledge and mutual learning among communities. They are; Gujarati (Loksarvani). Tamil (Nam Vazhi Velanmati). Telugu (Tenetiga). Kannada (Hittaiagida). Hindi (Sujh Bufn). Punjabi (Khoj Bhal) and Dzonkha language of Bhutan.

Other than these, SRISTI participates in agricultural fairs to reach farmers. conducts workshop of innovators, produces video films. multi-media packages as part of dissemination exercises.

Honey Bee network is now spread over 70 countries and continues to grow along with its regional versions. Regional versions have their own independent networks. More recently an International Conference on Creativity and Innovations at Grassroots (ICCIG) for sustainable Natural Resource Management was organised during January 11-14. 1997 by Centre for Management in Agriculture. IIM. Ahmedabad. with SRISTI as one of the co-sponsors.

Honey Bee Database on local innovations

It contains the innovations documented through Honey Bee network and its regional collaborators. As of November 1996. 5376 innovative practices from about 3500 farmers and artisans of about 2300 villages) have been documented.


SRISTI INITIATIVES
Database
Literature (Bibliographic)
NAPRALERT
Plant
TAPP
Honey Bee
Patent
NAARM
CPR Institutions
Policy & Institution Building
MoE/CBD
Watershed Mgmt
Knowledge Networks
Art 8(j) of CBD
Biodiversity
Natural Resource Management
Soil & Water Conservation
Tree & Forest Management
Sustainable Agriculture
Organic Certification
Pesticide Residues
Microbial Diversity
Green Markets
Education
Biodiversity Contests
Theses on IK
Primary Education & LEK
Innovations by Teachers
Curricular/Pedagogic reform/Innovation
Network
Honey Bee network
Regional Versions
Shodh Sankal
Workshops
Nature
Folklore
Environmental Conciousness
Philosophy
IPR Protection
IPR database
Registration of Innovation
Germplasm
In-situ
Ex-situ
Trust Funds
Characterisation
Bioethics
Pew Ethical Guidelines
Biotechnology & Biosafety
Value-addition
Collabarative Research
Plant products
Pest control
On-farm research
Veterinary Products
Farm Implements
Rewarding
Monetary
Non-monetary
Individual
Collective
Venture Capital fund for small innovators

NAARM database: This database has been developed from the information collected by the young scientists on local knowledge and innovations during the course of their training at NAARM, Hyderabad. This database has more than 700 records. This has been developed in collaboration with Dr Gopalam at NAARM (National Academy of Agricultural Research Management).

Literature Databases

SRISTI has an extensive collection (about 20000 titles) of reprints, documents, books, reports, on subjects related to sustainable development and natural resource management, especially local and indigenous technologies and institutions. In addition, SRISTI receives more than 300 newsletters and journals on related subjects in exchange with Honey Bee or otherwise.

Indigenous Instituitions for Management of Common Property Resources and Conservation of Biodiversity. A database of indigenous institutions from 20 countries based on literature review of case studies has been developed.

Databases acquired from other sources

NAPRALERT (Natural Products Alert) database provides state-of-the- art information on the research, primarily pharmaceutical products derived from plants. The uniqueness of any grassroots innovation may be established by comparing the uses reported with the information available from NAPRALERT. SRISTI has access to this database through email.

Other databases used on a regular basis include, Wealth of India, which has 822 records on plants with potential for use as insecticide or pesticide; the TAPP database developed by Dr. H Thurston at Cornell University on alternative ways of controlling plant diseases; Patent databases from the US Patent and Trade Mark office on genetically engineered micro-organisms etc.

Value addition in biodiversity and associated knowledge system

(i) ***On-farm and On-Station experiments*** in the fields of plant protection, growth promoters and farm implements. Preliminary experiments reveal that many herbal and non herbal materials and farm implements show high effectiveness under wide range of agro-ecological conditions in Gujarat;

(ii) Indigenous herbal insecticides

We have screened thirteen plants on two different insects (*Spodoptura litura* and *Pluttella xyloxtella*) for various activities, like antifeedant, insecticidal activity, ovicidal action and growth retardant activity. Same plants were screened for mutagenecity test, bacteriostatic and bactericidal activities;

(iii) *Indigenous Veterinary medicine*

We have been working on four plants for various pharmacological activities like antipyretic, antiulcerogenic and anidiabetic activities. The same plants were being screened for phytochemicals and active principles. SRISTI has recently entered into a Memorandum of understanding (MoU) with a public limited company to cooperate in further research and clinical trails to finalize suitable formulations for the commercial manufacture.

(iv) *Agriculture Implements*

Farm implements and agricultural equipment developed by local artisans deserve special attention because the formal institutions such as

agricultural engineering departments/colleges have failed to provide many alternatives for animal-drawn or manual implements. SRISTI's support to Shri Amrutbhai Agrawat resulted in an innovative tilting bullock cart. Some more innovations will be supported under the initiatives of GIAN (*Refer the section on Venture Capital Fund*. Feasibility studies on a three-wheeler tractor developed by Bhanjibhai, a farmer from Junagadh and a small scale electricity generation equipment by another innovator from Ahmedabad are being carried out currently.

