Technology Intervention for Mountain Eco-system (TIME)

A collective efforts to share field experiences amongst different stakeholders to evolve and bring in practice affordable and appropriate technological solutions for nurturing and revival of Himalayan Ecosystem and Local Livelihood under TIME-LEARN Programme of SEED Division, DST.

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Science for Equity, Empowerment & Development (SEED) Division, DST, New Delhi

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Himalayan Environmental Studies & Conservation Organisation (HESCO), Dehradun, Uttarakhand

Editorial

For the innovation and implementation of suitable R&D strategies to maintain a balance of intricate linkages between socio-cultural, ecological, economic and physical systems that could lead to sustainability of north western Himalayan mountain states of India, the SEED Division of Department of Science & Technology, Govt. of India has launched a programme named Technology Intervention for Mountain Ecosystem (TIME) Livelihood enhancement through action research and networking (LEARN). Under this programme 20 research projects are sanctioned and implemented since 2016, to three mountain states i.e. J&K, H.P. and Uttarakhand. The focus areas for technology intervention and development are Agriculture, Horticulture, Forestry, and Animal husbandry, water and soil conservation, solar energy utilization, disaster management, watershed management, biodiversity conservation and sustainable use, rural connectivity and drudgery reduction, etc.

In this effort special attention is given to intricate balance between fragility of mountains and sustainable use of natural resources, environmental problems, development and demonstration of best practices, local resource based technology packages and delivery systems for improving livelihood.

The field success stories, as an outcome of implementation of various projects are yearly published in TIME-LEARN magazine for the benefit of the larger set of community.

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Dissemination and Evaluation of Technology in Mountain Ecosystem

"Every once in a while, a new technology, an old problem, and a big idea turn into an innovation." *- Dean Kamen*

Introduction

The youngest chain of mountains, yet, is harbouring a diverse ecosystem-the beauty of the Himalayas lies in its intriguing complexity. Home to an impressive biodiversity, the mountains in themselves the most resilient, ironically, make life for its inhabitants quite vulnerable.

In the Himalayas, where livelihood options are few, mountain forests form an essential life-support system for the local people. However, a dwindling natural resource base, unsustainable agricultural practices, and lack of basic amenities create a challenge for the local people living here. In addition to this, human-wildlife conflicts, gender sensitive development, sustainable utilization of NTFPs as well as renewable energy and rural engineering are subjects of prime importance in the mountain regions.

Technology Intervention for Mountain Ecosystems (TIME)-Livelihood Enhancement through Action Research and Networking (LEARN) program, an innovative mechanism has been developed for promoting Science and Technology (S&T) based field groups/voluntary organizations to develop and implement innovative solutions for mountain specific problems in the Western Himalayas in the Indian states of Uttarakhand, Himachal Pradesh and Jammu and Kashmir.

20 projects (8 in H.P. and U.K. each, 4 in J and K) under TIME-LEARN have been sanctioned to various centers of excellence and research institutes for technological intervention in the mountain areas.

Methodology

Under the project "*Dissemination and Evaluation of Technologies through networking of various institutes and organizations of mountain ecosystem*", the Wildlife Institute of India (WII), as a monitoring agency, has been given the task of evaluating all the projects (20) under TIME-LEARN program to study their impact on the community, as well as the environment.

WII is helping in the development, evaluation and monitoring of the project, which includes:

- **Analysis and sorting of each project according to their thrust area.**
- **Identification of indicators based on the objectives and thrust area of the project.**
- **Organization of workshops and meetings of the program.**
- **Periodic field visits for community survey and data collection.**
- **Compilation of the results of the projects according to their state as well as thrust area.**
- **Evaluation of 'with and without project scenario'.**

Project Objectives

1. To promote the network between community and Research Institutes for technology delivery.
2. To organize technology delivery to community through volgas.
3. To provide appropriate technical, research and development inputs to the community
4. To identify gaps in technology for research institute.
5. To initiate periodical monitoring and workshop of network project.
6. To involve Govt. Development agencies for broader impact and policy issues.

THRUST AREAS

All the projects of TIME-LEARN program have been sorted into 7 thrust areas:

1. **Promoting Sustainable Agriculture and Bio-farming**
2. **Balancing Forest Use and Conservation**
3. **Water Resource Management**
4. **Harnessing and Conserving Renewable Energy**
5. **Disaster Management and Landslides Control**
6. **Gender Sensitive Development Approach**
7. **Rural Engineering and Technology Support Services**

Himalayan Environmental Studies and Conservation Organization (HESCO), coordination agency, will put the projects approved by the DST under the networking program. A committee of 3 to 4 people including the experts from the institutions will closely monitor the projects. Network based projects will be prioritized to promote adequate equity in knowledge dissemination of technology, and institutes with relevant knowledge will be linked with the project propose. The new ideas/gaps identified will also be a part of the project for future institutional partnership.

Involvement of various Govt. Developmental agencies for wider dissemination will also be the responsibility of the coordination agencies.

Wildlife Institute of India (WII), as a monitoring agency, has been given a task to evaluate all the projects under TIME-LEARN program to study their impact on the community as well as the environment.

Deliverables

- **To develop a strong network connection among the funding agency, research institutes and voluntary organizations;**
- **Documentation of each project's impacts on the social, economic, environmental front;**
- **Preparation of manuals and leaflets, organization of workshops for skill development of partner organizations;**
- **Compilation of annual and monitoring reports.**

Broad Achievements

All twenty projects have been sorted into **7 thrust areas.** Formats for the project progress reports have been developed and circulated. The TIME-LEARN program logo has been finalized.

Brochure for the TIME-LEARN program has been prepared and circulated. The updated brochure was recently published and launched during the AGMW, as well as uploaded on the TIME-LEARN website which was launched in the Annual Group Monitoring Workshop (AGMW). The website is being updated from time to time

Objectively Verifiable Indicators based on the approved objectives of each of the 20 projects have been identified and tabulated. 'With and without project' case scenario has been discussed with the PIs of the projects.

The technologies that have already been developed, or are in the process of being developed, are regularly distributed/ implemented among the communities through Voluntary Organizations (VOs) working at the grassroot level in rural areas for their impact assessment and larger benefit to the communities. Networking among local NGOs and SHGs for technology delivery is in progress.

Various Institutions like FRI, IIT Roorkee, GBPUAT, GBPNIHESD, Wadia Institute of Himalayan Geology, UPES, IHBT Palampur, Universities of Uttarakhand, HP and JandK have been involved with the program in various ways.

Various government agencies such as NMCG are being consulted for a broader impact. A combined report of all the projects has been developed, and the first phase of field tours for progress review and community survey has been undertaken.

Field visits to Himachal Pradesh

To discuss the 'with and without project scenario' with the PIs, and also to conduct community surveys, a reviewing tour was conducted in the month of November 2017 and April 2018.

Group monitoring workshop conducted / Field visits by expert team : Planning and Execution Workshop held on 22nd – 23rd May, 2017 at WII, Dehradun

Annual Group Monitoring Workshop 2017
The Annual Group Monitoring Workshop of TIME-LEARN Programme of SEED division, DST, New Delhi was held on 7th-8th December, 2017 at SKUAST-J, Jammu.

The IARI Regional Station, Shimla was visited on 8th November 2017. Dr. Santosh Watpade had discussed the project entitled "Establishment of virus free elite mother block of apple in the tribal areas of Kinnaur and Lahaul Spiti in Himachal Pradesh". Visit to the nursery was conducted where the samples collected from field sites are being studied. The progress made by the project team was found satisfactory and suggestions from the experts were given to the team. During discussion Dr. K.K Pramanik and Dr. A.K. Shukla both Co-PIs of the project were present.

On 10th November 2017 two field visits were carried out in the Mandi district where "Up gradation of conventional river rope way existing in rural/hilly terrain over main rivers" and "Introducing Bee Keeping Mud Hive

A) Farm visit in the project of bio-formulation at solan University : B) Interaction with apple grower in Kinnaour district, Himachal Pradesh : C) Traditional 'Jhula' in Kullu district, Himachal Pradesh : D) Solar dryer technology demonstrated by Solan University

Technology in Wet-Temperate Zone of H.P" projects are based. Dr. Anjana Sharma who is a team member as well as Co-PI in these projects summarized the progress of the projects to us. A prototype of the upgraded river rope way was shown to us and details about the improvisation were detected. Some improvisation in the design is going on with the help of IIT, Mandi.

On the 13th November 2017 a visit was conducted to CSIR Institute, Palampur where "Fortification of Mountain crops for value addition" project is going on. The meeting was hosted by Dr. Mahesh Gupta who is the PI of this project. Two products have already been developed and their nutritious value is being calculated. The PI also said that two more

products will be developed soon and the implementing agency is also trying to link this project with programs such as 'Start up India' and 'Swachha Bharat' mission.

Field visits to Uttarakhand

To review the progress of the projects and also to conduct community survey, a tour was conducted in Pantnagar, Nainital, Pithoragarh and Joshimath area of the Uttarakhand along with DST members and expert members in the month of May and June 2018.

The first visit was conducted at CHEA, Nainital. Dr. Pankaj Tiwari, who is PI of the project titled 'Livelihood Improvement and Drudgery Reduction through Appropriate Livestock Technologies and Biomass Enhancement in Kumoun Himalayas' gave a brief presentation about the activities of the project. The project is a latest addition to the program therefore the activities were at the initial stages. After the presentation, the expert team gave their comments to the PI for better implementation of the work.

Next visit was conducted at G.B. Pant University of Agriculture and Technology, Pantnagar where two projects are *viz.* 'Promotion of Polyhouse Vegetable Production Technology for livelihood security in Champawat and Pithoragarh border districts of Uttarakhand' and 'Empowering farming communities for conservation of plant genetic wealth of Uttarakhand through community participation, protection of landraces and farmers varieties and benefit sharing' are ongoing. The respective PIs of the projects Dr. D. K. Singh and Dr. A. S. Jeena gave brief presentations on the progress made under the projects. The expert team then visited the farm sites where field trials of both the projects were being conducted. Charuhas Dali, SRF at WII then continued the tour by visiting field sites in Pithoragarh and Joshimath.

Road Ahead

One Annual Evaluation workshop to be conducted
Second phase of field visits to be carried out
Data Analysis
Awareness and Demonstration Workshop- Institution + Volgas
Gap filling
Involvement of Government Developmental agencies
Documentation of networking

"Empowerment of individuals and communities is absolutely central. Getting the community involved in organising their own destiny has got to be a key part of it." – *Michael Marmot*

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Eco-Friendly Management of Woolly Aphid in Apple through Use of Woolly Aphid Trap

Apple (*Malus domestica*) is important temperate fruit worldwide. It has revolutionized lives of farmers of hilly states of India. Himachal Pradesh is 2nd largest producer of apples after Jammu and Kashmir in India. India is 5th largest producer of apple worldwide but productivity is very less (*i.e.* 7-8 tone/ha). Although there are several reasons for lower productivity of apple, biotic factors have a major impact on apple productivity. Among biotic factors, woolly apple aphid is becoming alarming in Himachal Pradesh that weakens the apple plant by feeding both at root and shoot. Kinnaur district is known for its quality apple production with lower insecticide use. But in recent years woolly aphid incidence is very serious in Kinnaur due to favourable climatic conditions. In present study we tried to develop technique for the eco-friendly management of woolly aphid in Kinnaur district.

The woolly aphid *Eriosoma lanigerum* (Hsm.) is native of North Eastern America. But with the spread of planting material it is currently a pest of apple worldwide. Elm is overwintering host for the aphids but in areas where elm is not available the woolly aphid subsists year round on apple. The aphids can overwinter on the aerial portions of the tree but in severe winter climates like Kinnaur winter mortality can be high. Hence in those area where winter is severe aphid primarily survives in the roots of the apple plant. Later in spring season first instar nymphs (crawlers) can re-infest aerial portion of plant. The woolly aphid feeds primarily on the woody parts of the tree, either the shoots, in pruning wounds and cracks or on the roots. The woolly apple aphids feeding result in formation of gall at feeding sites. Shoot galls are formed at the leaf axils and may kill or weaken the bud for the subsequent years. The aphid feeding and the galls formed out of it may aggravate the canker diseases. Galls formed on the roots can interfere with root function like uptake of nutrients and water. Also presence of aphids, wool and honeydew can reduce market value of fruits.

