

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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Type of Bee Hives



Mud-Hive for Bee-keeping

Science for Equity, Empowerment & Development (SEED) Division, DST, New Delhi
&
Himalayan Environmental Studies & Conservation Organisation (HESCO),
Dehradun, Uttarakhand

Editorial

There is now growing realization of the urgency to translate research findings into practical applications for the benefit of the people. Accomplishment of this has several prerequisites. Crucial amongst these are assured continuity and coherence of research efforts in ways that ensure appropriate and effective end-uses of the research endeavors. Multidisciplinary research and development outputs need proper integration for their actual utility. Collaborative and complimentary research and development programmes involving education and research institutions as well as the voluntary agencies and the people are essential in the application of scientific and technological knowledge and infusing refinements therein according to the location and situation.

The fundamental philosophy of Technology Intervention for Mountain Ecosystem (TIME) programme in Himalayan region focused on two aspects i) arresting environmental degradation in the mountains and subsequent restoration of environmental quality and ii) promoting livelihood opportunities to the people living in these difficult situations. Thus, the main objective of such endeavors would be to ensure a sustainable and self-reliant socio-economic development with reduced dependence on external inputs or support, by strengthening existing, or opening new income generating avenues through locally available resources.

The primary shortcoming has been gaps between Science & Technology research outputs and their practical applications at the user level, where the actual felt needs lie. Realizing this gap and recognizing the crucial need for bridging it, thereby ensuring that the fruits of S & T research efforts are translated practically in the areas where they are actually needed, the TIME-LEARN Programme in Himalayan Region has been implemented by DST, SEED Division focusing on two broad thrust areas i) local need based technology development and research for mountainous region, and ii) technology demonstration and extension related to drudgery reduction, agri-horticultural development, tapping alternative source of energy and enhancing livelihood opportunities.

To address the above two thrust areas, DST has implemented 20 projects during 2016-17 in the North-western Himalayan states of the country. The success stories and technologies related to the outcome of these projects are being published in TIME magazine for wider dissemination.

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Dr. S.S. Samant, GBPIHED, Kullu	Prashant K. Sharma & Manish Rathor

Energy Innovation for Domestic Needs in Remote and Tribal Valley of Zaskar under Ladakh region of Kargil District in Jammu and Kashmir

Purpose of the programme and project :

The level and pattern of energy consumption in any region or country is considered an index of its standard of living and developments. Ladakh region of J&K is cold desert and dung is the only source of energy in rural houses for cooking, water and space heating. Women toil hard to collect dung from grazing land and livestock sheds and store dung cakes for use in



Women collecting dung in Zaskar

winter. LPG and electricity are not helpful due to freezing temperature of -30°C during peak winter from December-February and dung cake is the only source of energy in villages of this remote valley. Burning of dung as source of energy deprive agriculture land of manure and result in poor productivity which restrict cultivation of traditional crops of Oat, barley and wheat.

Science for Equity Empowerment and Development Division (SEED) Division, Department of Science and Technology (DST), Government of India formulated a programme, Technology Intervention for Mountain Ecosystem (TIME) to address location specific needs of the community. Under this

programme one of the projects was designed to address domestic energy needs of tribal households in remote Zaskar Valley under Kargil District of Ladakh Region in J&K. Genesis of the project was initiated by Dr Tej Partap, the then Vice Chancellor of the Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST) Kashmir who was aware of needed technology standardization by the Himalayan Research Group (HRG) at Shimla in Himachal Pradesh which is one of the Core Group of the DST-SEED. Scientist-in-Charge of the Highland Agricultural Research and Extension Station (HAERS) at Padum of SKUAST Kashmir was deputed for three months training at HRG Shimla with condition that he will formulate a collaborative project with HRG to take customized solar water and space heating technology developed and tested in Himachal Pradesh by HRG Shimla under Core Support Programme and other DST supported projects to Zaskar. Three technologies namely solar panel for water heating, solar panel for space heating and preparation of silage of green fodder for livestock nutrition were selected for implementation keeping in view the basic needs of the community in Zaskar. Project was formulated and funded under DST-SEED-TIME-LEARN programme for support in July, 2016.

Technology gap areas (like water, energy, diversified agriculture, NTFP value addition and so on) and interventions carried out, geographical coverage area with location map :

Technological interventions in the valley are lacking and most of the population lives on traditional and subsistence agriculture/Livestock rearing technology. This is the first



View of Padum Administrative Headquarter of Zaskar Valley

ever intervention in the valley to provide innovative solutions at the household level to meet domestic needs of energy for water and space heating to improve tribal life. Administrative headquarters of Zaskar Valley at Padum is 240 Km from District headquarter at Kargil. Road is rough and difficult to drive and takes about 12 hrs to reach Padum from Zaskar. 156 solar panels (88 Water heating and 68 room heating) were transported from HRG field station at Mandi in Himachal Pradesh through eight passes including world's second highest pass Tanglangla at an altitude of 17582 feet in six days. Two demo panels one each for water and space heating were installed in September 2016 for observation of their performance in this climate with data loggers. In total 158 panels were installed in around 10 villages of Zaskar Valley with demo at HRES SKUAST (K) as per details presented in table-1.

Table - 1 Solar water and space heating panels installation in villages of Zaskar Valley, J&K

Sr. Villages No.	Solar Room Heaters	Solar Water Heaters
1. Padum	31	59
2. Shila	8	20
3. Ubarak	7	6
4. Salapi	6	0
5. Stara	1	0
6. Sani	2	0
7. Dena	5	3
8. Marutse	2	0
9. Ufti	5	0

10. Kisharak	1	0
11. SKUAST HARES Demos	1	1
12. Total	69	89

Source: HRG and SKAUST-K Data 2017.

Sunshine in this region is quite intense and clear for around 300 days and can be one of the major source of energy to meet domestic needs of the community during maximum period of the year. The government has initiated installation of solar station to provide electricity in different villages but serve the only purpose of the lighting. Other needs of cooking, space and water heating are solely met through dung. Popularization of commercial solar water heating system of evacuation tube model can be seen installed by few well off households in the valley but is not successful and tube cracking in winter is quite common and fails to repair. Burning of dung in households produce lot of smoke and leakage in living space effect human life on the long run and deprive agriculture fields of organic manure which result in poor agriculture productivity. This lack of nutrition in soil is the reason to grow only traditional crops of Barley and Wheat and few vegetables.

Specific features of interventions :

HRG solar panels for water and space heating were designed to suit specific climate and



Installation of Solar Water Heating Panel in Household of Zaskar Valley



Installed Solar Water Heating Panel in Household of Zaskar Valley

community conditions in the remote Zaskar Valley of Ladakh region. Fabrication of solar water and space heating panel of locally available material by the local artisan (carpenter) is cost effective and quite innovative with least post installation maintenance. Solar panels are fabricated on wood frame available in local households. Other material used in this is galvanized iron (GI) sheet as absorber and Galvanized Iron (GI) Pipe/ Aluminum alloy coil (3.75- 4.0 cm internal diameter) with inlet and out let connection for water on two ends. Absorber GI sheet is fixed in the centre of wood frame. Backside of the absorber sheet is insulated with thermocol sheet (3.75 cm) glued with bitumen and covered on outer side with thin aluminum sheet for protection. On the front illuminated side of the absorber sheet is fixed with GI or aluminum water coil with reducers (2.5 cm) to outlet and inlet of water protruding through the wood frame for cold water and hot water connections. Absorber sheet and aluminum water coil are coated with black paint having fine carbon powder produced locally from specific wood which increased efficiency of solar energy absorption. At the top of coil panel it is coved with two layers of window glass (4mm) having 1.25 cm distance between to hold air for insulation. Panel is installed at 45° angle on the roof top facing south.

Panel coil hold 18.0 liters of water and is heated to 70-80°C within 30-45 minute of solar illumination. Household member can draw 100-



Installed Solar Space heating Panel in Household of Zaskar Valley

120 liters of hot water in clear sunny day for household purpose without burning fire place for water heating. In high altitude sun is more bright (>250 sunny days/year) and intense in winter than plains and at the same time at high altitude boiling point of water is low. These conditions promote efficiency of this system to maximum and replacement of GI pipe coil design with aluminum tube coil improves quality of hot water and is of potable quality and can also be used for cooking. Specially designed cold water inlet with antifreeze and silt drainage outlet was fitted for better efficiency with manual filling during winter in absence of piped water supply is not available.

Solar space heating panel is same as that of solar water heating panel without water coil. The panel is fixed on south facing wall of the living room with air vent at the lower and upper end. When black absorber sheet of the panel is heated with sun through glazing air between glazing and absorber sheet is heated and moves up and enter through upper vent in living space. Vacuum is created between glazing and absorber space and cold air enter here from room. This way an air siphon is created and the room air is heated to a comfortable level without any active use of energy. Therefore, this panel is also known Thermosyphoning Air Heating Panel (TAP).

Impact Indicators with base line: Social, livelihood, quality of life, community view and ecology :

Panels installed during 2016 were observed for their efficiency in the winters of 2016 with pre-installation of data loggers for observation of performance of space heating panel in November 2016 for temperature recording. Data loggers installed for climate temperature, room fitted with solar space heating panel and room without panels were retrieved during this visit on July 20, 2017. Data loggers recorded minimum climate temperature of -26°C on February 11, 2017 at 7AM. This time room with solar room heating panel was at -4.1°C and room with dung heating stove was at 5.2°C. Dung stove was burning 50-60 Kg dung/day and inmate mentioned that room with solar panel was comfortable to sit during the day when there was sun shine in winter. This statement is verified with data from data logger that during the day at 3 PM on February 11, 2017 when minimum climate temperature was recorded room with solar panel was at 8.9°C and control room with dung heated stove was at 13.5°C. This was only a difference of 4.6°C. Household inmates accepted this as effective technology for space heating in winter and anticipated with result in 35-40% reduction in dung burning for space heating.

Similarly the water heating panels were evaluated for performance this year during stay of HRG team for installation at Zanskar. It is observed that cold water from 11°C was heated to maximum 84°C in 35 minutes and panel dispensed 120 liters of boiling hot water till 2 PM on July 28, 2017. Data loggers for performance of water heating panels were installed on July 2017 and will be removed next year for downloading of data to complete evaluation of the panel efficiency for water heating. Intensity of sun will increase in winter and efficiency is bound to increase. Community members were amazed to see hot water flowing from the panel outlet without burning of fuel or electricity connection.

This energy intervention is expected to save 3-4 hours of women in dung collection with 35-40% dung saving in winter months. Availability of hot water and heated space will reduce level

indoor pollution and general hygiene of tribal people through regular bathing and washing of cloths. Intervention will be immensely contributing in terms of mitigation of household emission from dung burning and process for quantitative measurement is in process.

Involvement of local Panchayat :

Locally Ladakh Development Council (LDC) of District Kargil members decide the development work of the valley. During the project implementation elected and nominated members of the LDC were consulted and took keen interest in installation of the solar water and space heating panels in 158 households. Local leaders of both the religions were also taken into confidence to avoid any social conflict. There was demand from almost every household for installation of panels but LDC members, religious heads and 'nambardars' were of great help in amicable installation. Success and interest created in technology will help in further advancement of the technology through other development programme under tribal sub plan and Government programme in future.

Value addition in building S&T capacities locally and for resources :

People are quite interested in learning and adopting new techniques and skills. During installation of solar panels and demonstration of silage preparation people observed the methods seriously and exhibited interest



Distribution of Solar Panel in Presence of Councillor at Padum Zanskar Valley

through installation of panels and silage preparation in their respective houses after demonstration. Everyone in the valley is ready to learn some new skills to improve their living conditions and make life comfortable.

Exit strategy: ownership at local level and replicability :



Installed Solar Water and Space Heating Panels in HARES SKUAST (K) at Padum

During project activities efforts were made to motivate local youth and artisans to include space heating panels in houses while constructing as integrated system in place of retrofit. Six panels were installed in under construction houses to popularize the technology and make this a permanent feature of house construction in the valley to provide thermal comfort to the household inmates in winter months. Simple, customized and cost effective technology of space heating panel will be adopted by the people with its performance in this winter season. Further orientation of community in follow up after one year during June-July 2018 will further help community adoption and sustaining the programme. In case of water heating panel availability of water heating coil is the main constraint in this area. Therefore, orientation of traders and artisans was done to source this through HRG Shimla for fabrication. It is expected that result of water heating panel this season will determine the further adoption of the panel for sustaining this technology to tide over the harsh winter months.

Installation and display of HRG fabricated solar water and space heating panel in the premises of HARES SKUAST at Padum will go a long way in demonstration of this technology and orientation of the visiting community members for adoption not only in this valley but also in other areas of J&K state as well.



Sitting on Chair from Left to Right: Mr. D.K. Thakur, Project Coordinator, HRG Shimla, Dr. Lal Singh, Director HRG and PI Zanskar Project, HRG Shimla, Dr Rizwan Rashid, PI, Zanskar Project, HARES SKUAST (K) at Padum, Zanskar, Mr. Mohd Javaid, Coordinator, Zanskar Project, HARES SKUAST (K) at Padum, Zanskar
Standing Left to Right: Mr Ghulam Din, Field worker Zanskar Project HARES SKUAST (K) at Padum, Zanskar, Mr. Om Prakash, Assistant Artisan, HRG Shimla, Mr Bodh Raj, Assistant Artisan, HRG Shimla, Mr. Harish Chander Master Artisan HRG Shimla, Mr. Dipal Singh Master Artisan HRG Shimla

Acknowledgements :

Team of HRG Shimla and SKUAST Kashmir are grateful to the DST-SEED-TIME-LEARN programme and HEAD DST-SEED and Coordinator Scientist of DST-SEED-TIME-LEARN for financial support and regular motivation to implement this programme in this remote and difficult valley of Ladakh.

Dr Lal Singh and D.K. Thakur
Himalayan Research Group (HRG) Shimla, H.P.
Dr Rizwan Rashid and Mohd Javaid,
Highland Agricultural Research and Extension Station (HAERS) at Padum of SAKUAST, Kashmir, J&K

Development of Low Sugar/Calorie Amaranthus Biscuits

Introduction :

Overweight and obesity have long been regarded as the main driver of type-2 diabetes and other health-associated risks. Fervent changes in the quality and source of food consumed along with a high level of mental stress and sedentary lifestyle have led to an increase in the prevalence of these non-communicable diseases. In order to limit the prevalence of diabetes and coronary heart diseases, it is recommended to reduce the calorie intake through sugars and saturated fatty acids. The food industry has focused for the last couple of decades on the production of low-fat/low-calorie, high-fiber foods in response to public interest for these functional products. Biscuits are the most popular bakery items because of their high nutritive value, ready-to-eat nature, and easy availability in different shapes and sizes at an affordable cost. Here, the idea was to formulate a functional biscuit containing valuable nutrients from traditional millets in addition to reduced sugar calories. Incorporation of amaranthus flour increases the nutritional profile of the products as they are a rich source of proteins, dietary fiber & trace minerals. As the sweetener plays an important role in providing flavor, appearance, color, taste, and dimension to the finished product, due to prevalence of diseases like diabetes and obesity, the use of artificial sweeteners as a sucrose substitutes for the development of low-calorie products has been the focus of R&D in the recent past. But now a days these are being discouraged because of suspicion that they may have some harmful side effects. So, here we have tried Stevia powder (Steviol Glycosides) in place of sugar which have zero calories and do not raise blood glucose levels.