Orgnanic certification : Towards sustainable organic crop production

The transition towards organic agriculture in high growth regions has not yet begun on a significant scale. This is primarily due to lack of (a) awareness, (b) non-chemical but efficient alternatives for soil nutrition, disease, pest and weed control, and (c) stabel demand and market channels for organic products in the country and outside.

Some of the drought prone regions, hill areas, and tribal regions are organic already due to heterogeneous ecological conditions, poor demand for chemical inputs and weak market forces. These regions represent a tremendous opportunity for generating supply of organic produce through appropriate market interventions. Such interventions would convert the laggards of green revolution into leaders of sustainable, organic farming. This would also help in improving the socio-economic status of some of the most disadvantaged communities conserving biodiversity despite remaining poor themselves.

SRISTI has taken following research initiatives as a groundwork towards creating capability for organic certification;

Green-Market Surveys

Country-wide surveys were conducted during the summers of 1995 and 1996 to estimate consumer demand for organic products. The survey is being done in 1997 also. The combined report would perhaps provide the first country-wide profile of green consumers. From the preliminary results, it appears that most consumers have a latent

demand for natural products and are willing to pay a maximum premium of about 15 per cent for the purpose.

Pesticide residue analysis

Intensive use of chemical pesticides over an extended period of time leads to non-sustainable development in three ways: (i) it triggers the pesticide treadmill leading to long-term decline in farm productivity, (ii) it creates new health hazards for human and non human beings, and (iii) it interferes with the normal ecological chain. SRISTI has initiated a study to map the pesticide residues in soils of different agro-climatic regions of Gujarat. An informal network of scientists and activists was formed last year drawing colleagues from Consumer Education Research Centre, GSFC, GAU, MS University, IISc, NIOH, JRF, IIMA and SRISTI. The purpose of this study is to not only to have a benchmark of the eco-system health, particularly through soil based indicators but also to develop a framework for certifying non-pesticidal organic cultivation.

Soil microbial deiversity

The cumulative effect of the activities of a host of resident micro-organisms, invertebrates and plants contributes to the dynamic role of the soil as

a living environment. The role of micro-organisms (comprising mainly bacteria, fungi, algae, and protozoa) in the ultimate determination of soil health has been well established.

It is possible that pesticide and other chemical residues may affect the soil microbial porperty in an unique manner. If the correlation between the microbial diversity signatures and pesticide residues is high, one could use microbial diversity signatures as the basis for organic certification.

A total of 720 soil samples were collected for both pesticidal residue analysis and microbial diversity mapping. Analysis of 100 samples has been completed. Some interesting observations have been made and some organisms were isolated. One of the outcomes would be a map of soil ecosystem heatlh status of Gujarat.

Natural Resource Management

Natural resource management receives special attention in SRISTI's research programme. Detailed case studies and in-depth research is aimed at studying innovations in soil and water conservation, forest and tree based innovations and common property resource management.

Studies on indigenous soil andwater conservation practices

Case studies on virda systems in Gujarat for harvesting fresh water in saline regions. Khadin systems and other traditional water harvesting structures in Rajasthan and some other innovations from Madhya Pradesh are in progress. Recently, a study on variation of indigenous water harvesting structures and farming systems on a gradient line cutting isohytes of 400 mm to 100 mm annual rainfall was initiated in Rajasthan.

Future plans include a compilation of selected innovations for watershed management and another compilation of detailed case studies exclusively on soil and water conservation.

Studies on local initiatives for tree and forest management and germplasm conservation

SRISTI has taken up studies on documenting, and augmenting, the repertoire of local initiatives for tree and forest management with the support from FAO/FTPP. Two detailed case studies

respectiviely from Gujarat and Rajasthan have been completed and five more in India are planned. One regional level and one south-east asia level workshops have been organised under the project. An inventory of sacred groves in being initiated.

Action research on institution building and ecological economics

Action research studies on institution building are being pursued with NGOs, farmers' groups in the form of Shodh Sankal (club of experimenting farmers) and Gyan Van (knowledge forest). SRISTI extends its support to its network members and institutions various activities and conducts many workshops in related disciplines.

A directory of scholars pursuing research and/or teaching in ecological/environemtnal economics was compiled as a part of a global initiative of Gothenburg University Sweden. SRISTI extended its support to the summer schools on CPR management for university teachers conducted by Centre for Management in Agriculture, IIMA.

Education

Conserving biodiversity and the knowledge associated with it is impossible without generating curiosity, respect and commitment towards this issue among children. Similarly, incorporation of local knowledge systems in regular curriculum can generate respect for people's knowledge systems. Some initiatives taken by SRISTI in the field of education are;

Biodiversity contests

Biodiversity contests have been organised in 14 primary schools of various parts of the country to generate respect for the alternative ecological knowledge systems of children of economically-backward, but ecologically-rich, areas. The contents were also useful in documentation of biodiversity knowledge systems and ecological indicators.