Management of woolly aphid is as difficult as any other sucking pest. Management practices are mainly focused on the aerial parts through spraying of insecticide s. But due to presence of wool on the aphid body, contact of chemical is difficult. Keeping in view economic importance of woolly aphid, its life cycle in India and difficulty in its management we devise low cost eco-friendly management practice for woolly aphid.

During research work carried out in the DST TIME LEARN funded project "Establishment of virus free elite mother block of apple in the

Fig. 1: Woolly aphid trap by tying jute bag treated with insecticide + linseed oil

tribal areas of Kinnaur and Lahaul Spiti in Himachal Pradesh" we visited apple orchards frequently. Severe incidence of woolly aphid provokes us to thought its management option. Due to lack of overwintering host i.e. elm, in India woolly aphid complete their life cycle in apple only. In winters a woolly aphid crawls down through stem and resides at roots. In spring season crawler migrate to above ground parts. It was thought to break this life cycle through some kind of trap, so that population of woolly aphid can be checked. It was thought that, if some kind of barrier can be created which can restrict the movement of woolly aphid in winters as well as in spring. By doing this woolly aphids which remain on above ground portion cannot survive harsh winters and those which are at roots will not able to move above ground. It will result in drastic reduction of population of woolly aphids.

Jute bag treated with insecticide + oil (Linseed oil) can be tie to apple stem (Fig. 1), it can restrict the movement woolly aphid. Twice a year woolly aphid migrates from above ground parts to roots and vice versa. Hence after harvesting of apple tree and before breaking of dormancy is the ideal time for applying jute bags to the apple stem. The technique was elaborated to Shri Kishori Lal, Pradhan Sumara panchayat, Block: Pooh, Dist: Kinnaur. This innovative farmer used this technique for 2 subsequent years in his own orchard. He tied jute bags to apple stems and put oil + insecticide on it after harvesting (Fig. 2). Both the years we documented results of above trial and found around 70% less population of woolly aphid than untreated check.

Fig. 2: Shri Kishori Lalji showing woolly aphid traps in his orchard at Sumara Panchayat Dist: Kinnaur (HP).

Following conclusions were drawn from above experiment

1. Movement of woolly aphid from above ground plant parts to roots can be restricted through tying insecticide + oil treated jute bag on the apple stem after fruit harvesting.
2. After tying jute bag treated with insecticide + oil, spray insecticide recommended for the management of woolly aphid.
3. Drenching of insecticide in the root zone of apple tree will ensure eradication of woolly aphid population inhabited in roots. This treatment can be given in the 1st year of experiment only.
4. Apply insecticide + oil on the jute bag before onset of spring season.
5. For best results adoption of this technique should be on community level. At least all the adjoining orchardist should follow this practice for good results.

By implementation of woolly aphid trap technique with minimum use of insecticides farmers can manage this notorious pest. Multi location trials of woolly aphid trap needs to conduct for analysing its result in apple growing areas Himachal Pradesh.

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Assessment of Hazard Resistant Construction Practices in Mountain Ecosystem

(A Case of Rural Uttarkashi District of Uttarakhand)

The basic requirement for safe and adequate shelter has always been the prime focus for any human being. Thus, human civilisation has constantly chosen to settle in areas where the threat of natural disasters can be kept at bay, and survival is relatively secure. The need for survival has led to a demand for successive technological breakthroughs in building and material science. In the context of India, this has put the Himalayan ecosystem in jeopardy in terms of insensitive building activities and various infrastructure projects, like road tunnels, hydro power plants, leading to frequent natural disasters.

Hazard Prone Area of Uttarkashi

Uttarakhand was formed on 9th November 2000 as the 27th state of India, when it was carved out of northern Uttar Pradesh. The state has been historically grouped into two divisions, namely Garhwal and Kumaon, and then relatively flatters lands like Dehradun, Haridwar and Udam Singh Nagar. It has been observed that Kumaon region is relatively stable in terms of disaster proneness as compared to Garhwal region, as the latter has high and young mountains, and therefore less vegetation, also leading to loose soil.

Uttarkashi, one of the 13 districts of Uttarakhand, has witnessed the highest (12%) increase in population from 2001 to 2011, as compared to other districts in Kumaon and Garhwal. (Census of India, 2011) Uttarkashi district is heavily dependent on its forest cover with approximately 3,145 sq. km. area (40% of geographical area) under forest. Uttarkashi, being in IV and V earthquake seismic zone of India, has repeatedly faced natural hazards. During the 1991 earthquake at Pilang-Bhatwari area, nearly 768 people were killed and 18,000 buildings were destroyed in the Uttarkashi-Chamoli region. A total of 221 people died during the Kailash Manas Sarovar Yatra in Malpa landslides in 1998 due to unplanned construction and urbanisation. During 2013 flash floods, 4,200 villages were affected, 580 human lives lost, 2,780 houses damaged, and 870 cattle sheds destroyed. (Sphere India's Situation Report, 2013)

Problem Statement: Vernacular or Modern Construction Practices

Vernacular architecture of Uttarakhand has led to detailed construction practices perfected to suit the conditions specific to its geographical, climatic and cultural context. These techniques carry with them solutions, executed and polished in local material and practices, and therefore bear immense weight as a knowledge-base. However, the 20th Century gave rise to globalisation and creation of concrete cities, which tended to create an aspiration in rural areas to erect their own 'pakkamakaan' — a perceived stable structure. This was aided by the influx of relatively cheap and readily-available material such as cement, and the touted longevity of the same. In this process, grass-root level sustainability of vernacular practices is being abolished by a ubiquitous use of material high in embodied energy, slowly wiping out the particular building expression and aesthetics native to the area. A good example for studying hazard-resistant construction technologies and the problems created by this shift is seen in rural areas of Uttarkashi.

Fig. 1: Mix of vernacular and modern construction practices in rural houses of Siror Village, Uttarkashi

Habitat Assessment of Rural Uttarkashi

Department of Science and Technology, Government of India, initiated the TIME-LEARN Programme (Technology Intervention for Mountain Ecosystem: Livelihood Enhancement through Action Research and Networking) in 2017. The primary focus of this programme is technology innovation in three states of Indian Himalayan Region (IHR), i.e. Jammu and Kashmir, Himachal Pradesh and Uttarakhand, working across five thrust areas (Agriculture, Biodiversity, Rural Engineering, Water Resource, and Disaster Management).

Development Alternatives (DA), along with implementation partner Himalayan Environmental Studies and Conservation Organisation (HESCO), Dehradun, and research support from DIT University, Dehradun, has conducted a detailed documentation of 10 rural houses and surveyed about 100 households in Uttarkashi district of Uttarakhand. The purpose of documentation was to understand building technologies and habitat designs in the hilly areas of Uttarakhand. This includes practices followed in construction of houses and other physical infrastructure, such as water and sanitation facilities, along with building material resource mapping. A quantitative assessment with holistic understanding of the past and current practices was conducted. In order to achieve these, four representative rural settlements in Uttarkashi district were identified for documentation. These were Siror and Raithal in Dunda block, and Karnad and Bharkot in Bhatwari block.

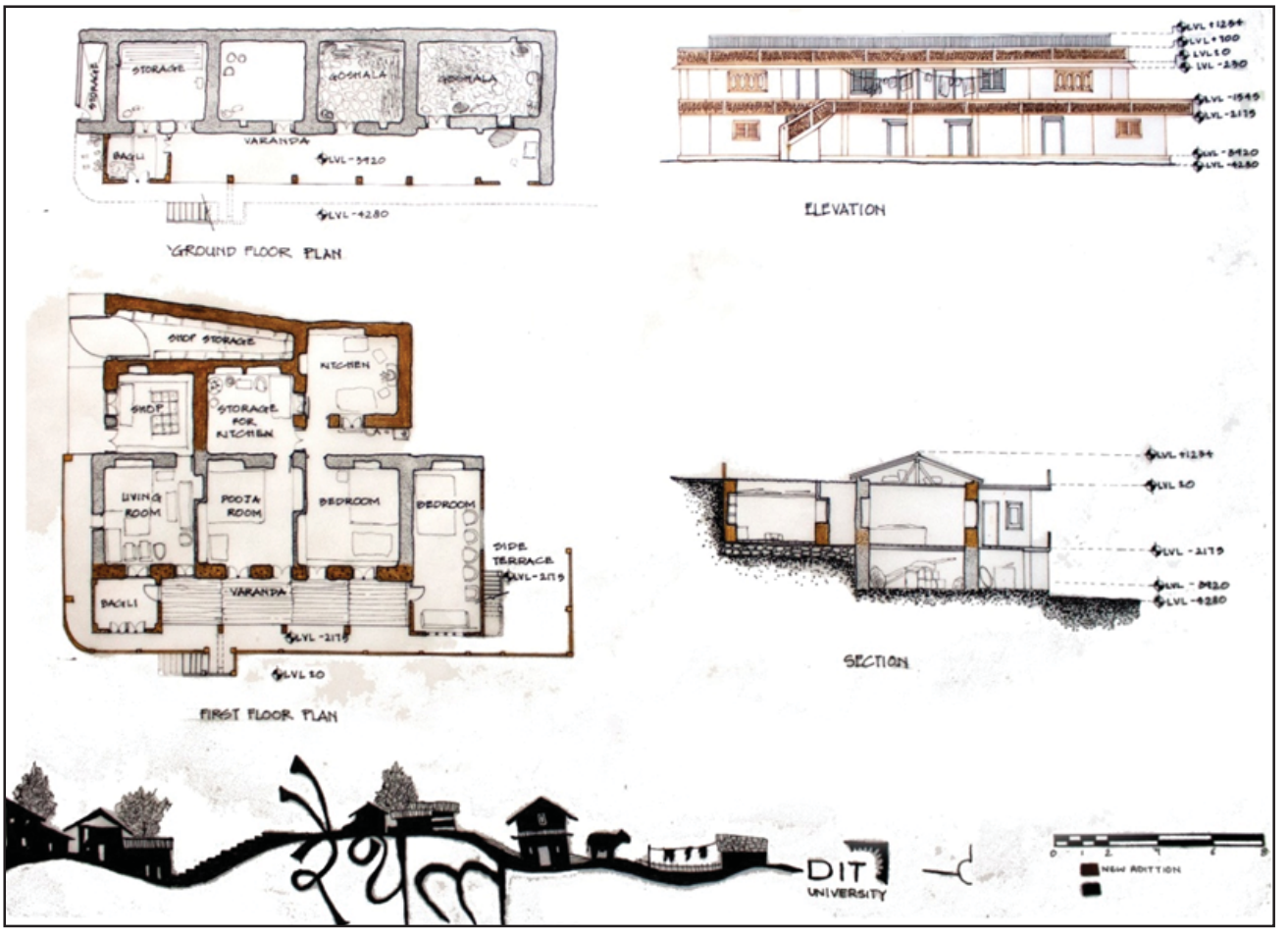

Fig. 2: Building material and design documentation of a rural house in Raithal Village, Uttarkashi

Over Stressing of Traditional Material and Lack of Knowledge on New Material

Despite having witnessed several brutal natural disasters in past, the people of Uttarkashi still retain their belief in their strong vernacular building systems. These systems use locally available material like wood, stone and slate shingles (pathal). However, since the Ministry of Environment, Forest and Climate Change (MoEF and CC) declared the Bhagirathi stretch as an eco-sensitive zone in 2012, natural resources such as wood and stone cannot be used for the purpose of building construction. As a result of this unavailability, people have turned to use of substitute building construction technologies, like use of cement concrete for casting flat roofs. Some of the findings from Uttarkashi indicate the following:

1. Current Stone Construction Practices
   a. Due to restricted access to stone, concrete block masonry evolved
   b. Gable walls are vulnerable to collapse
   c. No concept of 'through stones' to hold the stone masonry wall together
   d. Adding of verandah to the stone wall makes the structure weak
   e. Potential for more resource efficient options such as prefab concrete elements
2. Reinforced Cement Concrete Houses
   a. Slab is often 2.5"-3" thick, thus susceptible to corrosion of reinforcement
   b. No use of reinforced seismic bands for earthquake resistance

c. No provision of negative reinforcement to resist bending moment

3. Utility of Flat Roofs
   a. Flat slabs are valued for drying grains, thus shift from traditional sloping roof
   b. Unsafe attachment of flat slabs to sloping roofs
4. Abandoned Houses and Material Resources
   a. Occurrence of cracks in walls due to recurrent earthquakes, thus unwillingness to spend on regular maintenance
   b. Non-availability of replacement material
   c. Locked-in high quality material resources
5. Unsafe Use of New Materials
   a. Traditional material availability is stressed
   b. New materials like concrete block are convenient, but have no standardised quality
   c. Reinforced Concrete Cement frame is practiced because of perception of strength, but lacks structural continuity and anchorage
   d. Potential for adaptation of traditional spatial design using new materials and building elements

Way Forward for Hazard Resilient Solutions

The ease of access of cement based manufactured products has not ensured sound construction practices in the region. The local masons and builders are unaware of the basic properties of cement, its structural qualities and limitations, and therefore grossly misdesigned structures are being produced. Thus, these concrete structures are failing to provide the very thing they were planned for in their inception: safety, strength and longevity. They lost advantages of the vernacular system without adding any of their own; and the region, thus, still remains at a loss on good hazard-resistant building construction.