Methodology : Broad methodology was as follows :

Preparation of Biscuites :

The methods & materials followed in experimentation are presented under the following heads namely – (A) Processing methods, (B) Analytical methods (C) Sensory Evaluation by panelists.

(A) Processing Methods :

There are several steps involved in the process of biscuit making. These biscuits were prepared in the laboratory at unit of STD. Amaranthus seeds were procured from local farmers.

Technique of making biscuits

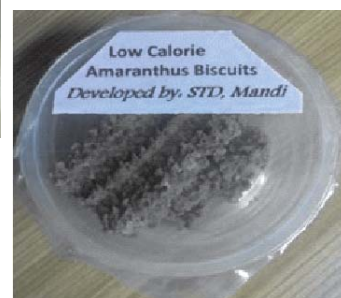
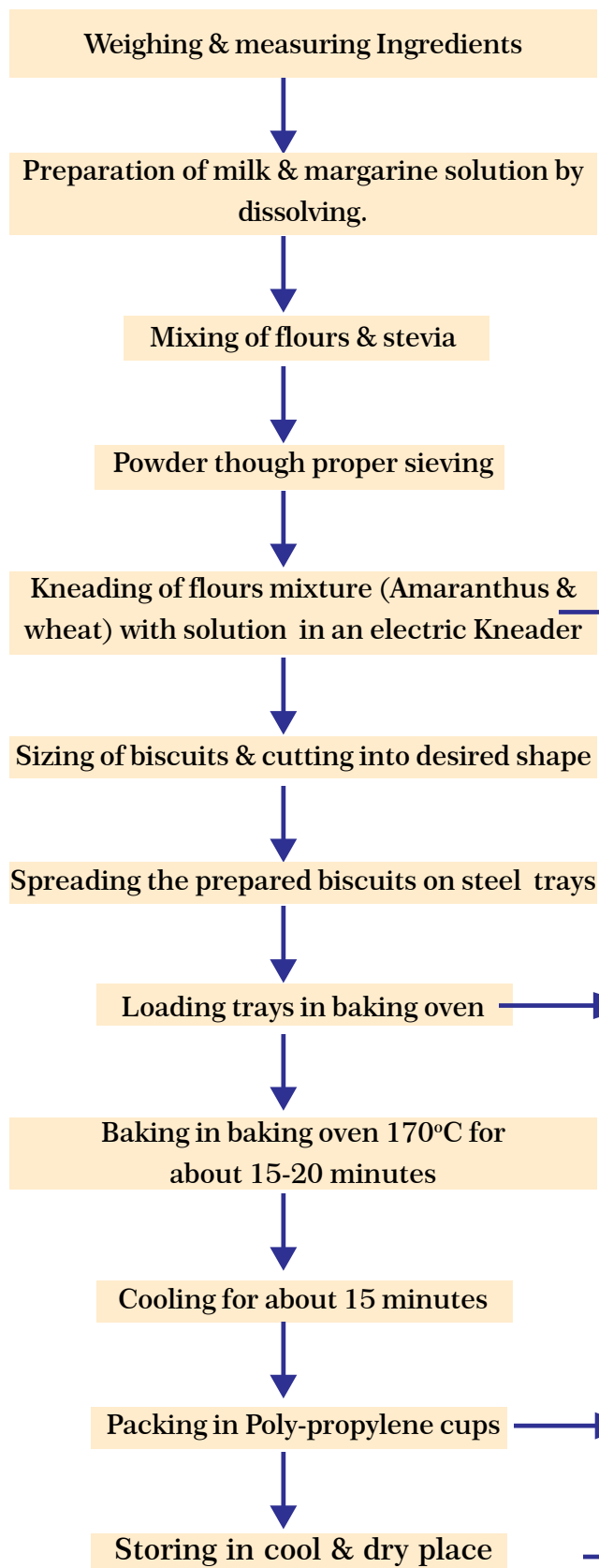
The steps involved in making biscuits using wheat flour & flour of amaranthus along with the proportions of the ingredients are given below. We have not used any other chemical / leavening chemicals.

Ingredients	Quantity
Wheat flour(kg)	1.0
Amaranthus flour (kg)	1.0
Stevia Powder(gms)	8.0
Margarine/Bakery shortening (kg)	0.64
Milk (Lit.)	0.8



Amaranthus plant

Method of making biscuits :



(B) Analytical Methods :

Physico-Chemical Analysis :

As moisture is the major physico-chemical parameter which contributes to quality of biscuits during storage, so the moisture content was determined using oven drying method during storage. Shelf life study was carried out for 6 months. The following table shows the moisture content of biscuits during storage.

Results & Discussion -

Moisture content (%) : (Packed in Poly-propylene cups) :

(1) At ambient/room temperature (°C)							
At zero time	After 1 month	After 2 month	After 3 month	After 4 month	After 5 month	After 6 month	After 7 month
6.5	6.8	7.1	7.3	7.4	7.7	7.9	8.2
(2) At accelerated conditions (35-37°C)							
At zero time	After 1 month	After 2 month	After 3 month	After 4 month	After 5 month	After 6 month	After 7 month
6.5	6.6	6.8	7.2	7.3	7.6	7.7	7.8

From above table, it is evident that there is not much increase in moisture contents of biscuits during storage at both conditions.

(C) Sensory evaluation of the products by panelists :

Since sugar in these biscuits had been replaced by Stevia powder which would have some effect on the shelf life & acceptability of biscuits. Thus Acceptability of the biscuits was subjected to sensory testing by a panel of 5 semi-trained panelists. A score card with 10 point scale for colour & appearance, taste & flavour, texture and over all acceptability was used. In all these tests, samples scored above 7 were rated as acceptable.

Results and Discussion -

From sensory evaluation, it was found that after 7 months of storage at both conditions product quality was satisfactory as average score given by panelists was well above 7. Although after

7th month product quality was declining due to slight change in taste & overall acceptability is just satisfactory. Although, colour, appearance & texture were in good remarks. This all difference is perhaps because it contains no sugar & due to Stevia powder used which gives slightly different taste as compared to cane sugar. In spite of this, product is very much liked by elder people keeping in view its low sugar content property. Thus, we can keep this low sugar product in best state at least for 6 months.

Nutrients Composition Analysis :

To have comparison for nutritional status especially sugars (Total, reducing & Non reducing) & calorific value of these biscuits with already manufactured Amaranthus biscuits made from sugar samples were got analysed for moisture content, TSS, Protein, Carbohydrates, Iron, Ash content, Sugars & calorific values at Central Food Technological Research Institute (CFTRI), Mysore.

Report of which is attached below :

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

सी एस आई आर- केन्द्रीय खाद्य प्रौद्योगिकी अनुसंधान संस्थान, मैसूर - 570 020
CSIR-Central Food Technological Research Institute
Mysore - 570 020, INDIA

TEST REPORT

FS AQCL/ATSF 05/CSC 313(1-2) / 2016-17 11.04.2017

Name & Address of the Customer : M/s. Society for Technology and Development
Vill. Malori, P.O. Belhna, Teh. Sadar, Distt. MANDI (H.P.) - 175 006

Request Reference : Your letter Ref. No.: STDF/CORE/10080
Date: 07.03.2017

Name of the Product/Sample : Biscuits Samples :
1) S-1 (Low Calorie Amaranthus Biscuits)
2) S-2 (Standard Amaranthus Biscuits)*

Sample Receipt Date : 13.03.2017

Certificate No. F- 9279 & T- 9385
Page 1 of 2

SAMPLE NOT DRAWN BY US

SL. No.	Parameters	Samples (1) (2)	Test Method
1	Moisture, % by wt.	9.22 4.88	AOAC 20 th Ed. 2016, 925.45
2	Total Ash, % by wt.	1.60 1.12	AOAC 20 th Ed. 2016, 923.03
3	Fat, % by wt.	21.7 22.2	AOAC 20 th Ed. 2016, 932.06
4	Protein Content (N x 6.25), % by wt.	11.73 7.92	AOAC 20 th Ed. 2016, 984.13
5	Crude fiber, % by wt.	1.77 1.31	AOAC 20 th Ed. 2016, 962.09
6	Carbohydrates (by difference), % by wt.	54.0 62.6	Nutritive value of Indian Foods, Gopalan C. et al; NIN, ICMR, 1996
7	Calorific value, (K.cals/100gm)	458 482	

* Information as given by the customer.

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

Ashta Martin
HEAD
Food Safety & Analytical
Quality Control Laboratory
CFTRI, MYSORE

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

सी एस आई आर- केन्द्रीय खाद्य प्रौद्योगिक अनुसंधान संस्थान, मैसूर - 570 020
CSIR-Central Food Technological Research Institute
 Mysore - 570 020, INDIA **cftri**

TEST REPORT

FS AOCL/ATSF 05/CSC 313(1-2) / 2016-17 11.04.2017

Name & Address of the Customer	M/s. Society for Technology and Development Vill. Malori, P.O. Behna, Teh. Sadar, Distt. MANDI (H.P.) - 175 006	 Certificate No. T-2576 & T-2580
Request Reference	Your letter Ref. No.: STD/CORE/10080 Dated: 07.03.2017	
Name of the Product/Sample	Biscuits Samples : 1) S-1 (Low Calorie Amaranthus Biscuits) 2) S-2 (Standard Amaranthus Biscuits)*	
Sample Receipt Date	13.03.2017	Page 2 of 2

SAMPLE NOT DRAWN BY US

Sl. No.	Parameters	Samples		Test Method
		(1)	(2)	
1	Total Reducing Sugar Content (TRS), % by wt.	6.2	29.8	AOAC, 20 th Ed. 2016, 968.28
2	Non-Reducing Sugar (Sucrose) Content, % by wt.	2.0	25.7	
3	Calcium, mg/100g	50.2	57.0	AOAC 20 th Ed. 2016, 985.35
4	Iron, mg/100g	2.89	3.30	
5	Potassium, mg/100g	200	173	
6	Phosphorous, mg/100g	258	166	

*Information as given by the customer.
 Please Note: The results contained in this Test Report relate only to the sample tested. This Report is intended only for your guidance and not valid for legal purposes or for advertisement.

Asha Mehta
 HEAD
 Food Safety & Analytical
 Quality Control Laboratory
 CFTRI, MYSORE

Analysis Report of Low sugar/calorie & standard Amaranthus biscuits.

From above reports it can be concluded that Total reducing sugar (TRS=6.2%) & Non-reducing sugars (sucrose= 2.0%) level in low calorie biscuit are very-very less as compared to standard biscuits, where its levels are 29.8 % & 25.7 % respectively. Also in low calorie biscuits, other desired functional parameters such as total ash, protein, crude fiber, K & P are also higher & un-desired parameters (fats, carbohydrates & calorific value) are lower than in amaranthus biscuits. Thus this product if introduced, could be beneficial to the elder people & people suffering from blood sugar problem.

Bhopinder Mehta,
 (Scientist In-charge)

Society for Technology & Development(STD),
 Vill. Malori, P.O. Behna, Tehsil Sadar,
 Distt.Mandi (H.P.) - PIN 175006

Ph.: 01905-246154-55, 094598-73461 Fax:246154

Email: stdpsn@yahoomail.com,

stdmandi@gmail.com

Website: <http://www.stdruraltech.org>

Grow Vegetable in backyard for Nutritional Security

Vegetables are grown in backyard for household use. Since early times a small plot near to the house has been used for growing a variety of vegetables according to the season. Local varieties such as radish, broad leaf mustard, chilli, beans, pumpkins etc. are all grown in the kitchen garden. Vegetables are a very important part of a good diet as they contain various nutrients for many body functions. For growing, energy and protection against disease, vegetables play an essential role. Vegetables are especially important for the young, and for pregnant and nursing women.

Vegetable gardening is not accidental. It is the combined result of planning, constant care and the will to grow healthy vegetables. Many factors contribute to successful gardening. The recommendations contained in this article are for kitchen gardens/ school garden/ community gardens etc. they may, however, be suitable for growing vegetables for commercial use also.

There are many advantages of vegetable kitchen gardening which are as below :

Healthy - because of fresh air, exercise, sunshine and mineral and vitamin rich food,

Wealthy - because of help to the family budget and personal savings, and

Wise - because fresh and quality vegetables are available whenever needed; you can save time in purchasing from the market.

Above all, enjoying fruits of labour is a rewarding experience.

Cropping Sequence :

Summer Season - Planting Time: Jan-March

crops - Amaranthus, Bittergourd, Bhindi, Bottlegourd, Brinjal, Capsicum, Chilli, Cowpea, Cucumber, French Beans, Guar, Muskmelon, Pumpkin, Ridge and Sponge gourd, Squashes, Tinda, Tar-Kakri, Tomato, Watermelon.

Kharif Season - Planting Time: June-July.

Crops - Amaranthus, Bittergourd, Bhindi, Bottlegourd, Brinjal, Chilli, Cauliflower (Early), Cucumber, cowpea, Dolichos, Guar, Ridge and Sponge gourd, Tomato.

Rabi Season - Planting Time: Sept-Nov.

Crops - Beet Root, Brinjal, Cabbage, Cauliflower (Mid and Late), Chinese Cabbage, Carrot, Knoll-Khol, Lettuce, Methi, Mustard, Onion, Palak, Peas, Potato, Radish, Tomato, Turnip.

Planning - The size would depend on the area available and the size of the family. To meet the demand of vegetables for an average family of 5-6 members; 200sq. meters will be sufficient. If the area is smaller it is preferable to grow a few selected vegetables.

Selection of site - Select a plot of good, and well-drained soil having water supply facility. It should be close to the home for convenience but should not come under shade of tall buildings or trees. Enclosing the garden with a fence is usually profitable.

Lay-out - many gardeners find it helpful to draw out on paper the location of each row and the crop or succession of crops to be planted. The land should be laid out preferably in small beds of 9 sq. meters with small irrigation channels.

Crop Requirements :

The suitable vegetable varieties, sowing and planting, spacing periods of harvest and expected yields are presented in table 1 and 2 respectively.