Dissertations on women's animal husbandry knowledge

SRISTI has been involved in assisting undergraduate women students of a rural college study the animal husbandry practices of local women. The aim of the exercise was to enable the students to learn from the practices of people through a critical process of inquiry. Over the last four years, more than 100 dissertations have been produced.

Informal network of innovative primary school teachers

SRISTI supported workshops of innovative primary school teachers at state and district levels to learn fromt these self starters. The idea was to stem the high drop out rate of children partiularly girl students in biodiversity-rich, economically-poor regions. All efforts to generate incentives for conserving biodiversity will be wasted if the children who should be the ultimate beneficiaries of these incentives become unskilled labourers and migrate from tehse regions.

Models for Rewarding Innovations

SRISTI is committed to protection of intellectual property rights of grassroots innovators and getting them their due reward for their knowledge. Prof Anil Gupta was requested to participate in preparing an approach paper for oeprationalising the article 8(i) of CBD dealing with the rewards for collective and traditional knowledge. SRISTI actively participates in various forums to sensitise the academia and policy makers towards these issues. Some of the initiatives in this direction are;

Action research on material and non-material rewards for individual and collective innovations and traditional knowledge

Various models, such as (i) Material - individual, (ii) Material - collective, (iii) Non-material - individual, (iv) Non-material - collective, have been developed and are being tested.

Policy advocacy for a global registry of innovations

Publication of a practice can exhaust the intellectual property rights of an innovator by bringing the innovation into the public domain. At the same time, the goal of networking innovators cannot wait till value is added and characterization of innovation is done in a manner that the intellectual property can be protected. This dilemma is being resolved through dissemination of a practice in a synoptic form, while at the same time undertaking research on value addition and characterization for purposes of potential commercialization with or without IPR protection. A proposal that is being considered in order to overcome the problem of publication-linked exhaustion of IPRs is to set up a national/international registry of innovations. Publication in this registry would entitle an innovator to some kind of patent protection (akin to petty patents).

INSTAR (International Network for Sustainable Technology Applications and

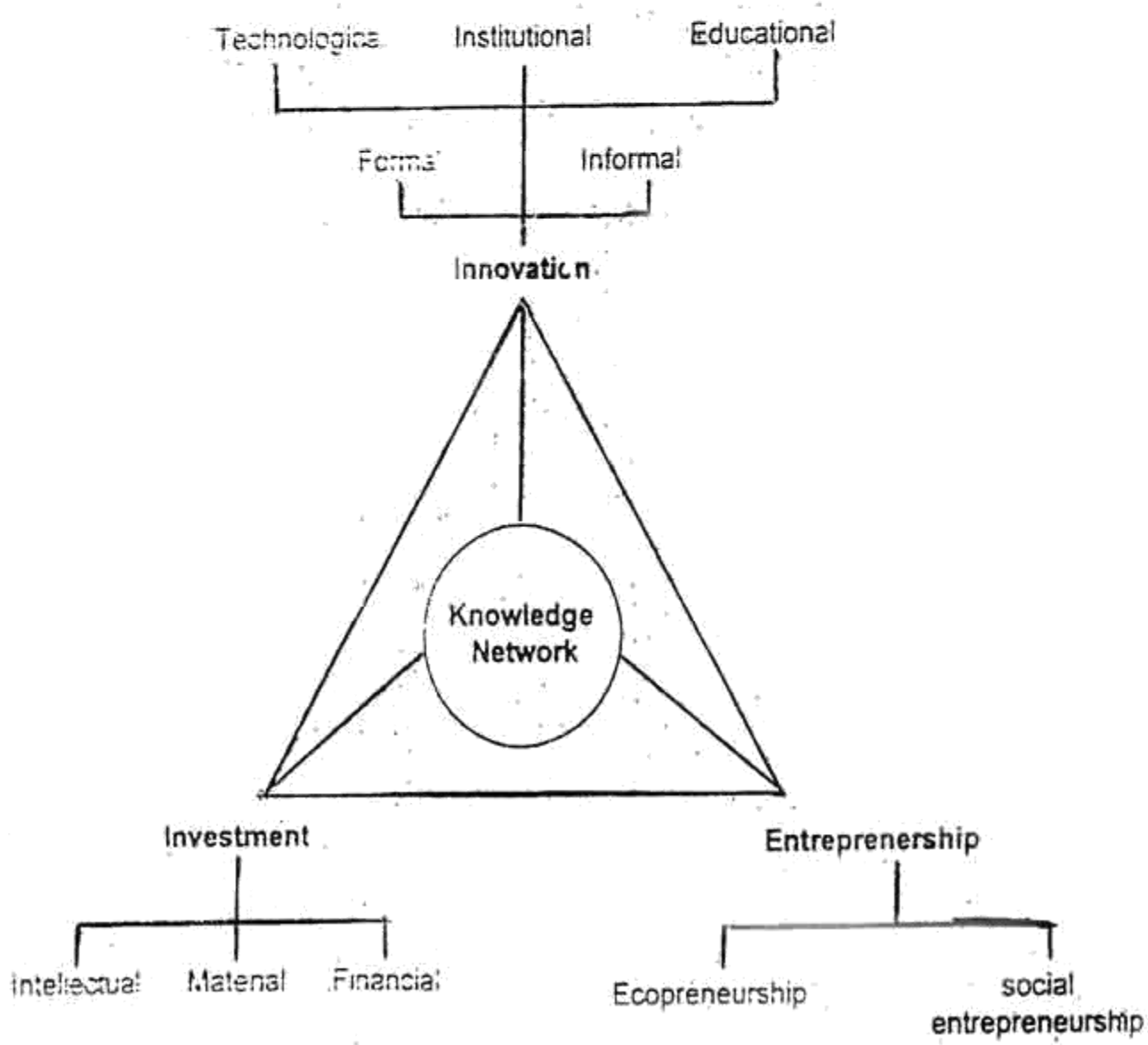
Registration) could be such a registry which will prevent any firm or individual from seeking patention patents on community knowledge as well as knowledge and innovations prodced by individuals without some kind of cross licensing.