The observations drawn from this documentation prove that the future of hazard-resistant technologies lies not in the pure vernacular, not in the current common materials, but in a fusion of the old and the new. A new form of hybrid architecture needs to be created, which respects the local building practices and uses that knowledgebase to elevate them to demonstrate strength, safety and responsibility. The sale of new construction materials and practices must be accompanied by the spread of the know-how of using these.

Srijani Hazra
Development Alternatives

Installation and Demonstration of Indirect Solar Drier with Temperature Controller and Thermal Storage Systems in Mountainous Areas of India

Abstract

An indirect solar drier has been designed and fabricated at Dr YSP University of Horticulture and Forestry, Nauni (Solan) for the drying of fruits, vegetables, seeds and medicinal plants. A temperature controller attached with fan to regulate the temperature inside the solar drier has been provided to use the solar drier throughout the year. The efficiency of solar drier has been increased using thermal storage system fixed below the solar air collector. Ten solar driers have been installed altitudinal wise at farmer's field in the state of Himachal Pradesh and Uttarakhand. The awareness trainings were imparted for women in the use and benefit of solar drier and technical trainings to carpenters in the fabrication of solar drier.

Introduction

Large quantities of fruits and vegetables are damaged due to perishable nature, bad weather or lack of transportation facilities, resulting in loss to the farmers. About 20% tomato, 10% ginger, 10% mushroom, 30% amla and 5% apple are generally damaged or wasted during a year. In order to augment their income, people in the state dry vegetables, fruits like apple, peach, plum, nuts, pomegranate, and spices like turmeric, ginger and chillies in open sun which adversely affect the quality of the dried product due to dust, fungus infection, insects, sudden rains, wild animals and monkeys, etc. The perishable crop like tomatoes and pomegranate produced during rainy season are also damaged due to bad weather. This gives low return to the farmers. Also the process of open sun drying is time consuming as well as labour intensive.

The economy of the people in the hill areas of India is dependent upon the cultivation of fruits and vegetables. Although people are quite conversant with cultivation practices of fruits and vegetables, yet the utilization of fruits and vegetables in product development is far behind. Several organizations including NGOs have taken up the task of building the manpower. Needless to say optimization of technology would be able to pave the way for industrialization of the hilly ballet of Himachal Pradesh and Uttarakhand. The beneficiaries are small farmers and the villages are linked with nearby market by roads and farmers sell their products in the F and V Mandi.

Solar drier offers better alternative for drying of fruits and vegetables, seeds and medicinal plants. Solar drying of fruits and vegetables can reduce the losses, better food preservation technology and improve the quality of product for better price in the market. The solar drier has closed chamber with preventing product from outside effects. The dryer can be used for drying of produce as well as their products of irrespective of the season, climate and location. It is very much effective and efficient in drying the products than drying the crops in open sun. Indirect solar dried products meet the International Standards for quality. About 90 % of women of hilly areas remain engaged in the drying of products in the traditional way

and they spent at least 2 hours daily in the drying of crops. The farmers can dry all types of vegetables, grains, cereals for their own use as well as for commercial purpose. Depending upon availability of space, local material and amount of material to be dried the capacity of indirect solar drier can be increased or decreased. Solar drying of fruits and vegetables can reduce the losses and improve the quality of products and farmers get better price in the market. The drying cost in indirect solar dryer is negligible and quality of dried product is also enhanced considerably. Indirect solar dryer also provide an additional income to the local artisans (carpenters) by adopting it as entrepreneurship.

Installation of solar driers at farmer's field

A modular indirect solar drier provided with blower (to provide dry air at inlet), thermal storage system (consists of gravels and iron scrap to increase the efficiency of solar collector during day time and to radiate heat after sunset so that drying continues for longer period of time) and temperature controller to regulate the temperature inside the solar drier so that all types of crops throughout the year could be dried, has been designed and fabricated. The analysis of solar dried crops revealed that the quality of crops dried in solar drier are better as compared to open sun and electric drier. Ten solar driers have been installed at farmer's field for which the transport charges were paid by the beneficiaries (Fig. 1). The solar driers were installed in collaboration with different five farmer's societies. The locations were selected on the basis of altitude which varies from 500 meter to 2,000 meter. One solar drier installed at Research Station of this university Neri (H.P.). The funds were provided by the beneficiary. The details of the solar drier installed at farmer's field have been presented in table 1.

Fig. 1: Solar drier installed at farmer's field

Table 1 : Altitudinal installation of solar drier at farmer's field

S. No.	Location	Organization/Society	Geographical position	Available crops
1	Kolar, Dhaulakuan	Progressive Farmer, Sirmour, HP	Alt: 501.3 meter Lat: 300.29N Long: 770.25E	Medicinal plants, herbal tea and fruits
2	Neri	Research Station of YSP University	Alt: 649.2 meter Lat: 310.41N Long: 760.28E	Research activities of Department of Food Science Technology
3	Rikkan (Dilman, (Sirmour)	Local SHG, HP	Alt: 1079 meter Lat: 300.49N Long: 770.09E	Fruits, vegetables and spices
4	Naltu, Sihunta, Chamba	Progressive farmer, Chamba, HP	Alt: 1096 meter Lat: 320.70N Long: 760.05E	Vegetables, fruits
5	Talhar (Nagwain)	STD Mandi, HP	Alt: 1157 meter Lat: 310.48 Long: 77.100E	Apple chips, apricot, papad, pomegranate, red chilies, cauliflower brinjal
6	Sidhwan, GHNP (Banjar)	Biodiversity Tourism and Community Advancement (WWF), Banjar, HP	Alt: 1312 meter Lat: 310.38N Long: 77.200E	Pears, apricots, apples, wild peaches, herbs like mint, mushkwala, chora, garlic and tomatoes
7	Purodi (Chakrata)	HESCO, Uttrakhand	Alt: 1975 meter Lat: 300.39N Long: 770.53E	Fruits and vegetables
8	Dugilagh (Kullu)	The Laxmi Agriculture and horticulture Marketing Cooperative Society Ltd, Kullu, HP	Alt: 1615 meter Lat: 310.58N Long: 77.030E	Dhingri (Mushroom), persimmon, apple chips.
9	Kaintha (Sirmour)	Himalayan awakening Society, Nahan, Sirmour (HP) in collaboration with "Chureshwar Farmer Producer Company, Balyandhar" Sirmour	Alt: 2181 meter Lat: 300.48N Long: 770.25E	Vegetables, fruits, pomegranate, spices
10	Ribba (Kinnaur)	Progressive Farmer, Kinnaur, HP	Alt: 2441 meter Lat: 310.35N Long: 780.21E	Apple, apricot, almond, wall nut, chilgoja and vegetables etc.
11	Sunnam (Kinnaur)	Progressive Farmer, Kinnaur, HP	Alt: 2839 meter Lat: 310.45N Long: 780.28E	Apple, apricot, almond, wall nut, chilgoja, fruits and vegetables etc.

Fig. 2: The crops dried by the farmers in solar drier

Drying of products by the farmers

The farmers have dried the crop products in solar drier installed at their field initially at low scale which will be enhanced at commercial level later on. The crops dried by the farmers are presented in Fig. 2.

Trainings on solar drier

In order to popularize the solar drier in the hilly region of India various types of trainings were organized in Himachal Pradesh and Uttarakhand.

Awareness training programme

People in the region were sensitizing about the use and benefits of solar drier for farmer's community. Awareness trainings were organized in the state in collaboration with NGOs, Societies and farmer's groups. Five organizations in addition to Panchayats were involved during awareness of solar drier. About 550 people attended the awareness camps. The details of the awareness camps organized in the state are presented in Table 2.

Table 2: Awareness Training programmes conducted

Sr No.	Date	Venue	No. of farmers	Resource person	Number of trainees by gender (M/F)	Organization
1.	19.9.2017	Nauni Campus	20	HOD, PI	19	YSP university
2	8-03-2018	Village- Fagu, P.O- Bhaya Chanrod, Tehsil- Rajgarh, Distt.- Sirmour	50	Project coordinator	44/6	Panchayat
3.	9-03-2018	Village and P.O- Sarahan, Distt.- Sirmour	50	Project coordinator	39/11	The Sarahan Fruit and Vegetables Grover Marketing Co-operative Society, Sarahan, Sirmour
4.	13-03-2018	Village and P.O - Dughilug, Tehsil and Distt.- Kullu	52	Project coordinator	24/28	The Luxmi Agriculture and Horticulture Marketing Co-operative Society Ltd, VPO Dughilag, Kullu
5.	14-03-2018	Village- Sairopa, P.O- Gahidhar, Tehsil- Banjar, Distt.- Kullu	56	PI and Project coordinator	5/51	Bio-diversity, Tourism and Community Advancement, Banjar, Kullu
6.	17-03-2018	Village- Jadli, P.O- Patta Brawari, Distt.- Solan	55	PI and Project coordinator	33/22	Panchayat
7.	21-03-2018	Village- Jadari, P.O-Kandaghat, Distt.- Solan	54	PI and Project coordinator	36/18	Panchayat
8	22-03-2018	Village and P.O- Shoghi, Distt.- Shimla	54	PI and Project coordinator	36/18	Shimla Hill Offering Pvt Ltd Shogi, Shimla
9	27-03-2018	Village and P.O- Dado devaria, Distt.- Sirmour	53	PI and Project coordinator	43/10	Panchayat
10.	28-03-2018	Village and P.O- Nauradhar, Distt.- Sirmour	54	PI and Project coordinator	45/9	Panchayat
11.	29-03-2018	Panchayat Bhawan Shimla	53	PI and Project coordinator	6/47	State Resource Centre, MHRD, Shimla

Fig. 3: Awareness of farmers regarding solar drier at Nauni

Awareness training for women representative of PRI at Shimla

Awareness training for farmers

Fig. 4: Awareness training programme regarding solar drier at Shimla and Shogi

Technical training programmes

The success of any technology depends on trained manpower at grass root level. Keeping in view of this the technical training programmes were organized during the installation of solar driers at farmer's field. Nine trainings were conducted in the field (Table 3.) in which 38 carpenters were trained in the field.

Table 3: Training programmes for carpenters in the field

Sr No.	Duration	Venue	No. of carpenters
1.	14-15 March 2018	Village- Sidhwan, P.O and Tehsil- Banjar, Distt.- Kullu	6
2.	16-17 March 2018	Village- Dughilug, P.O -Dughilug, Tehsil and Distt.- Kullu	5
3.	18-19 March 2018	Village- Talahar, P.O - Nagwain, Tehsil- Aut, Distt.- Mandi	5
4.	25-26 April 2018	Village: Purodi, PO: Tungra, Tehsil: Chakrata, Distt.: Dehradun (UK)	8
5.	22-23 June 2018	Village and PO: Sunnam, Tehsil: Pooh, Distt.: Kinnaur	3
6.	24-25 June 2018	Village and PO: Ribba, Tehsil: Moorang, Distt.: Kinnaur	4
7	24-25 July 2018	Village: Kaintha, and PO: Bohgdhar, Tehsil: Nohradhar, Distt.: Sirmour	7

Specialized training for carpenters

Two training programmes of 3 days duration were organized for carpenters in the fabrication of solar drier at camps. One training was organized for Uttarakhand in which 8 carpenters attended the training and one for HP in which 12 carpenters attended the training (Table 4). The carpenters themselves fabricated each component of the solar drier. They were sensitized in the use and benefits of the solar drier also. It will help them to generate income and also to create scientific temperament among the local artisans.