Manures & Fertilizers :

Organic manures - 2-3 baskets of well-rotten farm yard manure or well decomposed sludge manure should be added to each bed of 9sq. meters in the soil before soil preparation.

Chemical fertilizers – for each bed of 9 sq. meters a basal dose of 400 gm Superphosphate, 200 gm Ammonium Sulphate or Calcium Ammonium Nitrate and 70 gm of Potassium Sulphate may be added in the soil before preparation for sowing. In addition to basal dose, the crop should be top dressed 2-3 times depending upon the condition at the rate of 100gm each bed Ammonium Sulphate or Calcium Ammonium Nitrate every time.

Application – Broadcast the fertilizers uniformly in the beds and mix thoroughly in the soil before raising the crop while top-dressing should immediately be followed by irrigation.

Soil Preparation :

Dig the soil well or plough the land at least 2-3 weeks before planting. Re-work the secure a fine firm seed-bed for planting.

Raising Nursery :

In some crops like Tomato, Brinjal, Chilli, Cabbage, Cauliflower, Knol-Khol, Onion etc., it is desirable to sow the seeds in the nursery in well-prepared raised beds. Seeds should be sown thinly in lines 5 cms apart at the depth of 1-1.5 cms. Water the nursery beds after sowing with fine sprinkler. Flooding should be avoided at all times. Protect the nursery from hot sun, heavy rains and frost. A light dose of Ammonium Sulphate or Calcium Ammonium Nitrate (CAN) may be applied in the nursery by putting one handful of fertilizer in one bucketful of water to promote the growth of seedlings at the time of watering.

Irrigation :

Whatever the method used, it will be best to wet the soil thoroughly once in a week rather than to apply several light sprinklings.

Inter-cultivation :

The primary purpose of inter-cultivation is to control the weeds. This can best be done by shallow cultivation when the weeds are quite small.

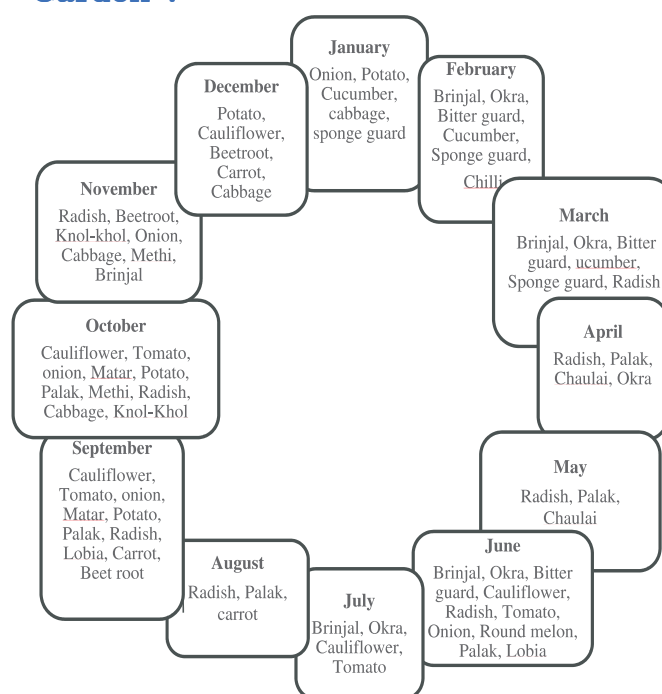
Insect and disease control :

Kitchen garden needs to be cleaned and infected part of plant/plants should be removed from bed otherwise it will affect the other crops also. If require some organic and fungicides may be sprayed for control.

Harvesting :

The frequent harvesting should be done at marketable stage. The marketable fruit should not keep on the plant otherwise further fruit setting will be decreased significantly.

Crop rotation in model Kitchen Garden :



Seed Requirement in model kitchen garden in 10 m² Area:

Crop	Seed req.	Crop	Seed Req.
Radish	10g	Cauliflower	5g
Carrot	20g	Cabbage	5g
Beet root	10g	Chilli	5g
Palak	50g	Tomato	5g
Methi	20g	Lobia	20g
Onion	10g	Cucumber	5g

Table-1 Varieties

SI No.	Crop Variety
1. Amaranthus	Chhoti Chaulai, Pusa Kiran, Pusa Kirti, Arka Sugna
2. Beet Root	Detroit Dark Red (DDR), Early Wonder, Crimson Globe
3. Bitter Gourd	Pusa Domosami, Pusa Vishesh, Coimbatore Long, Pant Karela-1, Pusa Hybrid-1
4. Bottle Gourd	Pusa Summer, Prolific Long, Pusa Naveen, Arka Bahar, Pant Sankar Lauki-1, Pant Sankar Lauki-2
5. Brinjal	Pusa Purple Long, Pusa Kranti, Pusa Hybrid-5, Pusa Hybrid-6, Pant Rituraj, Pant Samrat, Pant Brijal-4
6. Cabbage	Golden Acre, Hybrid-10,20,30,40 & 50, Pride of India
7. Capsicum(Simla Mirch)	California Wonder,, KT-1 Hybrid, Swarna, Natasha, Indira
8. Carrot	Pusa Kesar, Pusa Meghali., Nantes, Pusa Yamdagni, Arka Suraj
9. Cauliflower (Early)	Pusa Deepali, Early Synthetic, Pant Gobhi-2, Pant Gobhi-3
10. Cauliflower (Mid- season)	Improved Japanese, Pusa Synthetic, Pusa Early Synthetic, Pusa Himjyoti
11. Cauliflower (Late)	Pusa snow Ball Katrain-1
12. Chillies	Pant chilli-1, X-235, Pusa Jwala, Pusa Sadabahar, Punjab Lal, Punjab Surkh, Kashi Anmol
13. Cluster Bean(Guar)	Pusa Navbahar, Pusa Sadabahar, Pusa Mausmi
14. Cowpea	Pusa Barsati, Pusa Komal, Pusa Phalguni,
15. Cucumber (Khira)	Poinsette, Pant Sankar Khira-1, Swarna Ageti, Pant Khira-1, Pusa Uday
16. Dolichos Bean (Sem)	Pusa Early prolific, Pusa Sem-3, Kashi Shakti (VRP-7)
17. Fenu Greek (Methi)	Pusa Early Bunching, Pusa Kasuri, Hisar Sonali
18. French Bean	Contender, Arka Komal, Pant Bean-2, Pant Anupama (UPF-191), Arka Garima, Pusa Rituraj
19. Knol-Khol	White Vienna, Early Purple Vienna, Early White Vienna
20. Lettuce	Chinese Yellow, Great Lakes, Punjab Lettuce-1

21	Muskmelon	Hara Madhu, Pusa Madhuras, Punjab Hybrid, Pusa Rasraj (F ₁ Hybrid)
22	Okra (Bhindi)(Lady's Finger)	Pusa Sawani, Arka Anamika, Parbhani Kranti, P-7, Hybrid-8 (Co-3), Varsha Uphar, VRO-5
23	Onion	Pusa Red, Nasik 53, Pusa White Round, Pusa White Flat, Arka Bindu, Agri Found Dark Red (AFDR)
24	Peas	Arkel, Bonneville, Lincoln, Azad-1, Pant Matar-2, Pant Sabji Matar-3
25	Potato	Kufri Badshah, Kufri Chandramukhi, Kufri Jyoti, Kufri Bahar
26	Radish	Pusa Chetki, Pusa Rashmi, Chinese Pink, Japanese White, Pusa Himani
27	Palak	All Green, Pusa Jyoti, Pusa Bharti, Punjab Green
28	Sponge Gourd	Pusa Chikni, Pant Chikni Torai
29	Ridge Gourd	Pusa Nasdar, Pant Torai-1, Satputia, Swarna Manjari, Swarna Uphar
30	Tinda	Ludhiana (S-48), Arka Tinda
31	Tomato	Pusa Ruby, Pusa Early Dwarf, Roma, Punjab Chhuara, Arka-Vikas, Pusa Hybrid-1, Pusa Hybrid-2, Pusa 120, Pusa Sheetle, Pusa Gaurav, Pusa Red Plum, Arka Saurabh, Arka Abha, Arka Ahuti, Arka Aeghali, Sioux, Best of all,
32	Turnip	Purple Top White Globe (PTWG), Pusa Swarnima, Pusa Kanchan
33	Watermelon	Pusa Bedana, Ashai Yamato, Arka Jyoti (F ₁ Hybrid)

Table -2

PLANTING REQUIREMENT FOR VEGETABLE KITCHEN GARDENING

Sl No.	Crop	Sowing time	Transplanting time	Seed rate for 9 sq. mts. (gm)	Sowing method	Spacing in between (cms.)		Depth of sowing (cms.)	Period of harvest	Yield per 9 sq. mts. (kgs.)
1.	Amaranthus	Feb-July	-	15	To be sown in rows or broadcast	Rows	Plants	1-1.5	April-Oct	10-25
2.	Beet Root	Oct-Nov	-	30	Dibbling	30	10	1-2	Dec-Feb	25-30
3.	Bitter Gourd	Feb-March June-July	-	3-4 seeds/pit	Dibbling	120	90	2-3	May- July Aug-Oct	20-30
4.	Bottle Gourd	Feb-March June-July	-	2-3 seeds/pit	Dibbling	180	90	2-3	April-June Oct-Dec	30-40
5.	Brinjal	Jan-Feb May-June Oct-Nov	Feb-March June-July Oct-Nov	2-3	Transplanting	60	45	0.5	April-June Sept-Nov March-May	40-50
6.	Cabbage	Sept-Oct	Oct-Nov	2-3	Transplanting	45	45	0.5	Dec-March	50-100
7.	Capsicum (Simla Mirch)	Nov-Jan June-July	Jan-Feb July-Aug	2-3	Transplanting	45	45	0.5	April-May Sept-Oct	15-25 25-40
8.	Carrot	Aug-Sept Oct	-	10-15	Dibbling	30	7	1-2	Dec-Feb Feb-March	35-40
9.	Cauliflower (Early)	Early June	July	2-3	Transplanting	45	30	0.5	Nov	20-25
10.	Cauliflower (Mid- season)	July-Aug Aug-Sept	Aug-Sept Sept-Oct	2-3	Transplanting	45	45	0.5	Nov-Dec	40-50
11.	Cauliflower (Late)	Sept-Oct	Oct-Nov	2-3	Transplanting	45	45	0.5	Jan-March	20-25
12.	Chillies	Nov-Jan May-June	Jan-March June-July	2-3	Transplanting	45	45	0.5	April-May Sept-Nov	15-20
13.	Cluster Bean (Guar)	Feb-March June-July	-	30	To be sown in rows or broadcast	30	10 15	2-3 1.5	April-June Aug-Oct	8-10
14.	Cowpea	June-July Feb-March	-	30	To be sown in rows or broadcast	30 45	7 10	2-3	Aug-Oct April-June	8-10
15.	Cucumber (Khira)	Feb-March June-July	-	3-4 seeds/pit	To be sown in rows or broadcast	120	90	2-3	May-July Aug-Oct	15-20

16.	Dolichos Bean (Sem)	June-July	–	30	To be sown in rows or broadcast	90	30	3-4	Oct-Dec	10-15
17	Fenu Greek (Methi)	Sept-Nov	–	50-100	To be sown in rows or broadcast	30	2-3	2-3	Nov-Feb	10-15
18	French Bean	Feb-March	–	50	Dibbling	30-45	20-30	3-4	April-May	8-10
19	Knol-Khol	Sept-Oct	Oct-Nov	3	Transplanting	30	30	0.5	Dec-Feb	15-20
20	Lettuce	Sept-Oct	Oct-Nov	5	Transplanting	30	30	0.5	Dec-Feb	6-8
21	Muskmelon	Jan-Feb	–	3-4 seeds/pit	Dibbling	120	90	2-3	April-June	15-23
22	Okra (Bhindi) (Lady's Finger)	Feb-March June-July	–	30	Dibbling	30	15	4-5	March-June Aug-Nov	15-20
23	Onion	Oct-Nov May-June	Dec-Jan June-July	20	Transplanting Direct in rows	15	10	1-1.5	April-June Oct-Nov	8-10
24	Peas	Mid Sept- Early-Oct Oct-Nov	–	250	Dibbling	30	6	3-4	Nov-Jan Jan-March	10-15
25	Potato	Sept-Nov Dec-Feb	–	1400	Dibbling	45	25	8-10	Jan-March March-April	30-35
26	Radish	April-Aug Sept-Oct Nov-Jan	–	25	Dibbling	30	10	1-2	May-Sept Nov-Jan Dec-March Feb-April	20-25
27	Palak	Sept-Nov Feb	–	100	To be sown in rows or broadcast	30	3	1-2	Nov-Feb March-April	15-20
28	Sponge Gourd	Feb-March	–	3-4 seeds/pit	Dibbling	120	90	2-3	April-June	15-20
29	Ridge Gourd	June-July	–	Do	Dibbling	120	90	2-3	Aug-Oct	15-20
30	Tinda	Feb-March June-July	–	5 seeds/pit	Dibbling	100	25	8-10	May-June Sept-Oct	15-20
31	Tomato	June-Aug Nov-Dec	–	10	Dibbling	30	10-15	1-1.5	Dec-March	10-15
32	Turnip	Oct-Nov	–	10	Dibbling	30	10-15	1-1.5	Dec-March	15-20
33	Watermelon	Jan-March	–	2-3seeds/Pit	Dibbling	120	90	2-3	May-June	20-25

Dr. D.K. Singh* and Shashank Shekhar Singh**
**Department of Vegetable Science, G.B.Pant University of Agriculture & Technology, Pantnagar, Uttarakhand.
** Ph.D. Scholar SHUATS, formerly Allahabad Agricultural Institute, Naini, Allahabad, U.P.*

Establishment of virus free elite mother block of apple in the tribal areas of Kinnaur and Lahaul Spiti in Himachal Pradesh

Apple is the main cash crop of Himachal Pradesh and in particular of Kinnaur district. The production of apples has also stretched to some areas of Lahaul and Spiti districts as well. The economy of these areas is mainly dependent on the production of apples. With the changing climatic conditions, area under apple cultivation is increasing in Kinnaur and Lahaul-Spiti, which demands quality planting material.