Apart from the registration system a large number of specific incentives would need to be developed for different categories of knowledge, innovations and practices. Similarly the incentives for preservation of sustainable lifestyles of indigenous communities would also be different.

Venture Capital support through SVCF (Sristi experimental Venture Capital Fund)

It is recognised that large number of innovators may not like to become entrepreneurs or even if they want to do so may not have risk taking ability or funds for the purpose. Venture capital fund helps in transition of new ideas into products and products into commercially viable enterprises. Similarly there may be venture capital fund institutions which may like to support green innovations but may not have links with entrepreneurs of innovators. Knowledge network being evolved with the help of Honey Bee network and SRISTI will link Innovations, Investments and Enterprise - the Golden Triangle of rewarding Creativity.

SRISTI supported some ideas with Sristi venture capital funds. Amrutbhai Agrawat developed a tilting bullock cart with several advantages over conventional cart. The first cart produced was bought by University of Agricultural Sciences, Banglore. Many other farmers are willing to buy and some private agencies also approached him for manufacturing rights. A trust fund was



The Golden Triangle for Rewarding Creativity

ovided to Karimbhai, a herbalist for building a *yanvan*", (knoledge forest) which could not take f yet.

One of the major outcomes of the recent ternational Conference on Creativity and novation at Grassroots at Indian Institute of anagement during January 11-14, 1997, -sponsored by SRISTI was GLAN (Gujarat assroots Innovation Augmentation Network).

SRISTI has been asked to set up GIAN and ide its activities. Govt of Gujarat promised to obilise 10 million rupees as a corpus fund. GIAN d already been set up and currently involved in asibility studies of supporting some innovations.

hat next?

A proposal inspired by Honey Bee experience s presented at International Conference on nger and Poverty organised by IFAD with EU's pport at Brussels, November, 1995. Later, RISTI has been asked to take leadership for tting up a global Knowledge Network in the field sustainable technologies in collaboration with fferent actors and agencies.

The agenda for biodiversity conservation has en influenced far too long by those who either lieve in the role of state or only markets. The role f self-designed institutions and knowledge twork has remained rather obscure. SRISTI and oney Bee network are trying to create space for iversity in institutional forms for spawning and staining local knowledge sytems and odiversity.

Augmenting Innovations at grassroots:

Why special fund to encourage creativity and promote innovations

The Honey Bee netwrok initiated more than eight years ago has helped in documenting thousands of innovations developed by farmers, artisans, pastoralists and fisher men and women. Most of these innovations have contemporary origin or adaptations while many are part of traditional ecological knowledge systems. The latter include examples of biodiversity based knowledge for veterinary medicine, soil and water conservation etc. The contemporary innovations developed over last few decades or years include a whole range of new products some of which are commercializable, while others may need further research and development by the innovators on their own and/or with the help of external experts, scientists and other professionals.

Having documented thousands of innovations from all corners of Gujarat and other states in India (and some from other countries), we can say without hesitation that Gujarat in particular and India in general can be a global leader in sustainable technologies if only the policy space for grassroots innovations can be augmented.

The Honey bee data base has several kinds of innovations some of which are illustrated in this note and others in sample copies of Lok sarvani. Honey bee, background note on Venture capital Fund, and a brief report of research on grassroots innovations and biodiversity conservation.

It is obvious that unless we have a special innovator friendly facility in state, there is very little scope for these grassroots innovations to become globally competitive or even inspire others to try and break new ground.