Table 4: Training programmes for carpenters at Nauni

Sr No.	Duration	Venue	No. of carpenters
1.	25th August 2018 to 27th August 2018	Nauni Campus	8
2.	29th August 2018 to 31st August 2018	Nauni Campus	12

Fig. 5: Training for carpenters at Nauni campus

Contribution by the farmers :

The farmers were also involved in the installation of solar drier. The transport charges from Nauni to farmer's location were paid by the farmers.

Conclusion:

An indirect solar drier has been designed and fabricated at Dr YSP University of Horticulture and Forestry, Nauni (Solan) for the drying of fruits, vegetables, seeds and medicinal plants. The improvements made in the solar drier like temperature controller attached with fan to regulate the temperature inside the solar drier, thermal storage system fixed below the solar air collector and blower at the inlet of solar collector. Ten solar driers have been installed altitudinal wise at farmer's field in the state of Himachal Pradesh and Uttarakhand, which benefited good results not only for farmers but also to the local artisans.

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Sweet Pepper Cultivation in Polyhouse

Abstract

Sweet pepper is a high-value vegetable with excellent prospects both in domestic and export markets. Its cultivation faces many problems of insect, pest and diseases. Prevailing night low temperature, high rainfall, hails, frost, water logging, high relative humidity and cold winds are limiting factors for its cultivation in open field in hills of Uttarakhand. Protected production technology (poly houses and glasshouses) is most suitable solution for its successful cultivation.

The yield and yield attributes of Capsicum lines are higher in polyhouse structures than open field conditions. The greenhouses are economic structures to change the macro climate of a desired area. Sun rays enter through the glass or transparent polythene and warm the air by 6-10^{0}C than outside. The favourable microclimate in a polyhouse favours flowering and fruit production. Increased soil temperature is mainly responsible for higher fruit yield. The use of polyhouse structures increases the humidity inside. Due to deposits of water droplets inside the roof of poly houses, good humid conditions are maintained and enhanced relative humidity increase the yield. The greenhouse models could increase the yield of Capsicum. Glasshouses with ventilation in roof and side windows are more superior to polyhouse and open field conditions for Capsicum production.

Sweet pepper in polyhouse

Nowadays, due to construction of a large number of protected structures at farmer's fields, it is possible to produce quality Capsicum in terms of size, shape and colour, and free from diseases and pests. It also enables its growers to get more return per unit of land and other benefits, like early and longer harvest duration. The yields modifies naturally-ventilated polyhouses vary with location, greenhouse design and construction, including height of roof, plant geometry, variety, irrigation, fertilizer and day-to-day growing environment management practices. Therefore, understanding of climatic requirement, soil, training, pruning and pinching, fustigation, plant-protection measures and post-harvest management, and value-addition is vital and discussed here under:

Cultivation

Climate

Capsicum is a day-neutral crop, it is more sensitive to changing environmental conditions. Optimum temperature for its seed germination is 20-25 ^{0}c, while for quality fruit production it is 18-21 ^{0}C. When night temperature remains below 16 ^{0}C for a longer duration, there is a drastic reduction in growth of plants and yield and parthenocarpic fruits develop. There is adverse effect on growth and yield above 30 ^{0}C. However, it can tolerate above 30 ^{0}C as long as night temperature is within 21-24 ^{0}C. Cold weather in winter, especially in North India can affect development of quality fruits from mid-November to mid-February, which necessitates heating during night for enhancing fruit yield and quality.

Soil

Sweet pepper grows luxuriantly in loamy or sandy soils having good water-holding capacity. However, well-drained soils having pH of 5.5-6.8 and good aeration are ideal for commercial cultivation.

Planting material

Selection of an appropriate hybrid having bell-shaped or 4-lobed blocky fruits with red yellow or orange colour is pre-requisite. Selected

hybrids are in demand. They must be high-yielding with low incidence of pests, diseases and fruit cracking. The hybrids of sweet pepper are commonly available in our country for polyhouse production. They are:

Red	Indira, Natasha, Tanvi Plus, Mekong and US 81
Yellow	OROBELLE, Tanvi, swarana and US 26
Green	Bharat, Mahabharat, Indira, Mekong and California Wonder (OP)

Bed Preparation

Deep ploughing/digging should be carried out and raised beds prepared well in advance of planting. Vermicompost @ 10 tonnes/ha should be applied while bed preparation along with a basal dose of inorganic fertilizers based on soil test. After bed preparation, two drip lines (20:2:30 size) are laid on the beds at a distance of 45-60 cm.

Nursery and Transplanting

For production of disease-free and healthy nursery, it should be raised in soilless media. It takes 30-35 days for transplantation. Fresh seeds of a hybrid should be procured from reliable source. Cover the seed after sowing with 6 mm layer of vermiculite and watered with fine spray. Cover the pro-rays with glass or plastic to avoid desiccation. The seedlings are transplanted at a distance of 45-60 cm from row-to-row and 30 cm from plant-to-plant. Thus, about 2,000 plants can be accommodated in 500 m^2 polyhouse. Plants from portrays should be preferred for hi tech production. Planting of seedlings should be carried out in such a way that temperature and humidity inside greenhouse remain favourable for harvesting optimum yield and quality fruits. After transplanting, optimum day temperature of 22-23 ^{0}C (day) and 20-21 ^{0}C (night), and around 80 per cent humidity should be maintained.

Irrigation and Fertilization

A little but regular supply of water is essential for growing of crop in a polyhouse. The irrigation is provided through drip system and can be monitored through soil moisture meter/ tensiometer for optimum supply. The irrigation frequency depends upon crop growth stage and prevailing climatic conditions/ season and may vary from 1 to 2 week.

Time of Training and Pruning

The right time of training and pruning varies with the crop i.e. tomato and capsicum crop require pruning after 25-30 days of transplanting, but cucumber crop require training and pruning after 15-20 days of transplanting. The training and pruning will continue at weekly interval during crop duration after transplanting. Pruning and training methods of greenhouse vegetable

The following training and pruning methods are followed in polyhouse grown vegetables.

Capsicum training and pruning method

- Signal stem pruning method
- Double branch pruning method
- Triple branch pruning method
- Four branch pruning method
- Multi branch pruning method

Capsicum plants initially develop one single stem. After 9-13 leaves, a terminal flower develops and the plant branches into two. Sometimes three or four shoots develop naturally rather than two. Also two flowers may develop rather than one. The flower in the first branching is the crown bud. The terminal flower is not allowed to develop into fruit and it is removed just after appearance. Two main stems are maintained on each plant after pruning or pinching the other branches by leaving two leaves and one flower on each internodes. These two stems are trained upon strings to the main wire running on the length of the rows on 8-9 feet height. Either the stem are loosely


trellised or wound around the strings. The stems are clipped the strings using rings or plastic clips. The plant will continue producing terminal flower and two sides shoots at every internode of every two new shoots, one is retrained to continue the stem, and the other one in removed or just pruned by leaving one flower and two leaves. Three leaves are left on side shoots when the plant needs extra leaf area, either for better photosynthesis or for shading the fruit. In order plants, the pruned side shoots will carry the fruits.

Training and pruning should be done every week or even every two weeks during period of fast growth. The crop can grow up to 8-9 feet in height in 9-10 months period and after that the plants are topped to avoid stem breaking and to improve fruit size. Training, pruning and trellising work in highly technical and it should be done by the trained man power only.

Harvesting and Post-harvest Management

Sweet pepper fruits are climacteric and are harvested only when they attain full size, colour and are still firm. Hybrids of sweet pepper requires 6-8 weeks from pollination to mature green stage, and further 2-4 weeks are required to reach coloured stage depending upon the prevailing temperature. Harvesting of fruits should be done with a sharp knife. Harvesting should be done either in morning or evening depending on distance of market. Avoid direct exposure of harvested fruits to sun. After harvesting its fruits, they should be hydro cooled to reduce field heat and thereafter, handling and packaging should be done with care as fruits are prone to handling damage. Waxing provides some lubrication and prevents chafing and moisture loss during transit. Further, water loss can be minimized by packaging pre-cooled sweet peppers in moisture-retentive liners or into perforated polyethylene bags. The fruits can be stored at 8-10 ^{0}C and 90-95 per cent relative humidity for 2-3 weeks. Storage of fruits at 0-8 ^{0}C causes pitting and black spots become visible on flesh due to chilling injury.

Plant Protection

Pest population can be reduced in screened (net) polyhouse structures but cannot be eliminated. Sweet pepper is susceptible to a number of aphids and virus transmitted viruses. Therefore, timely control of these vectors or their elimination, are the best remedies. Use of sticky yellow traps or yellow water traps and regulation of humidity through fogging are cost-effective and eco-friendly techniques to minimize the incidence of vectors on bell pepper in a polyhouse.

Among soil-borne diseases, bacterial wilt and collar rot are most destructive and polyhouse growers are advised to avoid planting of Capsicum in bacterial wilt sick soils. Powdery mildew is another serious problem in polyhouses and its symptoms are visible when downy surface on leaves becomes yellowish due to powdery mass. Growers are advised to follow integrated management of powdery mildew and collar rot diseases of Capsicum and avoid repeated application of same fungicide. Nematodes pose serious threat in greenhouses and need to be controlled through integrated pest management approach.

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Appropriate Livestock and Fodder Management through Technological Interventions in Van Panchayats (VPs)

Summary

Community forest management in developing countries involves management of natural forests that would otherwise be degraded or deforested and producing carbon emissions. Deforestation and degradation of forests account for approximately 20 per cent of anthropogenic CO_2 emission. When communities participate in forest management in forests in their vicinity, they generally halt or reduce the rate of deforestation and degradation, and they allow the forest to regenerate, which enhances the forest sink. The purpose of the action research study is to justify the importance of managed forests and role of appropriate technologies in serving the environment. Forest management and conservation would play a vital role in addressing the issue of climate change. Thus the action research also aims on study management practices contributing for conservation of forests for carbon accumulation and scope for trading.

Project area

The proposed action research have been undertaken in Asota, Satyon, Guna, Ulsethi, Dhaili, Toli and Sirsoda VPs situated in Lamgarah development block of Almora district.

Objective of the study

The main objective of the study is as follows:

- To evaluate the role of appropriate management practices in community forests in enhancing carbon sequestration rates.

Adoption of appropriate techniques for Natural Resource Management (NRM)

Scarcity of fodder has been a common problem in the hills and further availability of nutritious fodder is almost negligible. Thus, the primary focus of the programme was to re-establish the growth and vegetation in project VPs for enhancing their natural base and pool of resources to achieve financial stability as the strengthening of VPs is directly correlated with existing natural resources and their

Plantation of improved fodder grass at village and VP level

Sl.	Name of VP	Latitude (N)	Longitude (E)	Altitude (m)
1	Toli	29 33 45.5	79 43 37.2	1875
2	Guna Chautra	29 34 23.5	79 41 29.0	1830
3	Dhaili	29 33 05.7	79 44 19.4	1860
4	Asota	29 33 26.5	79 41 18.8	1790
5	Sirsoda	29 31 11.7	79 44 18.5	1756
6	Satyun	29 33 16.7	79 41 55.8	1974
7	Ulsethi	29 33 34.1	79 40 36.3	1670

management. Further, it would also ensure the supply of locally available material for i.e., fuel, fodder, timber and wild edibles, etc., for growing population by developing a practicable sustainable forestry model through integrating forestry, agriculture and animal husbandry. In the rural villages most of the women devoted their time (8-10 hours) in collection of fodder resulting in drudgery by walking long distances. Thus, the efforts have been made through the project activities to increase the area under improved fodder grasses and plantation of broadleaved tree species in the VPs.

The data generated from the VPs revealed that a change in management practices in comparison to past after the project interventions. The time consumed for fodder collection has reduced because of easy availability of resources in their respective VP areas and the vicinity of the homesteads time to time. In most of the VPs the status of fodder availability is increased throughout the year and quantity of fodder purchased from the outside areas has also reduced which indicated the enhanced production of fodder.