Quality planting material is prerequisite for profitable cultivation of any fruit crop including apple. In Himachal Pradesh, apple orchardists procure planting material either from State Horticulture Department, SAU, ICAR institute or from private nursery growers. There are many nurseries in Himachal Pradesh but only few nurseries have been registered by National Horticulture Board. The main reason for less registered nurseries in H.P. is lack of virus free elite mother block. For any nursery grower elite mother block of commercial varieties is mandatory for commercial sale of nursery plants. Farmers/nursery growers are aware about morphological and yield parameters of elite mother plant. They can exclude the plants having fungal/bacterial infections. But it is almost impossible to eliminate the plants having viral infections, since most of the apple viruses are latent in nature and require sophisticated laboratory and skilled manpower for its detection. There are major four viruses which are known to infect apple. These include *Apple chlorotic leafspot virus* (ACLSV), *Apple mosaic virus* (ApMV), *Apple stem grooving virus* (ASGV), *Apple stem pitting virus* (ASPV) and *Apple scar skin viroid* (ASSVd), the major viroid.

Amongst these except ApMV, rest all (i.e ACLSV, ASGV and ASPV) are latent viruses i.e most of the times they do not produce any visible symptoms on apple plants.

At present, maximum nursery growers as well as farmers use scion wood from apple plant of unknown health status. It may result in planting of virus infected plants, which ultimately affect the yield, fruit quality and productive life of the tree. Kinnaur and Lahaul-Spiti are geographically difficult areas with restricted transportation in winter months (December-January) which is ideal planting time for apple. There is a great demand for planting material in Kinnaur and Lahaul-Spiti for new plantations, rejuvenation of old orchards etc. Another problem is difficulty in obtaining planting material with known pedigree. These problems inspired us to formulate a project entitled “Establishment of virus free elite mother block of apple in the tribal areas of Kinnaur and Lahaul Spiti in Himachal Pradesh”.

To identify virus free elite mother plants a contest was organized to get the active participation of the farmers. This awareness program regarding virus free quality planting material was organized in 16 Panchayats of Kinnaur district in the presence of Pradhan and interested farmers of the respective panchayats. In the contest “**Kinnaur Apple Contest**” 312 entries from the farmers as well as nursery men of Kinnaur were invited for the best apple tree in their orchard (Fig 1). Best plant suggested by each farmer was marked with the unique code (Block name/Village name/sample number) (Fig 2).



Fig:1 Awareness program on virus free quality planting material was organised at Nako Panchayat



Fig:2 Marking of mother plants proposed by farmer at Sumara panchayat of Pooh block

During the field visits, individual apple tree proposed by farmers was observed for various disease symptoms including fungal, bacterial, viral and phytoplasma. Some of the trees

showed typical virus-like symptoms such as chlorosis, curling, puckering, necrosis, mosaic, shortening of internodes etc. (Fig 3)





Fig 3: Virus-like symptoms observed during the field visits field. A: Leaf curling, B: Chlorosis, C: severe interveinal chlorosis, D, E & F: symptoms of phytoplasma, G & J: mosaic, H: marginal chlorosis, I: leaf curling, chlorosis and necrotic spots, K: necrotic spots, L: veinal chlorosis, M: interveinal chlorosis

The leaf samples from the same mother plants were collected and virus indexing was done using Double-antibody sandwich-Enzyme-linked immunosorbent assay (DAS-ELISA) (Fig 4).

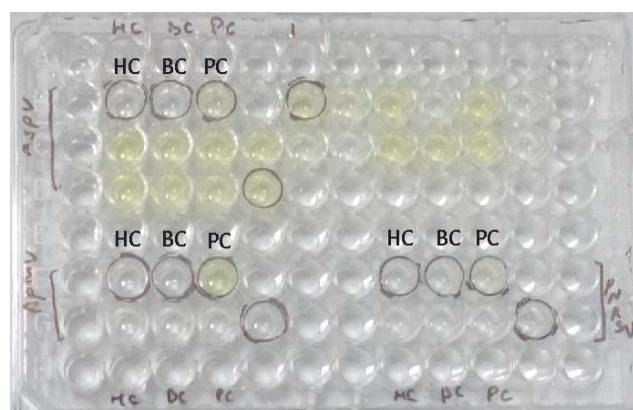


Fig 4 : Representative DAS-ELISA plate showing the results of the assay for different viruses. The samples showing yellow color depict the positive samples, whereas the colorless wells depict the healthy samples. HC-Healthy control, BC-Buffer control and PC-Positive control.

The samples were tested for the presence of five viruses i.e. ACLSV, ASGV, ApMV, ASPV, *Prunus necrotic ringspot virus* (PNRSV) and a phytoplasma *Apple proliferation* (ApP). DAS-ELISA results revealed 33.3 % incidence of ASGV, followed by 6.6 % incidence of ACLSV in Tehsil Nichar. While, no incidence of PNRSV, ApMV, ASPV and a phytoplasma ApP was recorded in the mother plants. Likewise, in Tehsil Sangla the incidence of ACLSV was found to be 15.5 % followed by ASPV 2.5 %. While the plants were found to be free from PNRSV, ApMV, ASGV and phytoplasma ApP. On the other hand in tehsil Kalpa the incidence of ASPV was 76.5 % followed by ACLSV 45.3 %, ASGV 28.1 % and PNRSV 15.6 %. Whereas, there were no incidence of ApMV and phytoplasma ApP in the mother plants (Fig 5).

The results obtained by DAS-ELISA will further be validated using more sensitive molecular detection technique “Reverse transcription-Polymerase chain reaction” (RT-PCR) so as to rule out the possibility of false positive and negative samples. The mother plants found free from virus and virus-like pathogens will be subjected to further multiplication. This process will ensure supply of virus-free planting

material to the farmers for raising orchards which in turn would help in enhancing the productivity and production of apple.

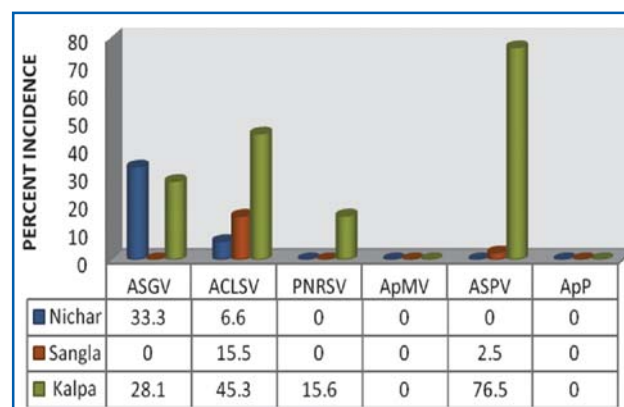


Fig 5: Combined DAS ELISA results for Kinnaur

Further apple fruit samples were also collected and subjected to quality analysis in the laboratory using following parameters: length, breadth, weight, ground colour, over colour, no of lobes, fruit shape, attractiveness, TSS, firmness, eating quality, texture, storage life etc. In addition to this fruit weight was recorded every month and TSS and fruit firmness was analyzed after an interval of two months (Fig 6). The room temperature was recorded daily (three times) for five months



Fig 6: Recording of fruit data using various parameters

During the analysis highest fruit TSS was recorded in the fruit samples of Nako Panchayat of Pooh block, followed by Sumara

Panchayat of the same block. While, the lowest TSS was recorded in the Purbani Panchayat of Kalpa Block. Variation in the TSS may be attributed to the altitude and climatic factors such as temperature, precipitation etc.

Fruit samples were analyzed for five months for keeping quality also. It was observed that samples from some blocks showed rotting, whereas in few blocks fruit rot percentage was minimum. In Sangla Panchayat fruit rot was maximum, it may be due to the reason that Sangla receives good precipitation and also have water reservoir nearby.

Virus indexing and fruit quality data mentioned above are recorded in the first year. Virus indexing through RT-PCR will be carried out in second year whereas fruit quality analysis will be repeated in second year as well as third year. Based on data elite mother plants will be identified. Thus, in the first part of implementation of this project we will identify elite mother plants of apple on the fields of farmers in Kinnaur district (which are free from viral diseases)

Further, in the second part, mother block will be established on the fields of farmers/nursery men who can sell the grafted plants by using virus-free elite mother plants identified during this project. Therefore, in this way after successful implementation of this project farmers of Kinnaur and Lahaul-Spiti districts will have access to virus-free quality planting material locally.

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**Santosh Watpade ¹, Pooja Bhardwaj ¹,
Rakesh Kumar ¹, K K Pramanick¹,
A K Shukla¹, Baswaraj Raigond ²,
Vikram Negi¹ and Sharda Sharma¹**

¹ICAR-IARI Regional Station, Shimla 171004,

²ICAR-CPRI Shimla, 171001

Email : santoshpathology@gmail.com

Growing nursery for doubling the vegetable production

Qualitative and quantitative food can essentially be produced from healthy plants which in turn are produced only when their seedlings/saplings are vigorous and healthy. The production of good quality seedlings is very much essential for getting higher yield and quality of any crop. So nurseries have great demand for the production of plants, bulbs, rhizomes, suckers & grafts. Nursery is consequently the basic need of horticulture. A vegetable nursery is a place or an establishment for raising or handling of young vegetable seedlings until they are ready for more permanent planting.

Why do we need Nursery?

Some vegetables require special care during their early growth period. There are some vegetables with very small sized seeds. These are the first sown in the nursery for better care and to combat with the time for field preparation and after about one month of seed sowing, transplanted in the main field. These vegetables are: tomato, brinjal, chilli, capsicum, cauliflower, cabbage, Knol-khol (kohl rabi), chinese cabbage, cabbage, brussels sprouts, sprouting broccoli, endive, chicory (red and green), celery and kale.

Advantages of nursery raising in vegetable production :

- It is very convenient to look after the tender seedlings
- It is possible to provide favorable growth conditions i.e. germination as well as growth
- It eliminates the problem of difficult soils
- Weed control is very easy
- It reduces field management costs
- There is saving of land and labour as main fields will be occupied by the crops after 1 month. More intensive crop rotations can be followed.
- Crop grown by nursery raising is quite early

and fetch higher price in the market, so economically more profitable.

- More optimal use of hybrid seeds
- Shorter growing season and more efficient use of land
- More accurate prediction of harvest date.

Site Selection:

Critical points need to be considered while selecting nursery area are:

- Soil should be well drained, porous and light to medium in texture. Soil pH should be 6.5 – 7.5.
- Soil should be rich in organic matter. Soil depth should be preferably by 15-25 cm.
- Soil texture should be neither too coarse nor too fine.
- Wind breaks and shelter belts should be raised prior to planting nursery plants.
- The nursery should be near the water supply so that irrigation can be easy.
- Soil should have a fair degree of water holding capacity.
- Regular supply of electricity is very essential.
- The area should be well protected from pet and wild animals.
- There should be good roads and transport facility.
- An ideal nursery has at least one well managed office and it should be near the house
- Generally, the location should be partially shaded i.e. under the trees. If not, artificial shade is to be provided.

Requirement of seed and seedling area :

The seeds and areas for raising the seedling may vary according to the soil, crop, seasons and methods of the nursery raising. The details are given below.

Vegetables	Seed rate (gm)	Area required (cm ²)
Tomato(hybrid)	200-250	75x100
Tomato (OP)	400-500	100x125
Brinjal	400-500	75x100
Chillies	500-600	75x100
Capsicum	400-600	100x150
Early flower	700-750	100x150
Mid late flower	400-500	100x150
Cabbage	450-500	75x100
Kohlrabi	700-750	100x150
Onion	800-1000	100x100

Seed Quality -

- Seed should belong to the proper variety, which is proposed to be grown.
- Seed should be clean and free from mixtures of other seeds.
- Seed should be mature, well developed and plump in size.
- Seed should be free from obvious signs of age or bad storage
- Seed should have a high germinating capacity.

Criteria for quality planting material of some important plant species -

Vegetable	Propagation method	Quality standards
Broccoli	Seed	4-6 weeks old
Cabbage/ cauliflower	Seed	3-5 week old seedlings
Onion	Seed	6-8 week old, 20-25 cm height
Tomato	Seed	3-4 week old, 12-15 cm height, 4-6 leaf stage

Nursery bed preparation :

- Nursery bed should be prepared according to the season and crop.
- In the rainy season raised beds are prepared but in the winter and summer season flat beds should be prepared. Similarly onion in the Rabi season requires flat beds. For the uniform and high percentage of germination the soil must be fine and moist enough.
- If the seedlings are to be raised in boxes during unfavorable weather condition, the flower pots, polythene bags, potting plugs, wooden treys, earthen pots etc. may be used. Prepare soil mixture in the ratio of 1:1:1 of soil, sand and well rotten FYM/ leaf mould etc. and fill the mixture in these seedlings raising structure. Arrangement should be made to drain excess water from these structures by making a hole in the bottom of all types of pots.

Raised nursery beds :

- Length of the bed may be kept 3 to 5 meter; however, width is restricted to 1 meter only which facilitates intercultural operations.
- The beds are raised 15 to 20 cm high from the ground level. A space of 30 - 40 cm is left in between two beds.
- The space between two beds helps in weeding, nursery care against diseases and insect pest and also for draining out the excess rain water from the nursery beds.
- The number of beds depends on the particular crop, season and growing area of crop.
- The beds should be prepared in the east and west direction and line should be made from north to south direction on the beds.

Media for propagating nursery plants :

Several materials and combination of different materials are available for media for germinating seeds and rooting cuttings. A good propagating medium should possess the following characters -

1. It must be firm and dense to hold the cuttings or seeds in place during rooting or germination.
2. It must possess sufficient moisture retaining capacity
3. It must be sufficiently porous to permit excess water to drain away and to admit proper aeration
4. It must be free from weed seeds, nematodes and pathogens.

1. Soil mixture :

This is the most commonly employed medium for potted plants. It usually consists of red earth, well decomposed cattle manure, leaf mold, river sand and also charcoal in some cases. Soil mixture commonly used for propagation is

Red earth	-	2 parts
F Y M	-	1 part
S a n d	-	1 part

2. Sand :

It is the most satisfactory medium for rooting of cuttings.

3. Peat :

It consists of the remains of aquatic marsh, bog or swamp vegetation which has been preserved under water in a partially decomposed state. When such peat is derived from sphagnum, hypnum or other mosses, it is known as peat moss. It is used in mixture after breaking them and moistened.

4. Sphagnum moss :

Commercial sphagnum moss is the dehydrated young residue or living portion of acid-bog plants in the genus *Sphagnum* such as *S. papillosum*, *S. capillacem* and *S. palustre*. It is generally collected from the tree trunks of the forest species in south Indian hills above 1500m above M.S.L. during rainy period. It is relatively sterile, light in weight and has a very high water-holding capacity. It is the commonly used medium in air layering.

5. Vermiculite :

It is very light in weight and able to absorb large quantity of water. This can be used as a rooting

medium for roofing of cuttings and air layering and also in pots for raising certain plants.

Container for propagation and growing young plants:

It is made up of polythene (bags, pots, and root trainers), clay (pots) or iron material. Polybags are the cheap containers, while root trainers are user friendly, easy to handle and transport.