The speical corpus fund for augmenting grassroots innovations could aim at:

a. Scaling up of innovations providing support for workshop, materials and technical expertise

b. Market research and marketing

c. Conversion of innovation into product through R & D by innovators or/and formal

scientific institutions in collaboration with and under leadership of local innovators

d. Support for intellectual property right protection

e. Operationalizing Knowledge Network for linking innovators to generate feedback and speed up the process of innovations

f. Establishing a Centre for Excellence on Grassroots Innovations with a continuing exhibition of innovations to inspire young minds and to provide an opportunity to link Innovators; Investors and Entrepreneurs

Aaruni Tilting Bullock Cart

Honee Bee Vol. 6(4), Page : 6

Amrutbhai Agravat
Vill.: Pikhor
Tal.: Malia (Hatina)
Dist.: Junagadh

Aruni Tilting Bullock Cart

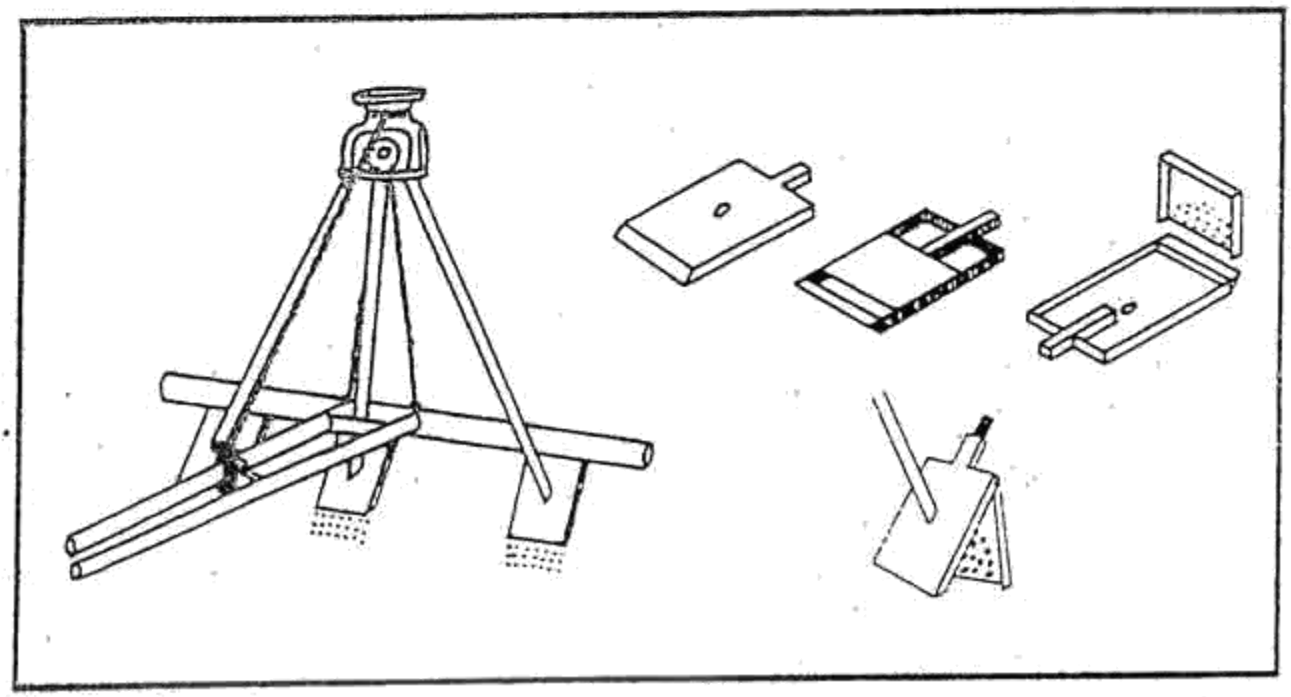
The Aruni Tilting Cart (Fig 1) is a breakthrough in the design of bullock carts developed by Amrutbhai Agrawat through the support of SRISTI and Honey Bee Network. Farmers have to spread manure with the help of baskets after carrying it to the field with the help of a cart. The process takes lot of time and effort. The tilting cart can help in distributing manure directly into the furrow. The distance between the outlets can be adjusted just as the angle of tilting can be. The approximate cost is about Rs.27500/= without taxes and transportation. The first cart was purchased by University of Agricultural Sciences and many farmers in Karnataka and Gujarat have shown interest in purchasing it.

Three Wheel Tractor

This innovative three wheel tractor (Fig 2) has been developed by Bhanjibhai Najibhai Mathukia through his own effort, persistence and repeated experiments. The tractor with an engine of 10 horse power costs about Rs.70.000/= It needs certification for its road worthiness (proved over the last seven years) so that it can be licensed for movement on road as well as for farm operations. Unfortunately, Bhanjibhai had to give an affidavit promising not to bring the tractor on the road again after it was intercepted by an RTO. The innovator feels confident in scaling up the manufacturing of the tractor if given proper support.