The data collected during the course of the present study revealed that in all 11.5 ha area demonstrated under improved perennial fodder grasses and 21.0 ha covered under different tree species plantation. The area covered under different VPs. Before the project intervention the villagers were not aware about the improved variety of fodder grasses and dependent on only traditional fodder species for fulfilling their needs. After the project interventions 06 species has been demonstrated of which the production of Napier was high. However in winter due to frost and low temperature twigs turns dry which produce new shoots during the February-March, thus still need to be emphasized.

Improved breeding programme

The livestock in the Himalayan region of India are mostly nondescript and majority of families have cattle of local breed. The livestock is kept for agricultural activities and dairy development. At present, the trend has gradually changed through the project interventions and modern livestock management approach was attempted. The project activities focused on disease control and proper care of cattle, Artificial Insemination for breed improvement in local breeds. The services were availed by the community members from each VP through BIAF experts. The success of AI (55-60%) in cows and the number of cows inseminated is an indicator of acceptance of the concept among the community.

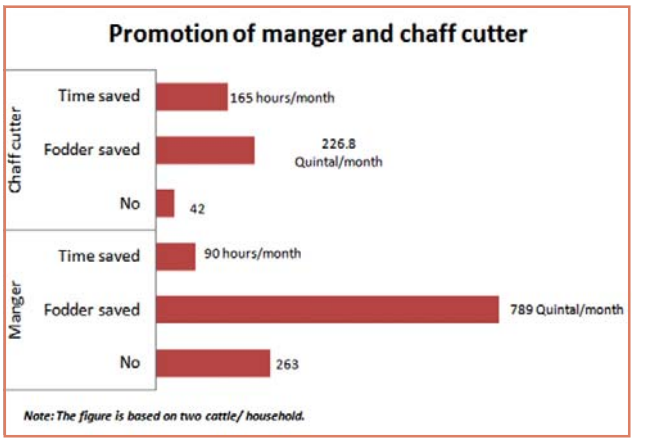
Promotion of manger and chaff cutter

Efforts have also been made to optimum utilization of fodder and time invested, the promotion of manger and chaff cutter was introduced so that the villagers may not have to visit frequently to their cattle for providing feed. Improvement has been seen in different VPs through adoption of appropriate techniques of reducing the wastage of fodder and maintaining cattle health. Fodder management have been given due importance under the project since its initiation and the response from the community is overwhelming.

Introduction of manger and chaff cutter for management of fodder

Now 47% of the families in the identified project VPs have mangers to feed their cattle and their optimum use is well seen among 70-80% of the manger owners. The concept is now accepted and families those took the initiative to construct manger are acting as resource person and motivating others. Overall 263 mangers and 42 chaff cutter were provided to the beneficiaries in the project villages. The activity has immensely reduced the pressure over women as well as over forests. It has also improved the cattle health and the fodder is also saved due to its optimum utilization. It was also observed while visiting the village and during interaction with SHG (Self Help Group) and VFC (Village Forest Council) members, chaff cutter has ensured mixing of different fodder together which is liked by the cattle and it has also reduced the time taken by cattle to munch the fodder.

In a nutshell overwhelming participation of community members in different activities and positive attitude towards adopting the interventions at village level for sustainable usage of available resources. Around 350 ton nutritious fodder has been harvested annually with average 40-50 head loads by each family. 150 more families are also willing to transplant rootstock in adjoining bunds and are well aware from the benefits in reducing the distance travelled for fodder collection and also to harvest quality fodder for their cattle. In addition to this SHGs are now shouldering the responsibility to transplant the rootstock at each and every household terrace. In all 120-150 hours are being saved by each of the family in a year which is utilized for other productive work.



The improved cross breeds are also performing well. The milk yield has increased 30-35% from cross breeds thus it has positively changed the mindset of community. As improved cross breeds are fetching to beneficiaries they are taken care ad kept at home thus reducing the pressure of open grazing on forests and supplementing natural growth. Now the livestock improvement through artificial insemination (AI) and appropriate management of fodder is very common among the community members especially women.

It was also observed during the interaction with SHG and VFC members, chaff cutter has ensured mixing of different fodder together which is liked by cattle and it has also reduced the time taken by cattle to munch the fodder. The time and fodder saved by the families due to adoption of the appropriate techniques is now disseminated to other members in the community to encourage them for adopting the concept. The concept is now well taken and accepted by the families those took the imitative to construct manger are acting as resource persons and motivator for others. Rural Resource Persons (RRPs) developed under divers sectors are facilitating villagers and got recognition in the area.

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Low Calorie Apple Spread

As on today, almost all the fruit jams available in the Indian market are prepared from fruit pulps and cane sugar mixed in required proportions as per legal standards, which has standard/defined calorific value whereas, in other countries low calorie foods are very common and consumed. So, keeping in view the above facts formulation of Apple Spread was standardized where we replaced cane sugar with sorbitol andto some extent with artificial sweeteners such as aspartame and sodium saccharine. Care was also taken about the maximum limits of various ingredients to be added in the product to avoid any side effects.

Apple spreads with different compositions of various ingredients were prepared taking in to consideration legal and safe limits of various ingredients to be used.

This optimized product was kept for storage at ambient temperature (15-32 °C) and at accelerated conditions in incubator (35-37 °C). Various quantitative and qualitative parameters (Total soluble solid (TSS), pH and acidity and Sensory quality) were determined.

Methodology : Broadly methodology was as follows:

1. **Procurement of raw material:**

- Apples and apple pulp was procured from farmer's processing unit Nagwain.
- Sorbitol, Low methoxy Pectin, and artificial sweeteners were procured from Chandigarh.

2. **Formulations:**

2.1 Apple spreads were prepared using standard method as per requirement and legal specifications. Recipe for optimum formulation is standardized as given below.

Apple pulp	=	10 kg
Apple shreds	=	0.5 kg
Sorbitol	=	3 kg
(Having TSS 70 °B)		
Aspartame	=	25 gm
Sodium Saccharine	=	15 gm
Pectin (LMP)	=	70 gm
Sodium benzoate	=	1.5 gm
Acidity	=	0.90 % as malic acid.
Final TSS	=	55 °B
Final weight	=	8.0 kg

2.2 Apple jam was prepared using standard method as per requirements and legal specifications.

3. **Storage study:** Storage study of apple spread was carried out at 2 different temperature conditions for six months:

1. At ambient/ room temperature i.e. 15-32°C
2. At accelerated conditions i.e. 35-37°C Samples from each condition were withdrawn at an interval of one month and following analysis was done (Analysis also done at zero time)

T.S.S : T.S.S. was determined using a hand refractometer.

pH : pH was measured with the help of pH meter.

Acidity : % acidity was estimated using standard methods

Sensory Analysis : Sensory evaluation was done by using a panel of 7 semi-trained panelists. They were asked to assess /rate the product by giving scores from 1-10. The scores were recorded and average of the score given was calculated and rated accordingly as follows:

1-2 = Unsatisfactory

3-5 = Satisfactory

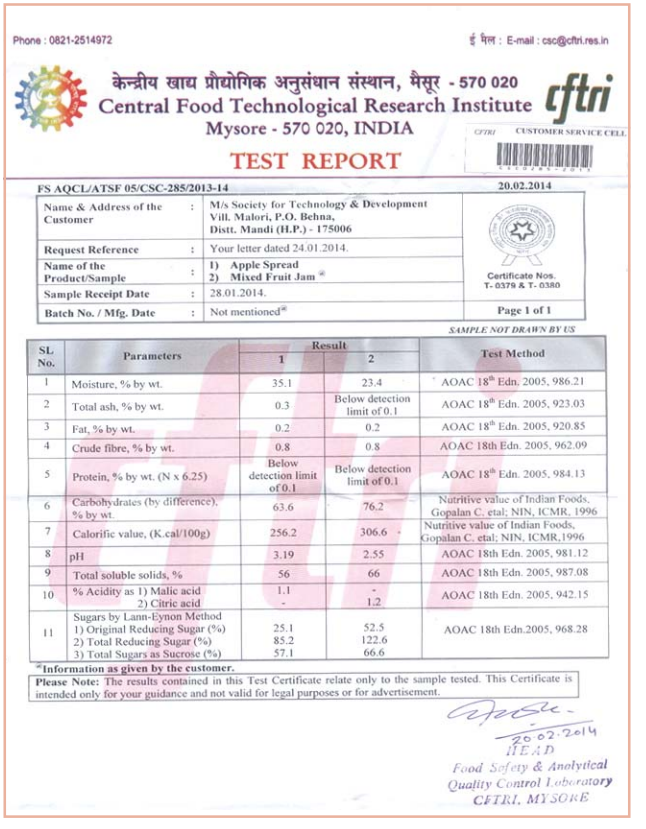
6-8 = Good

9-10 = Very Good

Observation and Results:

During storage, there was not much change in quantitative parameters studied, and product was found acceptable up to 7 months, but to have best quality of product we can assess the shelf life of this product six months, whereas formulation/product of apple standard Jam can be kept at best quality up to 1 year, because of higher sugar content.

Nutritional analysis: To have idea about nutritional and calorific values as compared to standards sugar jam, analysis was also carried out at Central Food Technological Research Institute, (CFTRI) Mysore. Report of which attached below:



Phone : 0821-2514972 ई मेल : E-mail : csc@cftri.res.in

केन्द्रीय खाद्य प्रौद्योगिक अनुसंधान संस्थान, मैसूर - 570 020
Central Food Technological Research Institute
Mysore - 570 020, INDIA

cftri

CFTRI CUSTOMER SERVICE CELL

TEST REPORT

FS AQCL/ATSF 05/CSC-285/2013-14 20.02.2014

Name & Address of the Customer	:	M/s Society for Technology & Development Vill. Malori, P.O. Behna, Distt. Mandi (H.P.) - 175006
Request Reference	:	Your letter dated 24.01.2014.
Name of the Product/Sample	:	1) Apple Spread 2) Mixed Fruit Jam *
Sample Receipt Date	:	28.01.2014.
Batch No. / Mfg. Date	:	Not mentioned*

Certificate Nos. T- 0379 & T- 0380

Page 1 of 1

SAMPLE NOT DRAWN BY US

SL No.	Parameters	Result 1	Result 2	Test Method
1	Moisture, % by wt.	35.1	23.4	AOAC 18th Edn. 2005, 986.21
2	Total ash, % by wt.	0.3	Below detection limit of 0.1	AOAC 18th Edn. 2005, 923.03
3	Fat, % by wt.	0.2	0.2	AOAC 18th Edn. 2005, 920.85
4	Crude fibre, % by wt.	0.8	0.8	AOAC 18th Edn. 2005, 962.09
5	Protein, % by wt. (N x 6.25)	Below detection limit of 0.1	Below detection limit of 0.1	AOAC 18th Edn. 2005, 984.13
6	Carbohydrates (by difference), % by wt.	63.6	76.2	Nutritive value of Indian Foods, Gopalan C. etal; NIN, ICMR, 1996
7	Calorific value, (K.cal/100g)	256.2	306.6	Nutritive value of Indian Foods, Gopalan C. etal; NIN, ICMR,1996
8	pH	3.19	2.55	AOAC 18th Edn. 2005, 981.12
9	Total soluble solids, %	56	66	AOAC 18th Edn. 2005, 987.08
10	% Acidity as 1) Malic acid 2) Citric acid	1.1 -	- 1.2	AOAC 18th Edn. 2005, 942.15
11	Sugars by Lann-Eynon Method 1) Original Reducing Sugar (%) 2) Total Reducing Sugar (%) 3) Total Sugars as Sucrose (%)	25.1 85.2 57.1	52.5 122.6 66.6	AOAC 18th Edn.2005, 968.28

*Information as given by the customer.

Please Note: The results contained in this Test Certificate relate only to the sample tested. This Certificate is intended only for your guidance and not valid for legal purposes or for advertisement.

20.02.2014
HEAD
Food Safety & Analytical Quality Control Laboratory
CFTRI, MYSORE

From above report we can interpret that apple spread has lower sugar content (reducing as well as total) about 30-50 %. Also calorie supplied is about 20 % lower than standard jam prepared with cane sugar.