Soil Treatment :

Soil solarization is a method of heating soil by covering it with transparent polythene sheet during hot periods to control soil borne diseases.

Procedure of soil solarization :

Drenching of the soil is done through formalin solution @ 1.5-2% in 4-5 liter of water 15-20 days before sowing and covered with the plastic sheet. Application of the fungicide like Captan and Thiram @ 5-6 gm /m² nursery area and should be mixed up to the depth of 15-20 cm for nursery preparation. Supply of the hot steam at least 4 hours continuously under the covered polythene sheet and allow the soil for the seed bed preparation.

Pre-sowing treatments:

Pre sowing treatments are methods applied to overcome seed dormancy to ensure rapid, uniform and timely seed germination that facilitates seedling production. Pre-sowing treatments are applied to seeds immediately before sowing. Most methods require only a few minutes to 24 hours. However, some pre-sowing methods require a few to several days. Appropriate pre-sowing treatment methods depend on the dormancy characteristics of the seed being treated. The most common pre-sowing methods are:

- 1) Soaking in cool water
- 2) Soaking in hot water
- 3) Boiled water treatment
- 4) Scarification (acid, mechanical, manual) methods
- 5) Fire or heating methods
- 6) Soaking in chemicals
- 7) Alternate wetting and drying

Sowing of seeds in the nursery :

After the seed bed preparation seeds are sown in the nursery bed either by broadcasting or in lines depending upon the nature and season of crop.

Seed covering material :

Seed cover -

After seed sowing a mixture of sand, soil and FYM in the ratio of 1:1:1 is prepared for covering the nursery bed for better emergence. Care should be taken that every seed is well covered by seed covering.

a) Use of mulch-

A thin layer of mulching of paddy straw or sugarcane trash or sarkanda or any organic mulch during hot weather and by plastic mulch in cool weather is done to maintain the soil moisture for proper seed germination. The advantages of mulching are:

1. It maintains the soil moisture and temperature for the better seed germination
2. Control weeds.
3. Protect from direct sunlight and raindrops.
4. Protects against bud damage.

As and when the white thread like structure is seen above the ground level, remove the mulch carefully to avoid any damage to emerging plumules. Always remove mulch in the evening hours to avoid harmful effect of the bright sunlight on the new emerging seedlings.

b) Use of shedding nets -

After seed germination during the seedling growth, if there is very high temperature ($>30^{\circ}\text{C}$) than beds should be covered by 50% or 60% shedding nets of green/green+black colour, about 60-90 cm above ground by the use of suitable support.

Watering:

To avoid drying of seedlings, a reliable and continuous supply of water should be ensured by the facility of storage of water for at least 3 days supply. It is also necessary to ensure the quality of water used for irrigation. Normal pH water is the best suited, while water with more than pH of 7 favors attacks of 'damping off' fungi.

Thinning :

It is important operation to remove weak, unhealthy disease, insects, pests damaged and dense plants from the nursery beds keeping distances of about 0.5-1 cm from plant to plant.

Weed control :

Weed competes with the seedlings for nutrients, water and light and suppresses the growth of young plants because the weeds are usually more vigorous and grow at a faster rate. So, timely weeding in nursery is very important to get the healthy seedling therefore manually removing them or pre-emergence herbicides such as stomp at 3ml per liter water should be sprayed on the nursery bed after the seed sowing and seed covering with the mixture.

Nutrient management :

Adding of well decomposed manure in the nursery mixture will assure the production of quality and healthy seedlings. Meanwhile, using of bio-fertilizers such as Azatobactor, Azospirillum and Phosphobacteria @ 5 to 10 g and vermicompost, VAM @ 10 to 50 g per container raised seedlings are also suggested to boost the growth of seedlings

Hardening of the plant in the nursery:

The term hardening includes any treatment that makes the tissue firm to endure better survival during unfavorable environment like low temperature high temperature and hot dry wind. This is done to induce stress and subsequent growth check when seedlings are transplanted to the main garden. In the process seedlings are given some artificial shocks at least 7-10 days before uprooting and transplanting. Seedlings are exposed to the full sunlight, polythene sheets should be removed and irrigation is stopped slowly and slowly.

Technique of Hardening -

Hardening can be done by following ways.

- By holding watering to the plant by 4-5 days before transplanting
- Lowering the temperature also retards the growth aids to the hardening process.
- By application of 4000 ppm NaCl with the

irrigation water or by spraying of 2000 ppm of cycocel.

Effect of Hardening -

Following effect must be observed by the hardening

- Hardening improves the quality and modifies the nature of colloids in the plant cell enabling them to resist the loss of water.
- Hardening improves the presence of dry matter and regards in the plant but decrease the percentage of feasible water and transpiration per unit area of leaf.
- Decrease the rate of growth in the plant.
- Harden plants withstand better against unfavorable weather condition like hot day, wind and low temperature. Hardening of plants increases the waxy covering the leaves of cabbage.

Plant protection :

Adaptation of plant protection measures in the nursery against the incidence of insect pest and diseases is very important task to get the healthy seedlings. Damping off seedlings, leaf curl, leaf blight diseases and leaf miner and borer infect the seedling in the nursery.

Integrated Nursery Disease and insect pests management :

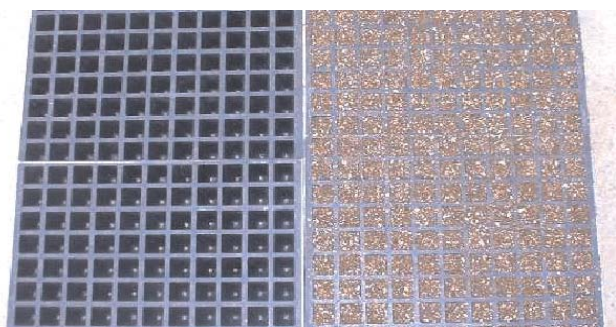
- Selection of apparently healthy seeds/propagules for seedling production
- Seed dressing with 0.2% Carbendazim/Methyl thiophanate/Benomyl/Thiram
- Sowing in sterilized/fumigated, clean beds and adequate watering
- Using sterilized budding knife, secateurs, and scissors during budding and grafting
- Transplanting seedling after root dip for 3-5 min in 0.02% Carbendazim solution
- Healthy planting material maintenance by keeping them under proper sunlight, watering and clean environment.
- Frequent examination of seedling health and removal of diseased stocks.
- Foliar spray of 0.2% Carbendazim/Dithane M-45 at regular interval.

Transplanting :

1. Transplanting should be done as soon as seedlings are about 4 to 8 weeks old, 10 to 15 cm tall and have formed about 3 to 4 true leaves.
2. The nursery bed should be watered 24 hours before uprooting the seedling for transplanting so that they may not suffer from desiccation and minimize root damage.
3. The seedlings should be dug up not pulled up.
4. When the seedlings are uprooted it experiences transplanting shock. Therefore, it is essential to water plants immediately after transplanting and till the plant has recovered.
5. Always transplant under cool conditions so that plants may establish themselves in the cool weather in the night and may recover from the shock of transplanting before sunrise.
6. Avoid seedlings which have grown too tall. Such seedlings become weak and may start flowering very early.
7. During transplanting, care should be taken to protect seedlings against wilting by frequently sprinkling water on them and covering the roots one with moist soil or leaves.
8. Setting the seedlings to a depth of first true leaves when transplanting in know to result in earlier fruiting and larger fruit size in some crops.

Benefits of Nursery Development :

The seedlings developed in the field nurseries will be in good demand; because they will show interest to develop their more desired/preferred species only. The success of plantation will be increased due to the improvement in quality of seedlings. It provides additional employment and livelihood opportunity during lean agricultural operation period.



Pot trays



Seed sowing in pot trays



Nursery plants prepared for transplanting

Common Possible Errors in Nursery activities

- Containers not filled properly
- Cylindrical shape of container not maintained
- Container not in upright position
- Soil or sand used in germination beds not changed after each production cycle
- Sowing seed too deep
- Lifting transplant seedlings individually and wrenching them
- Exposure of seedlings to air after lifting
- Bad transplanting and delayed transplant from container to beds
- Leaving air space around the root of the young seedling after transplanting
- Bad root pruning while transplanting
- Inadequate attention paid to root pruning in transplanted containers before transporting to field.

**D. K. Singh¹, D.P. Singh¹,
Khushboo Kathayat¹, and
Shashank Shekhar Singh²**

¹Department of Vegetable Science,
G.B.Pant University of Agriculture and
Technology, Pantnagar, Uttarakhand

² Ph. D. Scholar, SHUATS, Naini, Allahabad, U.P.

Organic pesticidal spray mixture for Cauliflower & Cabbage

Introduction:

Insect pests & diseases are every farmer's nightmare. Although, as a result of modern farming system, there has been a record increase in farm production but the use of chemicals to control pests and diseases has also increased manifold. Since, farmers in mid hill zone of Himachal Pradesh grow off-season vegetables make use of inorganic pesticides indiscriminately which add to cost of production as the inorganic pesticides are very costly & health hazards to the farmers as well as to the consumers and also destroy the ecology of the region through environment pollution.

Various pesticides have residual effects & enter into the body of consumer when these vegetables sprayed with these chemicals are consumed. Efforts were made to prepare some organic formulation based on locally available organic materials, which could be useful to control some major pests of some major vegetables being grown in the area. Keeping in view these facts, trials were conducted on formulation of an organic spray mixture from cow urine, Derek (*Meliaazedarach*) leaves & hach/whey (butter milk).

Adoption of this type of organic spray mixture will definitely reduce the use of chemical pesticides in the area by farmers, thereby also reducing air & water pollution. As also the chemical pesticides are harmful to the farmers as they do not take much protective measures during spraying, so will definitely reduce health hazards to them.

Objectives of study:

- o To reduce the usage of inorganic pesticides to maximum possible extent in major vegetable crops.
- o To make utilization of locally available organic materials for preparing organic spray formulation.
- o To develop an organic spray formulation which farmers can prepare at home easily

at any time, whenever required.

- o To reduce the cost of production on vegetable crops
- o To reduce the risks of health hazards of both farmers' as well as consumers'.
- o To save our environment from pollution.

Technology Package developed :

A comparative study on effect of inorganic/chemical & organic pesticidal formulations was carried out at STD field station Nagwain in vegetable crops. Cow urine, old lassie/whey & Derek/bakain plant leaves were used to prepare organic formulations. A plot was also kept as control (without any treatments) for comparison.

Although, study is going on & being carried out on pests of various vegetables, but a formulation of spray mixture has been standardized for cauliflower/Cabbage being major crops of the area.

Treatments for the trial were as below :

This formulation has been used as broad spectrum for both diseases & insect pests.

Although, the main target was aphids & caterpillars of cauliflower/cabbage.

In total 4 treatments in 6 plots were given which are as below:

T-I* = Cow urine (1.5 kg) + drake leaves (1.5 kg) + lassi/butter milk (1.5 kg)

T-II* = Cow urine (2.0 kg) + drake leaves (2.0 kg) + lassi/butter milk (2.0) kg

T-III = Chemical sprays (only curative spray) (1 plot)

T = IV = Control (without any treatment) (1 plot)

* These ingredients were mixed & kept for fermentation for 10 days & then filtered & total volume made up to 15 liters by mixing normal tap water. Spray of this mixture was done at weekly interval. Once prepared solution used for 2 sprays.

Plot No. 1: Preventive spray

Plot No. 2: Curative spray

2 plots (1 plot for preventive & 1 plot for curative spray)

Year of trial : May 2013

Crop selected : Cauliflower

Results & Discussion:

T-I = Cow urine (1.5 kg) + drake leaves (1.5 kg) + lassi/butter milk (1.5 kg)

Plot -1 (Preventive spray):

Total no. of plants = 80 plants

Aphid infestation occurred in 5 plants. This means that we were able to control aphids up to 94 %. Caterpillars of cabbage butterfly appeared in 7 plants. This means that we were able to control aphids up to 91 %.

Plot 2 (curative spray) :

Total no. of plants = 70 plants

Initially in first plot we got 30 plants infested at first & in total 38 plants got infested with aphids. After curative spray of mixture we could control aphid infestation almost in all plants.

Caterpillars of cabbage butterfly appeared in 12 plants. After spray of mixture we could control infestation almost in all plants.

T-II = Cow urine (2.0 kg) + drake leaves (2.0 kg) + lassi (2.0) kg

Plot -1 (Preventive spray):

Total no. of plants = 65 plants

Aphid infestation occurred in 3 plants. This means that we were able to control aphids up to 96 %. Caterpillars of cabbage butterfly appeared in 4 plants. This means that we were able to control aphids up to 94 %.

Plot 2 (curative spray):

Total no. of plants = 70 plants.

Initially in first (delete the red marked here) we got 24 plants infested at first & in total 46 plants got infested with aphids. After curative spray of mixture we could control aphid infestation almost in all plants. Larvae of cabbage butterfly appeared in 12 plants. After

spray of mixture we could control infestation almost in all plants.

T-III = Chemical sprays (only curative spray)

Total no. of plants = 60 plants

Initially in first we got 20 plants infested at first & in total 29 plants got infested with aphids. After curative spray of mixture we could control aphid infestation almost in all plants.

T=IV = Control (without any treatment)

Total no. of plants = 80 plants



Preparation of organic pesticide solution using cow urine, drake leaves & old butter milk

Initially in first we got 40 plants infested with aphids at first & almost all plants got infested with aphids. This completely hindered the growth of plants. Caterpillars of butterfly attacked about 54 plants.



Cauliflower crop

Comparision of treatment & control plots

Conclusion: Hence, from above study it can be concluded that this organic spray formulation is very much effective against these two major pests of Cole crops mainly cauliflower &

cabbage. It was also observed that because of total damage of leaves in control, plot size of curd remained almost half of that in treatment plot, means yield & productivity reduced to half, which clearly indicate that these two pests if not controlled can cause damage up to 50% or more. When no leaves are left, caterpillars also start feeding on curds of cauliflower. Above all, this formulation can be prepared by any farmer at home from his own resources at a very reasonable cost. It does not require much labour & skill.

Bhopinder Mehta,

Society for Technology & Development(STD),

Vill. Malori, P.O. Behna, Tehsil Sadar,

Distt. Mandi, H.P.- PIN 175006

Ph.: 01905-246154-55, 094598-73461 Fax:246154

Email : stdpsn@yahoomail.com,

stdmandi@gmail.com

Website: <http://www.stdruraltech.org>.