Bhanjibhai Nanjibhai Mathukia
Vill.: Kalavad
Tal.: Visavadar
Dist.: Junagadh

Wheat Sowing



Amrutbhai Agravat
Vill.: Pikhor
Tal.: Malia (Hatina)
Dist.: Junagadh

Wheat Sowing Box

This is another simple but very pioneering innovation by Amrutbhai. In most seed drills found all over the world, the lowest part through which the seeds fall on the ground is a pipe. This is the first kind that someone has used a box which helps in horizontal spread of the seeds. Once the seeds are scattered in a strip instead of falling one over another, each seed sets its route better and also becomes stronger. This innovation (Fig 3) has diffused locally but has a potential to diffuse nationally as well as internationally.

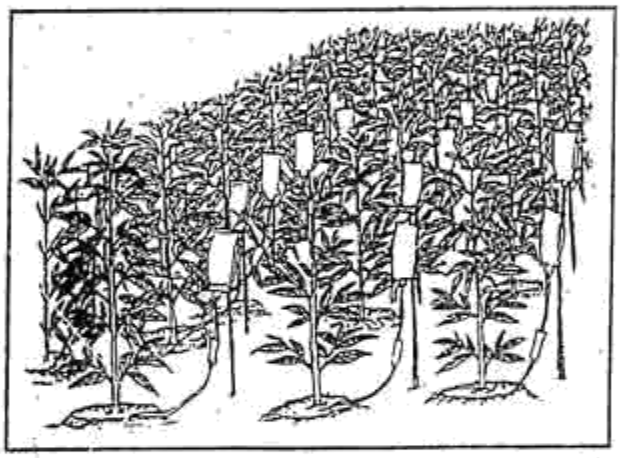
Lateral recharge of water in Virda

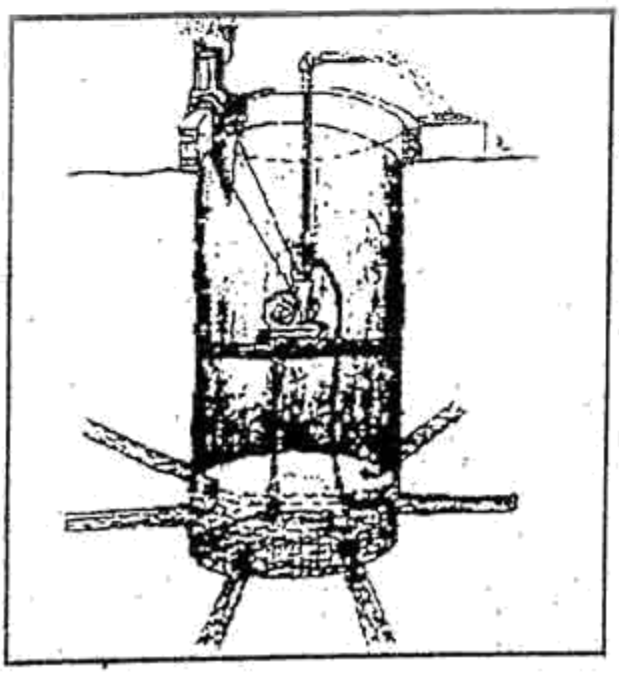
Babubhai Rajpurohit,
Poornimabhai Prajapati
Takhuva village, District Banaskanta

In many saline soil and sub soil water conditions, farmers conserve fresh water in virdas in Kutch, Banaskantha and other similar regions. A recent innovation has involved making lateral holes at the base of the virda with the pressure of water jet pumped through the pipes (Fig4). To scale up the innovation, the implications for sustainability, viability of other virdas, and cost effectiveness will have to be assessed.

Discarded Glucose infusion sets for Drip Irrigation

Use of discarded glucose bottles for drip irrigation (Fig 5) may be just an illustration of what farmers can try to reduce cost and recycle local resources. As a technology, its effectiveness has to be assessed along with the scope of futher modifications so that it can save cost and yet be effective.





Badribhai Somabhai Patel
Comm: Chaudhari Dineshkumar Nagajibhai
VLW. Vill.: Valavav, Tal: Savali, Dist.: Vadodara

Pest Control in Crops & Wound healing in animals

Satabhai Sangrambhai
Dist.: Bhavnagar

Pest control in crops and would healing n animals

Kidamari (Fig 6) is a plant which is used for cotnrolling pests through seed treatment as well as for healing wounds in animals. It is also used for healing the animals affected by foot and mouth disease. The plant is found widely in dry regions of

Surendranagar and Bhavnagar districts. A value added product can be developed which may eventually convert this 'weed' into a crop.