Bhopinder Mehta
(Scientist In-charge)
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Instant Rice Shaped Buckwheat Product

Introduction

Functional foods and Nutraceutical applications can be an opportunity for economic growth for many developing countries endowed with rich biodiversity and traditional knowledge of the health effects of certain indigenous bioresources/plant species. Despite low level of public awareness compared to western markets, functional foods and ingredients are finding growth in areas of India, as consumers switch on to the promise of healthier foods, beverages and supplements. The information available on traditional food and bioresources available in the western Himalayan region will be given priority to document and fortified these with required nutritional food ingredients e.g. calcium, iron and phytochemicals from natural local bioresources to combat deficiencies and enhance health and wellness among the peoples. In recent times, the local inhabitant has adopted the modern food diet pattern (low nutritional profile), resulting in multiplicity of health problems particularly malnutrition, diabetic and obesity. Therefore, our efforts was to highlight the importance of nutritionally enrich food system (having balanced nutrition) and possible value addition of traditional food bioresources. The low cost technology for product/process was developed after thorough R&D work keeping in view the abundantly available and underutilized resources in western Himalayan zone. The feasibility analysis of the proposed product formulation and preservation process will be done after prototype optimization and efforts will be made to reduce the cost, wherever possible. The process economics, viable scale of operation and estimated cost of the product was analyzed after development of proposed food prototype.

During the first 50 years of the 20th century, scientific focus was on the identification of essential elements, particularly vitamins, and their role in the prevention of various dietary deficiency diseases. This emphasis on nutrient deficiencies or "under nutrition" shifted dramatically, however, during the 1970s when diseases linked to excess and "over nutrition" became a major public health concern. To combat this nutrient deficiencies an attempt was made using crops which are grown widely in the middle region i.e. kangra, mandi and kullu but have lack of nutritional awareness.

Methodology

The traditional food and underutilized bioresources available in the western Himalayan region were selected and fortified with required nutritional food ingredients e.g. calcium, iron and antioxidants from natural local bioresources to combat deficiencies and enhance health and wellness among the peoples.

Therefore, our efforts were to highlight the importance of nutritionally enrich food system (having balanced nutrition) and possible value addition of food products. These nutritionally and functionally enriched local bioresources will be processed and preserved.

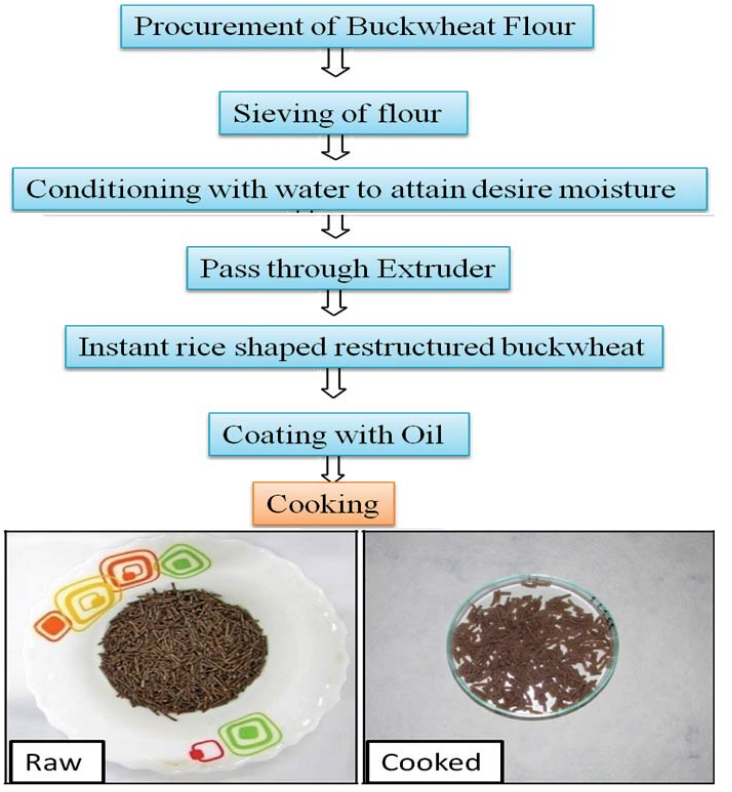
Product Development

Instant rice shaped restructured Buckwheat

Instant rice shaped restructured Buckwheat is a value added product, prepared to promote high altitude mountain crops. Buckwheat flour

is restructured to produce product similar to the rice with good cooking quality and taste.

Development of rice shaped restructures buckwheat



Nutritional and Sensory Evaluation

Moisture, protein, fat, fibre and ash are some of basic components of any food product which defines its nutritional profile. Instant rice shaped restructured buckwheat was analyzed for proximate composition by following standard methods of AOAC (2010). Product was also subjected to sensory evaluation by coding with alphabets A and B and offered to trained sensory panel. The scoring was carried out on a 9-point Hedonic scale ranging from 1 (extremely disliked) to 9 (extremely liked).

Table 1: Nutritional information of instant rice shaped restructured buckwheat

Product	Moisture (%)	Crude Protein (%) (db)	Total Fat (%) (db)	Crude Fibre (%) (db)	Total Ash (%) (db)
Instant rice shaped restructured Buckwheat (Raw)	4.76±0.06	7.59±0.10	12.20±0.12	0.80±0.05	1.16±0.01
Instant rice shaped restructured Buckwheat (Cooked)	80.26±0.04	6.77±0.04	8.10±0.08	3.86±0.11	0.38±0.04

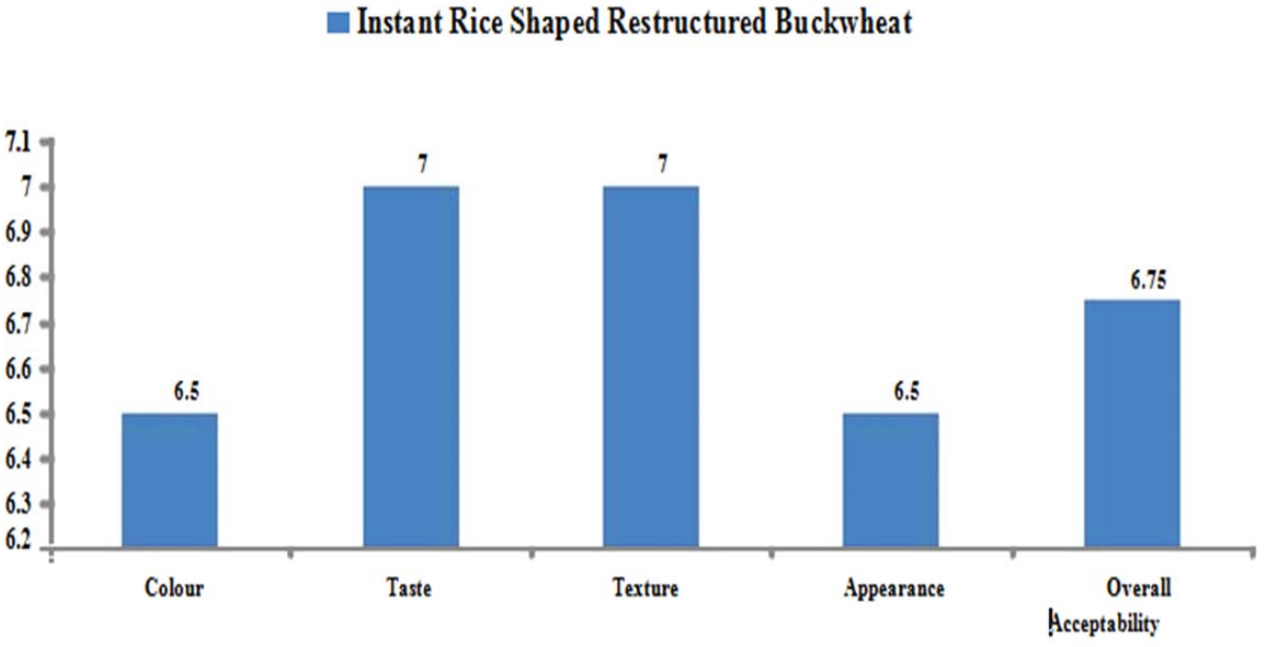


Fig. 1: Sensory evaluation of instant rice shaped restructured buckwheat

Conclusion

Buckwheat based restructured rice shape product, a value added product is prepared to promote high altitude mountain crops. From results it was revealed that buckwheat flour is restructured to produce rice shaped product, which can be cooked instantly and has textural and nutritional properties similar to original rice. This product is gluten free, rich in fibre and contains good amount of minerals and other micro nutrients and also acceptable.

This will also helps in:

1. **Improvement of Quality of Life:** The economical utilization of natural bioresources for development of nutritionally enriched food products will improve the health of the local societies and give entrepreneurship opportunities to local inhabitants.
2. **Health and Safety**: The food component(s) and development of functional food focusing on potential health issues being faced by the population i.e. malnutrition, diabetes and obesity at present will be addressed in this proposal.
3. **Livelihood Generation:** Entrepreneurship opportunities will be available at small scale and medium scale for the additional revenue generation by the local inhabitants and industrial partners.

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Empowerment of North - Eastern Tribes by Food Preservation & Processing

As we all know, the North-eastern states of India are rich in many tribes. Their cultural and economical structure is completely different from rest of the tribes of the country. From socio-economic developmental perspective, the empowerment of these tribes is challenging and completely based on different approach of development. In this endeavour, to empower these tribes a different and local based approach is needed called **"local need meet locally"** which can be only achieved by use of local bio-resources.

In the North-east of India, various endemic and nutritionally rich local bio-resources are available in abundance. There are full of diverse Agricultural/Horticultural products ranging from commonly occurring food/fruit plants to region specific produce. A rough estimate reveals that about 40 – 50% of fruits turn waste and under use due to inaccessibility to market and lack of knowhow of post harvesting techniques. Post harvesting techniques can help community to process the local food/ fruits for off seasonal use and can fetch better price of the resources. Among these local bio-resources, the agri-horticultural products such as Black-rice, Pineapple, Ginger, Gooseberry, among others are commonly grown. To extract these abundant bio-resources for income generation and empowerment, Himalayan Environmental

Studies & Conservation Organization (HESCO) along with a local NGO named Green Foundation, Manipur and Imphal based Institute of Bio-resource & Sustainable Development (IBSD) in the two states of Assam and Manipur run a project.

The purpose here is to develop bio-economy of rural areas by additional income through food preservation and processing unit. The whole project on bio-economical venture has three major features. These are local bio resources availability; local market through local community involvement; and market feedback which decide quantity of production and preferred products.

In this the tribal community by training and establishment of two Common Facility Centres (CFCs), increase the demand of the local diverse agri-horticultural produces through value addition and then marketing them in nearby local markets which will give them additional income. In the training, the women groups have given post harvesting techniques to process the local produce for off seasonal use that will fetch them the better maximum possible prices of the resources.

Through the number of trainings, the North Eastern Product development Protocols for value addition of local bio-resources have developed by using local available resources. The training programs have been conducted for which the community has been trained and the inventory of resources can be prepared. Various food varieties of bio resources available within community to be value added for common and commercial consumption. Commercial viability of the developed product also developed after studying and accordingly, community have trained on marketing of the products.

Also market skill and intelligence have been developed within the community for various products which have developed specifically by using Black rice, ginger, pineapple and gooseberry as these are the major bio-resources available in the region. Through the above interventions and trainings, following deliverables are achieved:-

- Awareness generation amongst the target community
- Appropriate and better utilization of available resources
- Skill development of community
- Employment generation
- Bio economy promotion

1. Product Development Training

Sl. No.	Crops/Fruits/Cereals	Products developed	No. of trainers	Trainees involved
1	Black rice (flour)	Laddu, cookies & cake, Namkeen, etc.	2 (Joychandra & Pinto)	Interested individuals, SHGs members from local and neighbouring villages
2	Pineapple	Candy, juice & Jam	1 (H. Shubhra Devi)	-do-
3	Gooseberry	Candy & Pickles	1 (H. Shubhra Devi)	-do-
4	King chilli & green chilli	Pickles	1 (H. Shubhra Devi)	-do-
5	Ginger	Candy & Pickles	1(H. Shubhra Devi)	-do-
6	Garlic	Pickles	1(H. Shubhra Devi)	-do-

2. One month turnover- A group of 4 women (avg.)- Additional income

S. No.	Product	Area of marketing	Quantity	Income (Rs.)	Profit (Rs.)
1	1. Laddu 2. Kabok (process food of black rice)	Imphal City and outside of Manipur	5kg/month each	2000(laddu) 1000(kabok)	700/-approx. 200/- approx..
2	1. Laddu, 2. Cookies, 3. Kabok, 4. Sweet rolls, 5. Namkeen and 6. Pickles	Imphal City	20 pkts /month each	5000/-(approx.)	1500/- (approx.)
3	1. Laddu, 2. Kabok, 3. Kingball, 4. Cake, 5. Namkeen and 6. Pickles	Local area of Sekmaijin and Kakching	2 dozens each/week	6000/- (approx)	2000/- (approx.)
4	1. Laddu, 2. Kabok, 3. Kingball, 4. Cake,	Thoubal Bazar	3 dozens each/week	9000/- (approx.)	3000/- (approx.)