Human-Wildlife Conflict Mitigation in Himalayas

The state of Jammu & Kashmir is bestowed with unique natural topography and many key wildlife species which are distributed along various altitudinal gradients. However, in many parts of the state like any other part of India, there is a serious issue of regular attacks by wild animals both on livestock as well as on the humans. In the recent past, there has been seen a surge in the number of cases of human-wildlife conflict in Jammu and Kashmir. Both the protected areas and territorial areas have seen rise in the attacks on both humans and livestock. Although the Department of Wildlife Protection has been maintaining a comprehensive database of the cases of attacks on the humans, the data related to livestock attacks has not been maintained properly. From a recent WWF study it has been revealed that a total of 1444 cases of attacks of wild animals on humans were reported to have occurred over a period of 6 years. There was seen an overall increase in the annual number of cases of human-attack by wild animals across the state of J&K. A total of 130 cases of conflict were reported in the year 2006 which went up to 296 cases in the year 2011, which is the highest ever, and fell down to 221 cases in the year 2012.

Human-wildlife conflict is the major issue threatening conservation of key wildlife species across the various Himalayan states including Jammu and Kashmir. Due to the habitat degradation of the wildlife, the natural prey of carnivore species has declined resulting into the increased depredation of livestock, which in turn causes the human-wildlife conflict. The key wildlife species which have been reported to part of these regular human-wildlife interactions in the state are Leopard, Black Bear, Brown Bear and Snow Leopard. However, in the region of Pir Panjal, the majority of the animal attacks have been reported by Leopard and Black Bear. In order to deal with this issue, currently with support from DST, WWF-India in collaboration with the Department of



Acoustic device being installed in the field

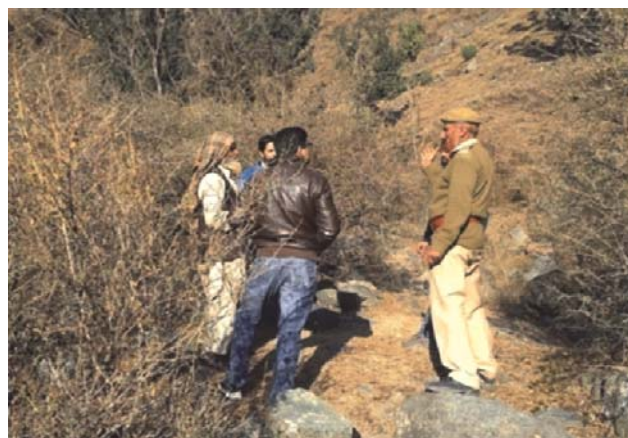
Wildlife Protection, Government of J&K is implementing a pilot project to deal with human-wildlife conflict in the area. This is important as this negative interaction of local communities with the key wildlife species actually defeats the purpose of wildlife conservation initiatives. Therefore, it is vital that we must design conflict mitigation strategies in partnership with the concerned Government department and local communities.

Under the project “Appropriate technological interventions for addressing human-wildlife conflict in Pir Panjal, Jammu and Kashmir” different technologies including solar electric fencing, ultrasonic device, acoustic device and LED devices, are being pilot tested for their potential to ward-off conflict animals in selected villages in the PirPanjal. There have been many studies with regard to the use of various technologies available such as motion detection sensors and lights, seismic sensors, chilly bombs and/or mechanized alarms, LED flickering lights, ultrasonic devices and acoustic devices. Earlier these have never been piloted in Jammu and Kashmir, and there is enormous scope of replication through demonstrations and adaptation.

The proposed technologies including bio-acoustic devices, solar-powered LED devices and solar-powered ultrasonic devices have been installed in the project sites. These technologies



A bioacoustic device installed in a conflict area



Field discussion with Forest Department members and locals

are being tested for their effectiveness in preventing the human-wildlife conflict by keeping away the animals of conflict. Bio-acoustic devices work in the similar way as do the traditional methods of making noise to ward off the animals using empty canisters, crackers, drums etc. This device can be loaded with any type of sound, which can scare away the predator. The ultrasonic devices emit the high frequency sound waves which are not audible to humans but most of the animals are able to hear them. Further, many of the animals find the ultrasonic waves unpleasant and are known to avoid the exposure to them. A study conducted on polar bears suggested that around 70% of the polar bears are run away when exposed to the ultrasonic waves. This can hold true for the Himalayan black bears also. The ultrasonic devices installed under this project are solar-powered.

Apart from the installation of the technology, capacity building programmes were also organized for the stakeholders. A workshop was organized to impart the frontline staff of the Forest and Wildlife Departments with basic training to use the equipment being installed

under the project and its potential in preventing the human-wildlife conflict. Field level community engagement has also been undertaken where different community households were visited by the field team to aware them about the key wildlife species of their area. Such an awareness drive will further



Capacity building programme for the frontline staff

strengthen the project implementation and will help saving the communities from the regular attack by wild animals. Overall through sound scientific interventions and through proper capacity building and awareness programmes, this project under TIME LEARN programme of DST plans to develop a model for dealing with human wildlife conflict in Himalayas.

Dr. Pankaj Chandan and Mr. Rohit Rattan

WWF - India

wwf.rajouri@gmail.com,

pchand@wwfindia.net,

Eco-friendly Bio-formulation Developed for Fruit Production

Use of locally available bio-resources has great potential in making farming sustainable with higher returns to the farmers. Further, it will help in enhancing the quality of the crop produce, soil bio-biodiversity and environment. However, despite of proven potentialities, use of bio-resources in crop production and disease management has not picked up. In India, area under certified cultivable organic farming has increased to 1.49 million ha with production of around 1.35 million metric tonnes which will have tremendous requirement of different organic inputs. The present requirement of bio-fertilizer is 4,26,000 metric tonne (MT) against which total supply is 65,528 metric tonne (MT). Organic manures is another important input generated out of bio-resources and which is required for the supply of nutrients in organic farming. Total requirement of organic manure is 710 million tonnes and supply is 105 million tonne. There is tremendous demand for the organic produce in India and abroad. The global trade is currently USD 60 billion (Rs. 3,60,000 crore) and may touch USD 100 billion (Rs. 6,00,000 crore) and in India the trade may reach Rs. 5000- 6000 crore in the couple of years. The first benefit of organic farming is the fact that it always allows you to get rid of the high cost of external inputs. Organic farming will thus reduce the expenditure on external inputs other than the seed and it is also associated with decreased irrigation needs by about 30- 50 per cent. Central Government is



giving more emphasis on organic farming and in the budget proposals for the year 2018, there would be emphasis to promote organic farming by Farmer Producer Organisations (FPOs) and Village Producers' Organisations (VPOs) in large clusters, preferably of 1,000 hectares each. Simultaneously, Women's Self Help Groups (SHGs) will also be encouraged to take up organic agriculture in clusters under the National Rural Livelihood Programme.

Worldwide, about 25 million agricultural workers experience unintentional pesticide poisonings each year, and it is estimated that approximately 1.8 billion people engage in agriculture and most use pesticides to protect food and commercial products that they produce. According to a report of the Ministry of Agriculture, residues of chemical pesticides were detected in 9.2 percent of the samples of different food articles collected between 2006 and 2012, out of which 1.5 percent of the samples contained residues above maximum permissible level. Organic pesticides act as a viable, economic and eco-friendly substitute to harmful chemical pesticides. It is estimated that bio-pesticides sector will have a five year compound annual growth rate of 16 percent compared to 3 percent of synthetic pesticides, which is expected to produce a global market of \$10 billion by 2017. Data from the



Impregnation of Trays with Botanical Formulations

Directorate of Plant Protection, Quarantine & Storage, Union Ministry of Agriculture & Farmers Welfare, indicates that between 2010-11 and 2016-17, usage of bio-pesticides increased by 23 per cent, while that of chemical pesticides grew only 2 per cent. The National Farmer Policy 2007 has strongly recommended the promotion of bio-pesticides for increasing agricultural production, sustaining the health of farmers, consumers and other species in the environment.

Locally available bio-resources have great potential in the management of diseases and pests. Overall, insect-pests and diseases result in almost 15- 25 per cent losses in the crop yield and use of crop protection chemicals can increase crop productivity by 25-50 per cent. Over the years, there is a growing realization that chemical fungicides are not the answer to the effective management of diseases. There is huge market of agro-chemicals in India which valued USD 4.4 billion in 2015 and 50 per cent worth of value is consumed domestically. Presently, consumption of pesticides in India is approximately 43,000 metric tonnes per year. Botanicals and microbial pesticides are the most common bio-pesticides originating from the bio-resources available in the field. There are about 1005 species of plants exhibiting insecticidal properties, 384 with anti-feedant properties, 297 with repellent properties, 27 with attractant properties and 31 with growth inhibiting properties. There are more than 200 plant species which have been reported to have anti-microbial properties against important pathogens of different crops. Among botanicals, neem (*Azadirachta indica*) is one of the most important trees which have a great potential for disease and insect-pest management. India has more than 18 million trees of neem with seed potential of 4,14,000 MT which can yield 85,000 MT of oil and 3,30,000 MT of oilcakes. Currently bio- pesticides constitute only 3 per cent of Indian crop protection market however there are significant growth opportunities as the Central Government is promoting traditional and chemical-free farming. Use of



Roylea elegans reported for the first time to possess anti-fungal properties

bio-pesticides in the country has increased from 123 metric tonnes in 1994- 95 to 8110 metric tonnes in 2011-12 and at least 410 bio-pesticide production units had been established in India.

Research work done in the Department of Mycology and Plant Pathology in Dr. Y.S.Parmar University of Horticulture and Forestry has got recognition at national level for development of bio-pesticide for the management of diseases. This work has been done under a research project funded by the Department of Science and Technology (DST), Gov't of India. DST has funded this project for the management of important diseases of strawberry with the use of native bio-resources. The bio-formulation developed by the scientists of this department has been selected for the prestigious Earth Care Award-2010 of Rs. 3 lakh under the category of **Innovations for Climate Change Mitigation**. The award jury was headed by the noted agriculture scientist Dr. M.S. Swaminathan. Earlier, this work has been selected by the National Research Development Council, New Delhi for commercialization. In this project, plants like Bougainvillea (*Bougainvillea glabra*), Artemisia (*Artemisia roxburghiana*), tulsi (*Ocimum sanctum*), karvya (*Roylea elegans*), dudhali (*Cryptolepsis buehanani*), darek (*Melia azedarach*) have been reported to possess excellent potential against different diseases. In these plants, leaves and tender stems are used, however, in case of *Melia azedarach*, seeds

and leaves are also used and seeds are more effective. Field Formulation 1 and Field Formulation 2 were evaluated under field conditions against grey mould on fruits and leaf spots (*Mycosphaerella* sp. and *Phomopsis* sp.). Field Formulation 2 was found more effective with 85.9 per cent reduction in the incidence of grey mould and 89.5 per cent reduction in the disease index of leaf spots. Field Formulation 2 also resulted in 128.3 q/ha yield which was 81.4 per cent higher than control. This work was also selected for the prestigious **India Innovates- Pehal** programme of the Doordarshan Kendra, Shimla which was telecast on March 11, 2012. This is the only technology of our University selected for this programme. This programme is based on the initiative of the Central Ministry of Agriculture and Prasar Bharti Corporation, Gov't of India. Further, the technology developed, disseminated and the work on adoption of the technology have been widely publicised in about 10 Television and Radio talks during the last 10 years.

Locally available many plants species are effective individually yet combined use of these plants in a single formulation makes it very effective. It is not necessary to use all the plants but the available ones can be used. Liquid formulation can be made from the seeds and leaves of these plants by adding equal quantity of water to the weight of the plant material used. Cow urine or urine of other animals can be used instead of water and this makes this

formulation more effective as cow or animal urine also possess pesticidal properties against diseases and pests. The leaves and grinded seeds of these plant species should be added to the cow urine in a drum and allow to remain for a month. After one month, this formulation is mixed thoroughly and strained to remove the plant parts. In this formulation, anti-fungal properties of *Roylea elegans* and *Cryptolepsis buchmanii* have been reported for the first time. Some of the plant species chosen for making this formulation are weeds. The use of this formulation will certainly reduce the cost of cultivation of different crops. The protective spray of this formulation has to be given at weekly intervals as soon as the crop is transplanted in the field. This formulation can be used at 5 to 10 per cent concentration (5 to 10 litres/ 100 litre of water). The formulation is also rich in different essential nutrients required for plant growth and thus results in growth enhancing effect in the crops. This formulation can be used against different diseases in different crops as it has been evaluated against four most damaging fungal pathogens namely *Fusarium oxysporum*, *Rhizoctonia solani*, *Sclerotium rolfsii* and *Botrytis cinerea*.

In another research project of Department of Science and Technology, Gov't of India sanctioned to the Department of Plant Pathology, a bio-formulation has been developed for the management of post-harvest diseases of apple. This bio-formulation has been made



Field formulation made of botanicals and cow urine



Use of botanical formulation in successful management of diseases in cauliflower

from plant species like *Bougainvillea glabra*, *Eucalyptus globules*, *Mentha piperita*, *Melia azedarach*, *Roylea elegans*, *Dedonia viscosa* and cow urine. This bio-formulation has been found effective against five major post-harvest rots in apple viz., blue mould rot (*Penicillium expansum*), bitter rot (*Glomerella cingulata*), brown rot (*Monilinia fructigena*), pink mould rot (*Tichothecium roseum*) and whisker's rot (*Rhizopus stolonifer*) which are responsible for 88 per cent of the total spoilage of apple. Out of the 8 different botanicals evaluated, six were selected depending upon their efficacy. These six botanicals were evaluated in two combinations along with cow urine against different pathogens. Further, two Field Formulations (FF-1 and FF-2) were made out of the six effective botanicals (*Bougainvillea glabra* + *Melia azedarach* + *Eucalyptus globulus* + *Roylea elegans* + *Dedonia viscosa*) and cow urine. Field Formulation-1 contained only the extracts of the six above mentioned botanicals, while the Field Formulation-2 in addition to these six botanicals also contained cow urine. Among all combinations of botanicals evaluated against different post-harvest pathogens of apple, FF-2 was found most effective with 100 per cent reduction in the mycelial growth of 7 important post-harvest pathogens of apple mentioned above. FF-2 impregnated papers were found effective in reducing the apple rot by 75.1 per cent after 75 days of storage at 4°C. FF-2 was also found effective as skin coating with 84.7 per cent reduction in fruit rot after 75 days of storage at 4°C. This treatment also helped in preserving the quality of the fruits. The fruits are crisper after the treatment. The



The PI is briefing about the use of bio-pesticides during a national seminar.

surface micro-flora of the apple has been reduced thus making it safer for consumption. The technology has a potential for commercialization as the trays used for packing the apples can be impregnated with this bio-formulation to enhance the self life of apple in storage and transportation.