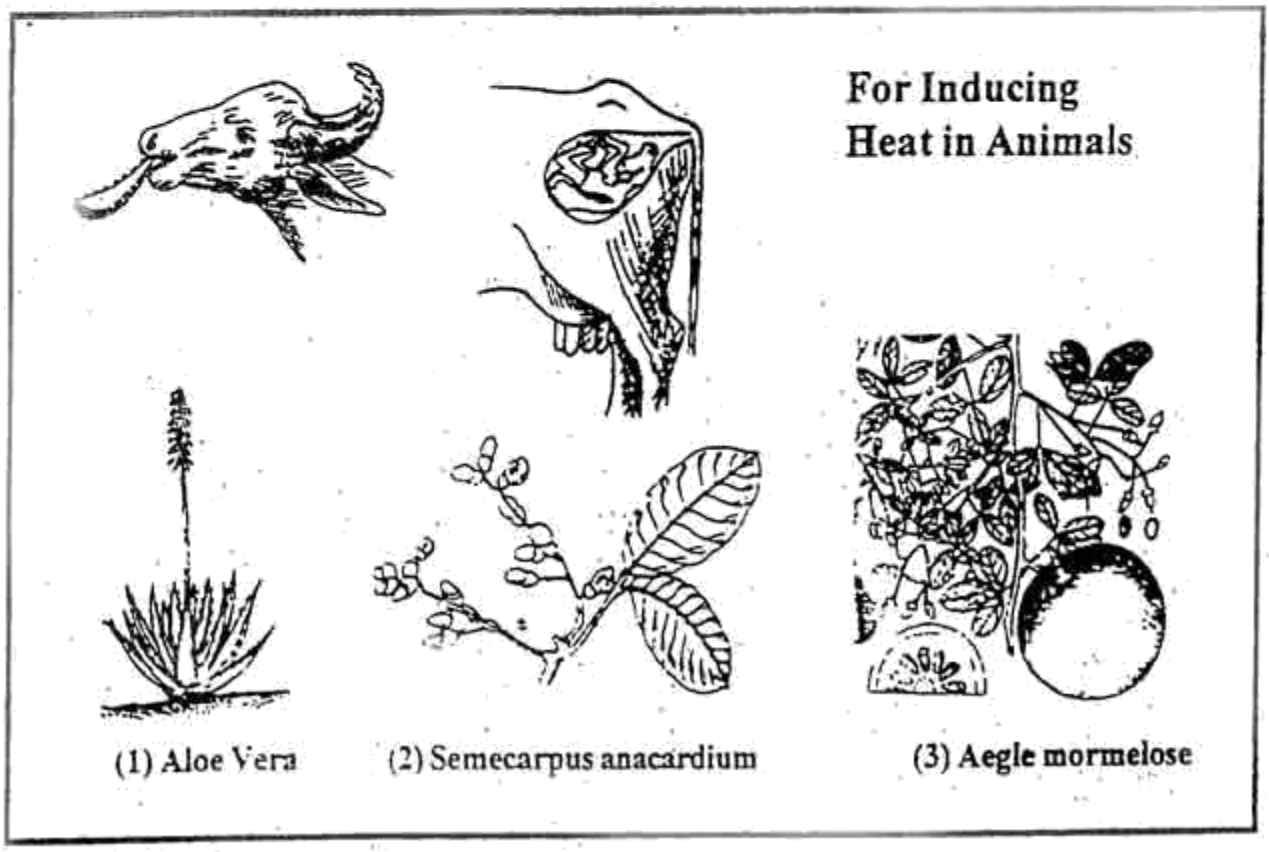
Morla : Groundnut variety bred by a farmer breeder

Thakar Singh of Junagadh District of Gujarat suffered great hardships like many other farmers in 1987 drought. He found two or three exceptionally good plants in the crop grown. He selected them, developed a more or less pure line, and has grown them since then. The new variety, whose pods are slightly curved and very compact and whose kernels are quite large, is called "Morla". Several farmers have bought this seed with good results.

Veterinary Medicines

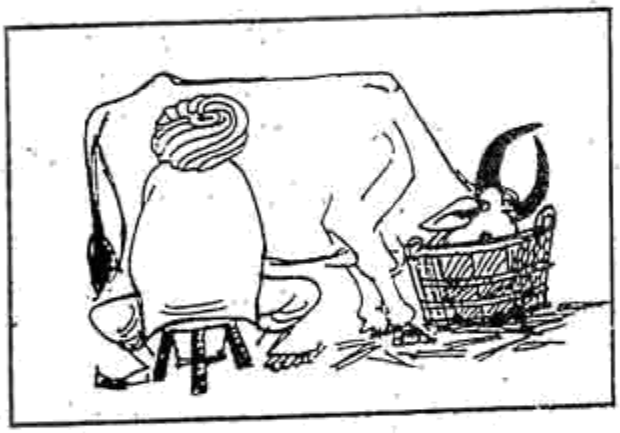
Indigenous veterinary medicine

All over Gujarat, a very rich repertoire exists of indigenous knowledge of herbal medicines particularly for treating animals. For instance, three



of the plants shown in fugure 7 have been used by different farmers in Tamil Nadu and Gujarat for the same purpose. If a drug is developed based on these plants and local knowledge, apart from generating incentives for the innovators, it may also help generate resources for conserving biodiversity as well as knowledge around it. The rosion of knowledge and of course the biodiversity ae serious threats for addressing which, market based incentive may provide some help.