	5. Namkeen and 6. pickles				
	1. Laddu, 2. Cookies, 3. Juice, 4. Cake and 5. Namkeen	Different location as per order place	As per demand	28000/- Approx. (till now)	10000/- (approx.)
6.	**Total**			**50,000**	**18,400**

After giving training to many tribal women of community in the two Common Facility Centres (CFCs) and as based on the above information given in the table, the additional income of per woman has increased to avg. of Rs. 4,500 per month. For just 15-20 hours per week of working to develop these products, the tribal community has empowered in their village without any outside dependency. The additional income generated after selling of these value added local bio-resource products, the tribal women can use the income to fulfil their various day to day needs for their family and children's education, health, and all round development of the community.

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Management of Haemonchosis in small ruminants of Jammu region, Jammu and Kashmir

Introduction

North Western Himalayan region includes Jammu and Kashmir, which have vast diversity in agro-climate and topography, low to moderate rural population and abundance of green mass. These natural factors collectively attract a majority of rural population and tribal communities (like 'Bakerwals' and 'Gujjars') to earn their livelihood through animal rearing and sale of animal products. Diseases of animals affect the economics of production and finally the profit. Parasites not only cause the damage but also lower the immunity and predispose the host to wide array of diseases of other biological origin. Among the diseases that constrains the survival and productivity of sheep and goats, haemonchosis caused by *Haemonchus contortus* rank highest on a global index. *H. contortus* is a blood-sucking abomasal nematode responsible for extensive economic losses in small ruminants.

Life cycle

Life cycle of *H. contortus* is direct and the eggs (free living or pre parasitic phase) passed in the faeces, hatch to first stage larvae (L1) on the pasture and may develop to L3 (infective stage) in as short a period as five days. L3 migrates on to herbage, where they are ingested by animals. In the wall of the stomach they develop into fourth stage larvae (L4), which turns into adult worm after 14 days.

Pathogenesis and Clinical Symptoms

Infection with Haemonchus can be classified as either acute, sub-acute or chronic. Acute infection is due to high levels of blood loss, resulting in the rapid development of anaemia and death. Acute haemonchoisis is most common in young stock or adults in poor condition that cannot compensate for the blood loss with the rate of production of new red blood cells. Sub-acute haemonchosis is when blood loss through worm infection is compensated by red blood cell production. This is not maintainable as the bone marrow will become depleted and disease will often become acute. Chronic haemonchosis is observed the host is able to compensate with red blood cell production to a moderate level, although protein loss is gradual as is the loss in condition and pallor. Each worm of *H. contortus* removes about 0.05 ml of blood per day by ingestion from the lesions so that a sheep with 5000 *H. contortus* may lose about 250 ml daily. Acute haemonchosis is characterized by anaemia, variable degrees of oedema, of which the submandihular form (Bottle Jaw) and ascites are most easily recognized, lethargy, dark coloured faeces and falling wool. Chronic haemonchosis is associated with progressive weight loss and weakness.

Fig.1: Pale Mucus membrane

Fig.2: Bottle Jaw condition

Diagnosis

Usually diagnosed by history, clinical signs and supported by faecal worm egg counts. The cardinal sign of haemonchosis is pallor of the skin and mucous membranes. A characteristic gross lesion is widespread subcutaneous edema especially the submandibular soft tissues are involved producing the so-called "bottle-jaw". Edema is concentrated in the submandibular soft tissues because the head is often dependent in grazing animals. Degree of anemia can be judged by the use of a anaemia chart, which shows images of eyes of animals with different hematocrit levels with an indication of which animal should be treated.

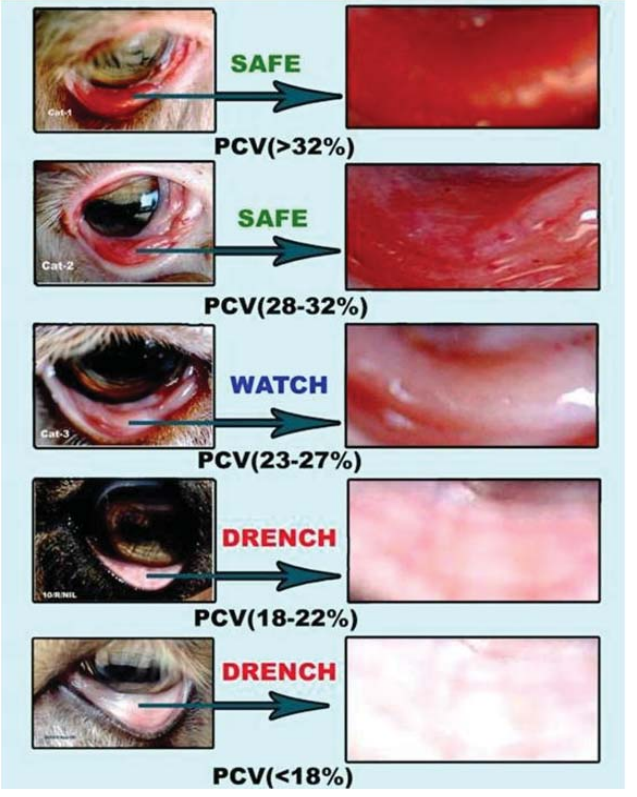

Fig. 3: Anaemia Chart for diagnosis of haemonchois (Courtesy Dr. D. Singh and Dr. C.P. Swarnkar, CSWRI - Avikanagar for providing photo-graph)

Post Mortem Lesions

The abomasum has dark red-brown contents with multifocal mucosal hemorrhages and *H. contortus* adults. In a freshly dead animal, the worms are often alive. The adult parasites are easily identified because of their specific location in the abomasum and their large size (2.0-3.0 cm). In fresh specimens, the white ovaries winding spirally around the blood-filled intestine produce a characteristic appearance.

Fig. 4: **Haemonchus contortus** *from abomasum*

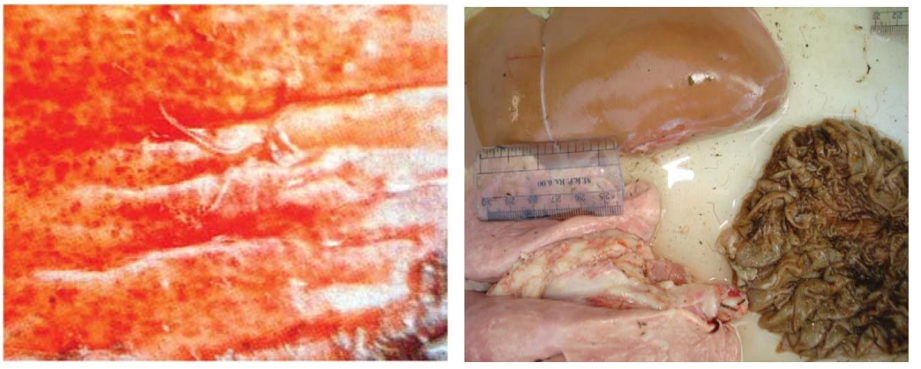

Fig. 5: Haemmorhages in abomasum in acute haemonchosis(A) and Pale organs (B)

Treatment

Albendazole and Fenbendazole @5-7.5 mg/ kg b.wt and Ivermectin @ 0.2 mg mg/ kg are highly effective against haemonchosis.

Management Practices

Deworming should be done as per schedule i.e. only two dosing are required in Jammu region- first in late March/early April to counter over winter larvae, second in late July/early August to counter larve abundant during monsoon. Underdosing and overdosing should be avoided to check the emergence of anthelmintic resistance. Animal diet should be rich in proteins. Addition of cobalt in diet reduces the pathogenic effect of haemonchosis. Goats should be encouraged to browse rather than to graze so that larval uptake from soil is minimized. Young and adult animals should be separately allowed to graze and efforts should be made to allow grazing on clean, safe and rested pastures. Susceptibility varies with age thus it is logical to graze the younger animals first in the pasture followed by adult animals. Animals should not be grazed in early morning or evening as larvae are entrapped by moisture on the tip of grass blades. During monsoons and post animals should be fed with leaves of fodder tree as well as straw feeding should be encouraged. For goats browsing should be preferred than the grazing. Anthelmintic resistance against *H. contortus* is widely reported from several states of India, including Jammu & Kashmir. Rapid Development and dissemination of anthelminthic resistance lays a strong need for various interventions to tackle this menace viz. increase refugia, selective treatment, reducing chemical and increased non-chemical approaches, appropriate stocking rates.

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Up-gradation of conventional areal river crossing in rural/hilly terrain

Being a hilly state many areas of Himachal Pradesh still lack road connectivity a bridges over rivers and rivulets in interiors of the state and residents in these areas depends on conventional river ropeway system to cross rivers and rivulets.

Conventional river rope way crossing

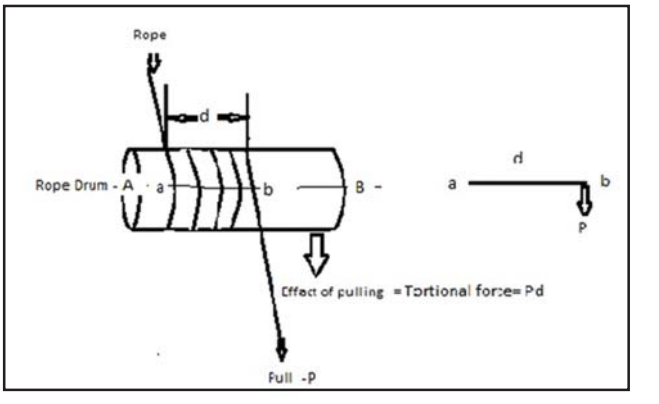
These river ropeway systems act as a daily lifeline for residents for crossing rivers to reach schools, medical institutions and nearby market place. The ropeway system also helps in taking their agriculture-horticulture produces to market and bring back things of daily needs, for seeking medical help, etc. Despite being in practice in many areas this system is full of many pitfalls as it is difficult to rerate the systems, especially for children and women.

To make this system safe, more efficient and hassle free, the Society for Technology and Development (STD), Mandi with the support from Department of Science and Technology (DST), has tied to upgrade this system with an ongoing project "Up-gradation of conventional river rope way crossing in rural/hilly terrain".

Objective of the project is to eliminate shortcomings of conventional river rope way and to make it safe and easy to operate. Shortcomings are as below:-

- Trolley runs uncontrolled on downward slope due to gravity till mid of span.
- Further, it requires exerting full force to move further on up-slope of wire rope.
- Possibility of trapping fingers between pulley & rope always exists, during pulling rope to move forward.
- Derailing of pulley from rope is general complaint. It occurs due to the rags of cloth which are used to stop its backward motion.
- Excessive movement of passenger disturbs balance of trolley, which may cause dropping of passengers.
- Some peoples come under influence of vertigo while looking current of water during downward motion of trolley.

An effective solution, based on a scientific and technical knowledge would help in up-gradation of conventional river rope. The paddles were



Prototype - I

modified to rotate a rope drum, wrapped with one or two folds of a thin pulling rope on its periphery and both ends of rope are fixed on piers on both banks. As such, rotation of rope drum causes linear movement in direction of winding side of rope because rope wounds on its periphery on one side & un-wound on other side. This rope drum when coupled to trolley will also move along with rope drum.

Hence, this concept/idea is picked up for development/up-gradation of conventional river rope way crossing. Use of this concept, can serve the purpose to upgrade conventional river rope way & possible to be produce it easily with available resources.

While planning to shape, it is observed that rope drum with single pulling rope will cause turning moment of suspended trolley due to acting of pulling force P on point a & b shown in sketch. Hence, use of two pulling ropes on a long drum by wrapping them in opposite direction on both ends are planned so that torsional forces will counter each other. But, space could not be found for such long drum in the system. At last splitting of rope drum into two parts and placing them adjacent to left and right walls of trolley, is finalised.