Presently, Dr H.R. Gautam is engaged in another research project of SEED Division of the DST with the objective of popularization of the botanical pesticides in commercial crops like tomato, capsicum and cauliflower.

(The author is recipient of prestigious national Earth Care Award for 2010 of Rs. 3 lakh for his work on development of botanical bio-formulation for the management of diseases.)

Dr. Harender Raj Gautam,
Principal Scientist,
Department of Plant Pathology,
Dr. Y. S. Parmar University of Horticulture
and Forestry,
Nauni, Solan-173230, Himachal Pradesh

Traditional management practices and promotion of NTFPs for livelihood in the North Western Himalayas

Abstract :

Indigenous and Traditional knowledge is defined as scientific study of the way animals and plants are used, treated and managed by different human cultures. It is also related to the knowledge of past and present interrelations of primitive human societies like tribal and aboriginal communities with the surrounding flora and fauna. The Indigenous and traditional Knowledge of NTFPs associated with management and conservation of food, fodder, fiber, medicines, tans, dyes, gums, resins, fumitories, spices and condiments etc. from forest transferred orally for centuries from one generation to other is fast disappearing because of the technological developments and changing culture and ethnic groups. Traditionally, local communities of Himalayas are extremely knowledgeable about local plants and other natural resources, on which they were so importantly and intimately dependent. Much of this wealth of knowledge is rapidly becoming lost as traditional culture become eroded, which is a serious concern that prompts proper documentation of this knowledge for future generations. Indigenous people believe in conservation and management of natural resources because their livelihood depends on them. They never over exploit the resource but the commercialization of every resource today has resulted the greed of human beings which is leading to vast depletion of our natural resources.

The rural people, particularly the tribal and other poor living on mountains of Western Himalaya depend on forest resources for meeting their energy requirement, forest products, and for employment. Forests provide year round fuel wood, fodder, other forest produce to all mountain communities. It also form a part of the culture and natural way of life. Historically, forests have been providing substantial support to rural economy. With fast

depletion of the forest resources, the livelihood of the rural poor and the tribal families living in and around the forests is threatened, while creating an ecological imbalance and loss of biodiversity.

Therefore, for proper documentation of the indigenous and traditional knowledge related to conservation and management practices on one hand and promotion of NTFPs including medicinal plants through productivity improvement and value addition is necessary to reverse this trend and to sustain the livelihood of the rural families, who have been dependent on NTFP since ages in mountain states of North Western Himalaya including, Jammu & Kashmir, Himachal Pradesh and Uttarakhand.

Introduction :

The Indian Himalayan region occupies a special place in the mountain ecosystems of the world. These geodynamically young mountains are not only important from the stand point of climate and as a provider of life, giving water to a large part of the Indian subcontinent, but they also harbor a rich variety of flora, fauna, human communities and cultural diversity (Singh, 2006). The Himalayan mountain system covers only 18% of the geographical area of India, but accounts for more than 50%



A woman carrying fodder leaves from forest.



Sheep and Goat rearing - backbone of mountain economy

of India's forest cover and for 40% of the species endemic to the Indian subcontinent. Himalayan resources and ecosystem services are critical, not only for the sustainable livelihood of 115 million mountain people but also for a much larger population inhabiting the adjoining Indo Gangetic plains (Rao *et al.*, 2003).

The western Himalayan region covers three mountain states namely J&K, HP and UK which has common vegetation varies according to altitude and climate: *Alnus nepalensis*, *Pinus roxburghii*, *Mallotus phillippensis*, *Toona ciliata*, *Grewia* spp., *Acer* spp. and *Celtis australis* are common species found in the subtropical zone; *Quercus leucotrichophora*, *Quercus floribunda*, *Juglans regia*, *Corylus jacquemontii*, *Rhododendron arboreum*, *Cedrus deodara*, *Picea smithiana*, etc., in the temperate zone; *Taxus wallichiana*, *Quercus semecarpifolia*, *Pinus wallichiana*, *C. deodara*, *Rhododendron campanulatum*, *Ulmus wallichiana*, etc., in the sub-alpine zone; and *Picrorhiza kurroo*, *Nardostachys grandiflora*, *Androsace globifera*, *Danthonia cachemyriana*, *Acontium heterophyllum*, *A. balfourii*, *Cyananthus* sp., *Gentiana* sp. and *Potentilla* sp. dominate the alpine zone.

These areas are rich in NTFPs particularly the medicinal and aromatic plants. The other NTFPs of the area are related to food (fruits, flowers, roots, rhizomes, tubers), leaves (maloo, sal, banana, *Ficus* species like timla) fibers (grasses, bhabhar grass, maloo, ram bans, bheemal, bamboo and climbers), gums, resins, dyes, spices and condiments, etc. Medicinal plants have attracted considerable global interests in recent years. In the USA alone traditional drugs and preparation worth several hundred million dollars are imported from other countries especially India and China (Singh *et al.*, 2005). India has a rich heritage of herbal medicines and an ethno-pharmacological tradition which has developed into an established scientific faculty dealing in plant-based Medicare, called Ayurveda (Mahapatra

and Panda, 2002). The description of Himalayan medicinal plants can be seen in ancient as well as modern literature including those dealing with Ayurveda, Yunani, Tibetan, Chinese and Western system of medicine. It is believed that out of over 1600 species of medicinal plants traditionally used in India (Uniyal *et al.*, 2002), more than 50% species come from the Himalayan region. About 2,500 wild plant species are reported in use for medicinal purposes in Indian sub-continent, of which, possibly about 300 taxa are used in 8,000 licensed pharmaceuticals in India (Ahmad, 1993).

The common mode of preparation of herbal medicine is decoction, concoction, crushing and powdering. Most of the herbal medicines consumed orally or applied on skin or through nasal. The most common disease categories are mainly muscular-skeleton disorders, gastrointestinal problems, birth and menstrual disorders, skin infections, cut, wounds, burns, fever, cough and cold. The traditional values of various forest products, especially of plants having medicinal and aromatic properties, have acquired tremendous importance in the present century. The Himalaya mountain system being a repository of



keera Jodi



Guchchi



Ganoderma lucidum

high value medicinal plants has been providing raw material for continuation of various traditional system of medicine from the distant past. The different tribal communities of western Himalayan states like gaddis, kinnaura, lahaula, bhotia, swangla, ladaki, gujjars, jaunsaris, boksas, tharus, etc. are well acquainted with biodiversity based traditional knowledge and practices. A part of traditional knowledge on use of plants, with due course of time, has attracted commercial sector, which finally give space to develop small scale herbal factories. With the development of herbal sector in these states, the demand of a group of Medicinal plants fetching high amount of price has cropped up enormously. At the same time, a part of traditional knowledge has started declining due to the ignorance of less known medicinal herbs.

Indigenous people have a vast knowledge of, and capacity for, developing innovative practices and products from their environment. Indigenous knowledge grows from close interdependence between knowledge, land, environment and other aspects of culture in indigenous societies and the oral transmission of knowledge in accordance with well understood cultural principles and rules regarding secrecy and sacredness that govern the management of knowledge (Tripathi *et al.*, 2000). Maintaining traditional knowledge in the face of sweeping modern medicine and diminishing folklore is imperative (Abbas *et al.*, 1992) as such wisdom in the past has proved to be the key for inventing wonder drugs for diseases once considered incurable. It is important to make strategies for the conservation of biological resources and to document the folk knowledge for the benefit of mankind. NTFPs have always been and continue to be an important element of the forest resources in India; however, they have not received due attention. Extraction of non-timber forest products (NTFPs) has assumed considerable significance in global efforts to conserve biodiversity (Godoy and Bawa, 1993).

Judicious harvest of plant parts can be more sustainable than the harvest of whole adults, as is often the case when timber is harvested.

Identification of key habitats for conservation (Campbell, 1994) and integrating the traditional knowledge of forest users into conservation initiatives (Martin, 1995) can assist successful implementation of biodiversity plans and programmes. Such studies are beneficial in reducing the exploitation of product through the discoveries of new resources and will provide scope for the economic prosperity of the region. Traditional botanical knowledge of indigenous communities relating to the uses and management of wild plant resources is extensive (Cotton, 1997, Turner *et al.* 2000), and review showed that traditional ecological knowledge of indigenous people has fundamental importance in the management of local resources, in the husbandry of the world's biodiversity, and in providing locally valid models for sustainable life. There is strong need to conserve over exploited species due to large scale collection from natural habitats. Conservation strategy has to build on by involving local people and all stakeholders for achieving a long lasting solution.

The NTFPs have a huge potential that could lead to generate huge employment and revenue. In hilly areas, where the traditional agriculture could not match with the per unit area production with the plain areas, cultivation of medicinal plants could bring substantial benefit to local communities (Sundriyal, 2005). If the development interests of local people are marginalized for a long period of time, they might adopt actions detrimental to the goal of conservation. Capitalizing on the positive dimensions of traditional knowledge and overcoming its negative dimensions through conventional science based inputs. In the interior areas of western Himalaya, plants become the only source of medicine and well being. However, information on the uses of plants as traditional medicines has not been documented from various interior areas of

western Himalaya. Due to remoteness and lack of modern health facilities dependence on plants for medicine is very high. The role of market economy in depletion of traditional

knowledge has been well documented in many parts of Himalaya. Thus many important leads to drug discovery may be lost in absence of proper documentation.

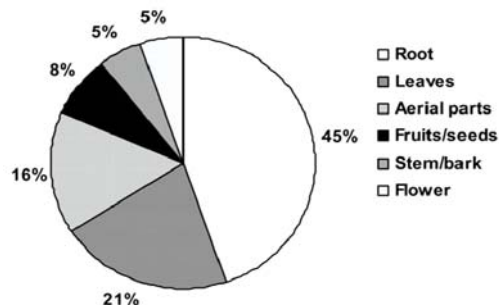


Jhundaru



Kutki

Percentage of plant parts used for medicine:



Source: Uniyal et al., 2006.

Traditional use of some medicinal plants-

Scientific name (family)	Local name	Part used	Uses
<i>Aconitum heterophyllum</i> Wallich ex Royle (Ranunculaceae)	Patish	Roots	Dried roots are powdered and taken orally to cure stomach ache and fever.
<i>Aesculus indica</i> (Colebr. ex Cambess) Hook. (Hippocastanaceae)	Khnor	Fruits	Fruits are used for preparing a nutritious recipe called "Sik". It is a pre- and post- pregnancy food for ladies. It is also used for curing excessive bleeding and pain during menses.
<i>Ajuga bracteosa</i> Wallich ex Benth. (Lamiaceae)	Neel-kanthi	Leaves	Leaf powder is given to cure ulcer of mouth. Decoction of leaves (3–4 drops) is given thrice a day to small children (4–5 months old) who have breathing problems and also to cure internal sores.
<i>Ainsliaea aptera</i> DC. (Asteraceae)	Kandyari	Roots	Crushed roots are used for gastric problems. Oily and sour food items are avoided.
<i>Angelica glauca</i> Edgew. (Apiaceae)	Chora	Roots	Root powder is (1–2 g) is consumed daily for a week with "Gud" (jaggery) to cure fever and cold. It is also used as spice in local dishes.
<i>Anemone rupicola</i> Cambess (Ranunculaceae)	Kakrya	Leaves	The sap obtained after crushing the leaves is used in treating ears with pus.
<i>Artemisia sieversiana</i> Willd. (Asteraceae)	Charmara	Leaves	Decoction of leaves is given to the pregnant ladies as an abortifacient. Paste prepared from the leaves is also applied on wounds to cure pain and swelling.
<i>Berberis asiatica</i> Roxb. ex. DC. (Berberidaceae)	Chunchri	Roots	The roots are used for curing diabetes and jaundice. Fresh roots are cut into small pieces and decoction is prepared. This is later filtered through a cloth, concentrated and dried in shade. Small

			pills (each of ca. 1–1.5 g) are made from this. For adults, 3 pills a day are recommended with the sap of bitter guard (locally called "karella") to cure diabetes. These pills are also consumed with " <i>Kujja Mishri</i> " (local sweet made out of sugar) and water to cure jaundice.
<i>Berberis lyceum</i> Royle (Berberidaceae)	Kashmal	Roots & new shoot apices	The roots are dried in shade and boiled in water. This decoction is concentrated at low temperature and finally dried. The dried product is called " <i>Rasaunt</i> " and is used to cure eye infection. New vegetative apical shoots are also used for the same purpose. These are crushed and the sap is applied directly on the eyes.
<i>Bergenia ciliate</i> (Haworth) Sternb. (Saxifragaceae)	Sadpottar	Roots	Root decoction is taken empty stomach in the morning for 3 months to cure kidney stones.
<i>Cannabis sativa</i> L. (Cannabinaceae)	Bhang	Seeds	Oil extracted from dry seeds is applied to cure paralysis and joint pain. It is also applied to cure fever caused by severe cold. Concentrated and dried sap extracted from the leaves is mixed with mustard oil and applied internally, as well as externally to cure piles.
<i>Cirsium wallichii</i> DC. (Asteraceae)	Bursa	Root	Root powder taken with water in early morning helps to cure gastric problems.
<i>Cynodon dactylon</i> (L.) Persoon (Poaceae)	Drub	Aerial parts	Entire aboveground parts are crushed with water. Two to three drops of this extract are poured in the nostril to cure nasal bleeding.
<i>Fragaria nubicola</i> Lindley ex Lacaita (Rosaceae)	Kida-bhumla	Aerial parts	Decoction of plant is consumed twice a day for 5–6 days in the morning and evening to cure fever.
<i>Grewia optiva</i> Drummond ex Burret (Teliaceae)	Dhaman	Leaves	Fresh leaves are boiled in water to prepare decoction which is further concentrated at low temperatures. The concentrated paste is applied to cure joint pains.
<i>Malva parviflora</i> L. (Malvaceae)	Nasochal	Aerial parts	Entire plant is boiled in water to prepare decoction. It is used for abortion.
<i>Parthenocissus semicordata</i> (Wall.) Planchon (Vitaceae)	Amru bail	Aerial parts & Root	Sap collected by giving a cut in the above ground portion of the plant is drunk to cure leucorrhoea. It is also used to cure piles but is not recommended for male as it may cause impotency. Further, the paste prepared from the roots is also applied externally over the wounds and boils to inhibit puss formation.
<i>Picrorhiza kurrooa</i> Royle ex Benth. (Scrophulariaceae)	Kurro	Roots/ Rhizome	Fresh as well as dry roots/rhizomes are ground with water to prepare a paste. The paste is applied to cure joint pains. It is also used for curing fever.