Milk Increasing Practice



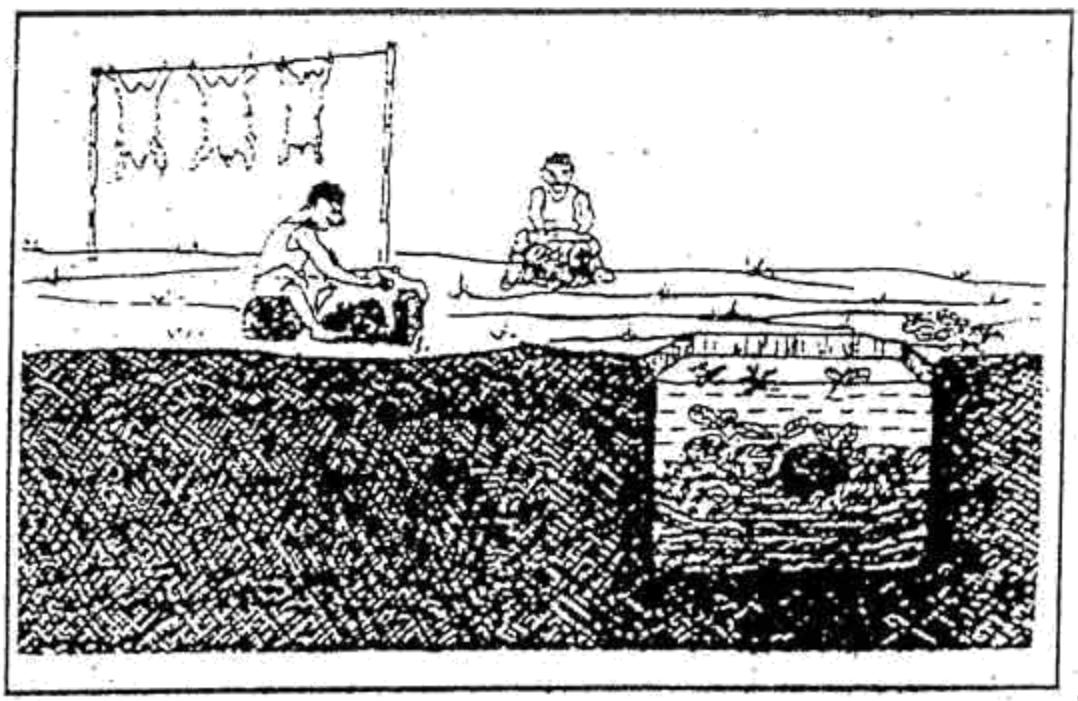
Gamit Hirabhai Gordhanbhai
Dist. Dang

Milk increasing practice

Farmers use large number of different plants for increasing milk in the cattle. *Taverniera cuneifolia* (jethimadh) has been used in addition to *Tinospora spp* collected from the forest. The incentives for conserving biodiversity in and around forest can be generated by building upon knowledge of people around such plant so that they receive higher income from non-timber products of the forests. In addition, commercializable formulations can also be developed.

Leather processing

Leather tanning through vegetative material is a living art and science in dry regions of Banaskantha district. The use of *Cassia auriculata* has been found to be very effective for the purpose. Given increasing sensitivity of enlightened consumers, the demand for vegetative dyes and leather tanning materials is bound to emerge in the years to come. This can be a very strategic sector for capturing niche markets.



Vegetable Dyes

Acacia catechu

Butea monosperma

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YIELD VARIATION IN SUMMER GREEN GRAM WITH RESPECT TO EFFECTIVE FLOWER PRODUCTION IN DIFFERENT DATES OF SOWING

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ABSTRACT

A trial was undertaken in 1992 with six green gram varieties in four dates of sowing to identify the best performing varieties and the most suitable time for sowing with respect to effective flower production in the summer season. The best varieties in terms of flower production and grain yield were AAU-39 and ML-131. Flower drop and poor pod setting were the most serious problem limiting crop yield. Total number of flower produced, percentage flower retention and total number of pods harvested were positively correlated with grain yield. The best period for sowing summer green gram was identified as the period between last week of February and first fortnight of March.

KEYWORDS : Green gram, yield variation, effective flowers

Green gram (*Vigna radiata* (L.) Wilcjek), which is mainly cultivated in the *kharif* season in Assam occupies around 9000 ha of cultivable land. Until a few years back, summer green gram and black gram cultivation was not a traditional practice among the farmers of Assam. But after intensive research and extension efforts, many of the farmers are beginning to cultivate these crops in the summer season also. As most of the upland in Assam remains vacant in the period between February and March, the cultivation of summer green gram and black gram provide the farmers