Pulling rope wrapped on a cylindrical surface of drum make an angle (angle of helices) with face of drum hence, changes its position continuously during rotation. The width & diameter of drum are indirectly proportional to each other whereas size/weight is directly proportional to span. Thus, diameter and width of drum is calculated accordingly keeping span into consideration so that, the movement of pulling rope could be restricted within its width. But, it is observed that, size/weight goes beyond

Trolley of Prototype-II

permissible limits above 60 meter span. Hence, for prototype-II, movement has been blocked by providing guides on both side of drum.

It is evident that sufficient force is required to be applied on paddles to rotate rope drum or to run trolley on upward section of sag in rope. Torque required to rotate rope drum, is the by product of human force, applied at paddle. Generally, capacity of healthy human is 400 watts till initial 5 minutes thereafter; it drops substantially. Average capacity is not more than 200 watts only which is not sufficient to generate required torque. Thus, a train of steel roller chain & chain wheel has been used to increase mechanical advantage. There is great difference between power available & torque required, hence, single set of chain & wheel can't give requisite MA. That is why, two set of chain & wheels has been used in proposed model. First set is used to increase speed of intermediate shaft with the available human power & this speed is used to increase torque in the second set by using smaller wheel as driver and larger as driven sprocket which is directly coupled to rope drum. Driver wheel of first set is coupled to paddle through crank & housed in the centre of trolley so, that it can be operated comfortably by seating on the space provided for it.

Up-graded model is being equipped with a controlled power transfer system to multiply force applied to it through pedal. This system is being placed in a safe and enclosed cabin/ carrier having comfortable seating arrangement and entry or exit doors. Trolley is suspended on steel wire rope with a set of friction less pulleys. Pulling wire ropes wound on drums both sides, will also provide support against tilting of carrier also.

Prototype-I has already been fabricated on the bases of aforesaid concept and keeping safety as main consideration. But, it was adjudged **heavy** by experts of DST though its field trial remains successful. Experts have suggested working on functionality rather than safety. So, Prototype-II has been designed with lightweight materials and fabricated with latest means of fabrication process. Now it's almost ready for test run.

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Solar electric fencing : a key eco-friendly component to reduce human-wildlife conflict in mountain areas

Introduction

Like any other part of the world, under the current development scenario both the humans as well as the wildlife are increasingly competing for similar resources and space. Unplanned and unregulated development activities especially in and around key wildlife habitats are bringing the humans in conflict with wildlife. This confrontation between humans and wildlife has led to loss of the human life & property as well as the wildlife. The key issues being faced by the people in these areas are crop damage, killing of livestock and attack on humans causing a fear among local population specially women and children. The situation has gone from bad to worse, so much that in some areas, violent retaliation has led to persecution of the conflict species. In order to avoid this, the best possible way is to ensure that the confrontation between humans and wildlife brought down to a minimum. As this conflict is increasing with every passing day, there is an urgent need to mitigate this conflict by implying a mix of traditional and modern methods. WWF-India project supported by DST under TIME LEARN programme is a step in this direction. Currently under this project various traditional and modern methods are being implemented in combination so as to develop a model to deal with human-wildlife conflict in mountain areas on pilot basis. One key intervention proposed under this project is the installation of the solar electric fence. The electric fence, along with some other technologies, is being pilot tested for its potency in warding off the conflict animals.

Project Area

The area where this fencing has been installed lies in the village *Dhar Sakri* located in the Pir Panjal region of Jammu and Kashmir. *Dhar Sakri* is located right on the edge of the forest which is dominated by oak trees. The settlements are more or less dispersed along the hill slopes close to the forest. A majority of the local community is poor and dependent on the forests for wood and minor forest produce. The local communities practice subsistence agriculture on whatever little land they have. The major rabi crop is wheat while kharif crops are maize and paddy. The people also rear livestock and poultry.

The area is home to black bear and common leopard which frequently visit the village and pose a constant threat to the life and property of the villagers. In the wake of depleting prey-base, leopard finds it easy to prey on dogs and livestock owned by the villagers and at times, also attacks humans. There have been many cases of leopard attacks on humans in this area. The black bear is a bigger problem in that area than leopard. They frequently visit the maize fields before going for their winter torpor. They can destroy acres of maize fields in just a couple of days leading to a significant economic loss to the poor villagers. No human has courage to confront an animal as ferocious as a black bear and the only solution available to the villagers is making noise to drive them away. Considering this as an opportunity, WWF-India proposed to test the potency of solar electric fencing in driving away the black bear and leopards.

Following this, J&K's first ever solar electric fencing was installed in *Dhar Sakri*.

Solar Electric Fencing

A solar electric fencing is a potent, non-lethal method of driving away the conflict animal without coming in direct confrontation with the animal. Despite seemingly a physical barrier, the solar electric fence is more of a psychological barrier as it delivers a memorable shock to the animal when it comes in contact with the fence. After getting the shock, the animal makes a mental connection between the fence and the shock and would try to avoid making any contact in future. A solar electric fence is primarily a wire fence which has a current source, an energizer, attached to it. The fence also has solar panels which charge the batteries which further power the energizer. A set of hooters is also connected to the fence which set off as soon as the fence is touched by any animal. The alarm by hooters alerts the people about the intrusion attempt by some animal. A solar electric fence is customizable with respect to the type and power of energizer.

In *Dhar Sakri* village, the electric fencing has been installed around the land of a woman, Smt. Krishna Banti. The beneficiary is a widow and has three sons. This family of four is dependent on their land to feed themselves. She grows wheat and maize on her agricultural land. While she is able to reap a good harvest of wheat, a large portion of her maize crop is completely destroyed by the black bear every year. Black bear totally destroy the crops, while they eat the cobs, they tear apart the maize plants which are sued as dry fodder for the cattle during the winters. Not just the maize, the bears have also been coming for the walnuts. Last year, she had to harvest all her maize before the crop could even ripen.

On the pilot basis, a 400 meters long solar electric fence has been installed around her land to see if such a fence is helpful in tackling the human-wildlife conflict.To test the positive implications of solar electric fencing on its effectiveness to deal with conflict related issues WWF field team has simultaneously initiated a study wherein we are collecting data about the numbers of cases related to conflict in fenced area and nearby by area where there is no fencing. Considering the steep mountain terrain the initial data on the effectiveness of solar electric fencing is encouraging and has helped to reduce human-wildlife related cases of conflict. Moreover, the local women folk works in the field with lot of confidence and without any fear. Although in the long run fencing may not be the only feasible option to deal with human-wildlife conflict but it will certainly control many of the species which locals consider as problematic. In the long run project focus is to design an effective management strategy and such solar fencing is a vital component of the same.

Conclusion

Apart from the testing of different technologies, a strong awareness component is also very vital and thus WWF has launched a massive awareness campaign as well. The key focus of this campaign is to engage the local communities and to make them part of this conflict mitigation strategy. Such awareness is very important especially for the women folk and children who on many occasions are most vulnerable to the attacks by wild animals. This campaign is providing them the basic skills so that they remain alert while venturing inside the dense forests in the project area.

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Western Himalayas Landscape, WWF-India

Panel Discussion on Technology Connect for Green Growth in Mountain Areas; Addressing Sustainable Development Goals (SDGs) & Up Scaling TIME-LEARN Initiative of SEED, DST

The Panel Discussion on "**Technology Connect for Green Growth in Mountain Areas: Addressing Sustainable Development Goals (SDGs)**" was organized by the Science for Equity Empowerment and Development (SEED) Division, Department of Science and Technology (DST), Govt. of India, New Delhi during Group Monitoring Workshop for ongoing DST-SEED, TIME-LEARN network program held in Shimla on 3-4 Dec. 2018.

The Panel Discussion was attended by the officials of Govt., Scientists of universities and institutes, community based organizations, civil society and students participating in the GMW at Shimla from Uttarakhand, J&K & H.P.

Introduction

Globally, there are 17 SDGs that have 169 global targets linked with 232 indicators; 189-200 in the Indian targets to achieve SDGs and tracking indicators is quite important at the regional and national level.

The United Nations adopted three mountain-related targets under two of the 17 SDGs in September 2015. The three mountain-related targets are:

1. By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
2. By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and dry lands, in line with obligations under international agreements
3. By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development.

SEED Division, DST, Govt. of India through TIME-LEARN programme has planned a system contribution to this global agenda through networking of different stakeholders in three North-Western (NW) Himalayan States of India for Sustainable Development. This programme is focused in particular on the needs of the poorest and most vulnerable population with the participation of different knowledge institutional and field-based organization having S&T capacities. Indian Himalayan Regions (IHR) are rich in endemic species and provide basic ecosystem services such as fresh water, food, fiber, fuel wood, fodder, medicinal plants, minerals and scenic beauty. Whereas, NW Himalayas covering Uttarakhand, Himachal Pradesh and Jammu & Kashmir constitute >60% population of IHR.

The following were the objectives of the Panel Discussion

1. To obtain feedback on the work related to mountain specific technologies related to green growth & rural livelihoods for better quality of life in past efforts.
2. Systemic interventions: To identify and for-

malize strategic collaborations for macro level application of field tested technologies and prototype for TIME-LEARN programme in next phase with linkages & convergence to Planning and Development Departments of the State and National Government.

3. To finalize the programme structure and expected outputs of TIME-LEARN programme·
4. To formalize procedures for efficient implementation of TIME-LEARN programme.

Following comments and actionable points were delivered by the panellist at the concluding session of the panel discussion.

- *We need to examine the socio-economic transformation of the North-west Indian Himalayan Region and understand the issues of the mountains, not just economic but the social as well; and design interventions accordingly.*
- *The focus should be on generation of mountain specific technologies which have community acceptability and this can be achieved by community involvement in participatory mode. In this context TIME-LEARN Programme play a crucial role in easy access of technology to local communities.*
- *Defining and fulfilling the SDGs at the local levels and the need to bring about development in the mountains in a just and equitable manner needs emphasis.*
- *There is a need to preserve the indigenous traditional knowledge with scientific validation.*
- *The technologies need to be fabricated according to the villages need.*
- *Socio-economic surveys, problem and solution identification and need based assessments should be carried out with the active participation from the local communities.*
- *TIME-LEARN program serves as an important platform for knowledge sharing between the local and scientific community. An important aspect that needs to be considered is the output of this platform and the wider dissemination of knowledge.*

Panel discussion ended with vote of thanks to panellists, organizers and participants from J&K, Uttarakhand and Himachal Pradesh.

Major Events of TIME-LEARN Programme during the year 2018-19

1. Launched 20 Projects in the North Western Himalayan states (J & K, H.P., & UK).
2. Periodic field visits for community survey and data collection is being done for the year 2018-19.
3. Field visits of experts' team for different project sites for monitoring the progress of the project work.
4. Documentation of annual progress reports of projects under the programme for 2018.
5. The Annual Group Monitoring Workshop (AGMW) with Technical Advisory Expert Group (TAEG) committee was held on 3th -4th December, 2018 at Central Potato Research Institute (CPRI)-Shimla, Himachal Pradesh, and two brochures (i) TIME-LEARN Programme and (ii) **"सेब के जैविक और अजैविक विकारों का एकीकृत प्रबंधन"** were released during the inaugural session of the workshop.
6. Two awareness and demonstration workshops were organised at HESCO, U.K. and

Field Visit by expert members at Joshimath, Uttarakhand

Exhibition visit by the Additional Chief Secretary of H.P. and experts

Organized training for developing virus free elite mother block of apples in nako village of Kinnaur district, H.P.

In augural speech by the Chairman, TAEG committee, Prof. Tej Pratap

Introductory Remark by Dr. D. Dutta, Head, SEED Division, DST, New Delhi

Dharamshala, H.P. on date 28th April and 28th May, 2018, respectively.

7. The TIME magazine (2017-18) both in English and Hindi were published.
8. The TIME-LEARN website was updated regularly.
9. Exhibition of various mountain related technologies was organised during GMW at CPRI, Shimla on 3rd December, 2018.

The Annual Group Monitoring Workshop of TIME-LEARN Programme of SEED division, DST, New Delhi was held on 3rd – 4th December, 2018 at CPRI, Shimla, H.P.

Release of TIME-LEARN Programme brochure by Shri R.D. Dhiman, Additional Chief Secretary of Himachal Pradesh with TAEG Committee members and DST officials

Exhibition visit by experts

For any suggestion/comment please contact :

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