<i>Pinus roxburghii</i> Sarg. (Pinaceae)	Chir	Needles	The green needles are ground and sap is extracted. It is taken to increase the flow of urine.
<i>Polygonatum verticillatum</i> (L.) All (Liliaceae)	Salam mishri	Roots	Fresh roots are cleaned, broken into small pieces and kept in water overnight. Next day these are ground in the same water. About 10 ml of this solution is taken regularly empty stomach in the morning to cure spermatorrhoea (locally called <i>Dhat</i>) and piles.
<i>Polygonum amplexicaule</i> D.Don (Polygonaceae)	Mindle	Roots	Root sap is extracted and applied to cure fresh wound in the eyes.
<i>Prinsepia utilis</i> Royle (Rosaceae)	Bakhel	Roots	Root extract is taken orally as an antidote to neutralize the effect of poison intake. Root paste after heating at low temperature in an earthen pot is applied on wounds.
<i>Prunus cerasoides</i> D.Don (Rosaceae)	Pajja	Stem bark	Decoction of stem bark is concentrated at low temperature and applied to cure joint pains.
<i>Ranunculus hirtellus</i> Royle (Ranunculaceae)	Goodi	Roots	Roots of plant are crushed with cow's urine to make a paste. The paste is applied at the base of thumb. If the swelling is on the right testes then the paste is applied at the base of left hand thumb and vice versa. The paste should not be kept for more than 20 minutes and is applied only once.
<i>Rheum austral</i> D.Don (Polygonaceae)	Chukri	Aerial parts	Whole plant is crushed and poultice is made in a cotton cloth. This is then heated and applied to cure swelling, which has developed as a result of fractured bone.
<i>Rhododendron arboreum</i> Smith (Ericaceae)	Brah	Flowers	Flowers are crushed and snuffed to stop nasal bleeding.
<i>Rubus niveus</i> Thunb. (Rosaceae)	Khiradi	Fresh root tips	Fresh root tips are used for curing excessive bleeding during menstrual cycle. The root tips are made into a paste with water and small pills are made. One pill per day, preferably with butter made from buffalo milk, is taken empty stomach in the morning for 7 days. The original rootstock of the plants is avoided.
<i>Rumex hastatus</i> D.Don (Polygonaceae)	Almoru	Leaves	Leaves are believed to have cooling properties and help in stopping nasal bleeding.
<i>Rumex nepalensis</i> Sprengel (Polygonaceae)	Albar	Leaves	Leaves are crushed and applied on wounds as an anti- allergic.
<i>Saussurea costus</i> (Falc.) Lipsch. (Asteraceae)	Kuth	Roots	Root paste is applied externally to cure joint pains.

<i>Selinum tenuifolium</i> Wallich ex C.B. Clarke (Apiaceae)	Matoshal	Roots	Root is powdered and mixed with mustard oil and applied on the body of women to cure swelling which develops after delivery.
<i>Stellaria media</i> (L.) Villars (Caryophyllaceae)	Khukawa	Seeds and leaves	About 20 dry seeds/day of the plant are given to the children to cure skin infections. The leaf paste of the plant is also applied on wounds caused by burning.
<i>Swertia chirayita</i> (Roxb. ex Fleming) Karsten (Gentianaceae)	Chirayta	Aerial parts	Entire plant is ground, boiled in water and filtered. 1–2 drops of filtered decoction is given to children against skin infections.
<i>Thalictrum foliolosum</i> DC. (Ranunculaceae)	Barmot	Roots	Dried root powder mixed with <i>Thymus linearis</i> in equal proportion is taken regularly to cure stomach pain and gastric trouble.

Source: Uniyal et al., 2006.

Conclusion :

The indigenous people of the Western Himalaya inherit a rich traditional knowledge and documentation of this knowledge is essential to provide the information of the local NTFPs from the areas. The tribal communities living in remote areas are still depend on the plants for medicinal and other purposes and are very much concerned about their degradation in wild as they now have to travel even more far to collect these plants. Cultivation and management of these NTFPs for livelihood and income generation are the need of the day to conserve this fast depleting resource as well as make it a source of earning to younger generation who are aware of market economy. This endeavor certainly will have larger implications. Thus, the documentation of traditional knowledge , management, cultivation and utilization of NTFPs of this area will not only provide recognition to this knowledge but will also open opportunities for better livelihood to rural masses thus arresting migration of youth from this area for the search of job.

References :

- Abbas JL, El-Oqlah AA, Mahasneh AM. Economic Botany 1992;46(2):158-163.
- Ahmad RU. Medicinal plants used in ISM- their procurement, cultivation, regeneration and import/export aspects- a report. In: Govil JN, Singh VK, Shamima H, eds., Glimpses in Plant Research. Vol X. Medicinal Plants: New Vistas of Research. PartI. Today's & Tomorrow's Printers and Publishers, Delhi. 1993:221-258.
- Campbell DG. Scale and patterns of community structure in Amazonian forest. In: Edwards PJ, Mayand RM, Webb NR eds., Large scale ecology and conservation biology, Blackwell Scientific Publications, London. 1994:179-199.
- Cotton CM. Ethnobotany, Principles and applications. John Wiley & Sons, Chichester, UK. 1997.
- Godoy R, Bawa KS. The economic value and sustainable harvest of plants and animals from the tropical rain forest: Assumptions, hypotheses, and methods. Economic Botany 1993;47: 215-219.
- Mahapatra AK, Panda PK. Ethno-pharmacological knowledge of Juang and Munda tribes of eastern India, International Journal of Sustainable Development and World Ecology 2002;9:151-158.
- Martin G. Ethnobotany. A people and plants conservation manual. Chapman and Hall, London. 1995.

Rao KS, Semwal RL, Maikhuri RK, Nautiyal S, Sen KK, Singh K, Chandrasekhar K, Saxena KG(2003): Indigenous ecological knowledge, biodiversity and sustainable development in the central Himalayas. Vol.44 (1):93-111.

Sanjay Kr. Uniyal, Amit Kumar, Brij Lal and R. D. Singh (2006): Quantitative assessment and traditional uses of high value medicinal plants in Chhota Bhangal area of Himachal Pradesh, western Himalaya

Current Science, Vol. 91, No. 9 (10 November 2006), pp. 1238-1242.

Singh JS. Sustainable development of the Indian Himalayan region: Linking ecological and economic concerns. *Current Science* 2006;90(6):784-788.

Singh D, Srivastava RK, Khanduri VP. Marketing strategies and trade of medicinal plants in Uttarakhand: Present and future prospects. *Indian Forester* 2005;131(3):330-340.

Sundriyal RC. Medicinal plant cultivation and conservation in the Himalaya: An agenda for action. *Indian Forester* 2005;131(3):410-424.

Tewari JC, Tripathi D, Pratap N, Singh SP. A study of the structure, energy fluxes and emerging trends in traditional Central Himalayan Agroforestry systems. *Forest, Trees and Livelihoods* 2003;13 : 17-38.

Tripathi, M. K. ; Agrawal, I. S. ; Sharma, S. D., 2000. Performance of crossbred calves on acid processed or copper and iodine supplemented high glucosinolate mustard meal incorporated diets. *Anim. Nutr. Feed Technol.* 1 (1): 39-50.

Tripathi S, Varma S, Goldey P. Using plants for health: indigenous knowledge in health care in a tribal region of Bihar, India. *International Journal of Sustainable Development and World Ecology* 2000;7:321-332.

Turner NJ, Ignace MB, Ignace R. Traditional ecological knowledge and wisdom of aboriginal peoples in British Columbia. *Ecological Applications* 2000;10:1275-1287.

Uniyal SK, Awasthi A, Rawat GS (2002) . Current status and distribution of commercially exploited medicinal and aromatic plants in upper Gori valley, Kumaun Himalaya, Uttarakhand. *Current Science*; 82(10):1246-1252.

Uniyal S.K., Singh K.N., Pankaj Jamwal and Brij Lal (2006): Traditional use of medicinal plants among the tribal communities of Chhota Bhangal, Western Himalayas *Journal of Ethnobiology and Ethnomedicine* 2006:14.

Uniyal SK, Awasthi A, Rawat GS(2002): Traditional and ethnobotanical uses of plants in Bhagirathi valley (western Himalaya). Indian Journal of Traditional Knowledge., Vol-1: 7-19.

**Subhash Nautiyal, Anil P. Joshi,
Rakesh Kumar, Sunil Agarwal* and
Prashant Sharma**
*Himalayan Environmental Studies and
Conservation Organization (HESCO),
Vill. Sukhlapur, Via-Premnagar,
Dehradun-248001,
Uttarakhand*
**SEED Division, DST, New Delhi.*

Grassroot Innovators and Entrepreneurships

1. Entrepreneurship among Local Communities through “Prasad” in Various Shrines

Intoduction:

India, the land of diverse religions and cultures is also land of rich resources. By establishing relation between religion and the available local resources, an attempt has been made by HESCO to develop entrepreneurship and boost employment opportunities through locally made **“Prasad”**. A huge economy is involved in the country’s most popular religious shrines. From the flowers offered to the Gods, to the sculpting of idols’ worshipping, there is a huge market that can be exploited by local communities. Ironically, the villages in and around the pilgrim stations are not the beneficiaries of the market, despite being the abode of rich resources.

Every culture and tradition in India has a religious-agricultural perspective. Be it Baisakhi, Diwali, Id, among many national and local festivals, the first offering to the God has been the agricultural harvest. Hence, agriculture is the main culture of India and religion can be a good way to couple agriculture with the economy of rural India.

Accordingly, most of the holy places of India offer things to God such as ‘Puffed Rice’,

‘Batashas’, ‘Elaichi dana’, and ‘Sugar Balls’ as **“Prasad”** (offering). To create entrepreneurship among the local community, the offering or Prasad making is used to provide employment to women and youth of the villages which are located in and around the various religious shrines. In this endeavour, Himalayan Environmental Studies & Conservation Organisation (HESCO) initiated WISE-Women Initiative for Self-Employment has intervened with the motto of **“Local Need Meet Locally”** where local resources are used to economically empower local communities and bring a decentralised economy. This endeavour envisages empowerment for women living near shrines through technology intervention in better utilisation of available resources such as Buckwheat, Amaranthus, Foxtail millet, etc. for making **“Prasad”** as offering to shrines of the Western Himalayas which are given below:

1) Badrinath :

Badrinath is a Hindu holy temple located in Chamoli district of Uttarakhand and is one of the “Char Dham’s” pilgrimage shrines of the country. To create entrepreneurship among villagers living in and around the shrine, in two villages namely, Sairdhar and Dangwal, **Prasad and Incense material** have been prepared, however, Dangwal and Bonn villages are involved in making **Ringal baskets** of different sizes.

The women group “Mahila Mangal Dal” formed in these villages where the group started preparing the **“Prasad”** for Badrinath temple. The temple committee was approached for marketing inputs that followed with the production. Now, with this initiative the turnover of this group is more than Rs. 18 lakhs per year. With Prasad the other inevitable offerings for worship are incense sticks which are also made by use of locally available aromatic plants.





The next thing was to make baskets which are used to contain offerings. Again, a locally available variety of bamboo was used called Ringal. Ringal is a smaller variety of Bamboo and found in high altitudes of the Himalayas. The baskets are made to replace the polythene bags. The Rudiya community is chiefly engaged in the creation of baskets and other items using Ringal.

2) Vaishno Devi Shrine :

Here, the initiative of “Offering” started at several places. One of the places where entrepreneurship had created among villagers was Parthal village. Parthal is located at the bottom of Shrine Vaishno Devi in the state of Jammu and Kashmir. This village is economically independent today as it has an annual turnover of Rs. 4.5 million. In the past, the village depended on local agriculture produces and Maize was the most common crop was growing in the region. But Maize did not give them a good return and making it difficult for farmers to continue its production which forced the farmers to look for alternative source of income. After analysing the problem, HESCO with the help of CFTRI, developed a protocol for making sweets from the maize after giving value addition to the products to create offerings for shrine.

Locally, the sweet is called “Laddoo” and after the introduction of protocol, villagers agreed with the idea. Later, a deal was made between the villagers and the Shrine Board in which the Board agreed to take a fixed number of packages from the locals to sell to the pilgrims. Now, the village today stands as an example where “Vaishnavi Mahila Dal” was formed as women were the partners in making Prasad. They had initially started by supplying the product to just one Shrine, now they supply to other places as well and also consumes the products locally. At present, the group is more organised and is able to give employment to numerous needy and unemployed persons.





Turnover of Different Shrines:

S.No.	Temples Turnover (2016-17)
1. Vaishno Devi (J&K)	45 lac
2. Shadra Sharif (J&K)	4 lac
3. Shiv Khori (J&K)	5 lac
4. Badrinath (Uttarakhand)	18 lac
5. Gangotri (Uttarakhand)	3 lac

The other shrines were Shadra Sharif (J&K), Shiv Khori (J&K) and Gangotri (Uttarakhand) in which **Prasad** from local resources is offered and local villagers are involved in making this Prasad. This is a continuous endeavour and turnover of each shrine is increasing year by



year leading to prosperity of local communities.

Dr. Kiren Negi, Dr. Rakesh Kumar and Prashant K. Sharma,
Himalayan Environmental Studies and
Conservation Organization (HESCO),
Vill. Sukhlapur, Via-Premnagar,
Dehradun-248001,

2. Protected Cultivation: Proven Technology for Youth Employment

A Case Study of Lohaghat, Dist. Champawat, Uttarakhand

Horticulture is progressing in the country and its total production has surpassed the total food grain production. It is an indication that our country is progressing towards horticultural revolution, providing not only the food security but nutritional security also. Among the horticultural crops, vegetable and flower crops are tender and sensitive to climate change. Prevailing climate change is adding to uncertainty in production of these crops. Other stress faced by the horticultural crops is that high water requirement while availability of irrigation water is limited. Rapid urbanization is another factor reducing land availability for farming. To face this challenge protected cultivation has emerged as one of the technologies that have bright future.

Because of high input (land, water, seeds and chemicals) use-efficiency and protection from fluctuating and sudden abiotic stresses, the protected cultivation in the country is picking up by covering approximately 50,000 ha land.



Protected cultivation technology is a relatively new technology for our country. The total area covered under protected cultivation in our country is approx 50,000 hectares. There has been a very good development in this area

during the last five years. The leading states in the area of protected cultivation are Maharashtra, Karnataka, Himachal Pradesh, North-Eastern states, Uttarakhand, Tamil Nadu and Punjab. The major crops grown in the protected cultivation are tomato, capsicum, cucumber, melons, rose, gerbera, carnation and chrysanthemum. Nursery grown in the protected cultivation is becoming very popular venture for income and employment generation. Protected cultivation, which enables some control of velocity, moisture temperature, mineral nutrient, light intensity, and atmospheric composition has contributed and will continue to contribute much to a better understanding of growth factor requirements and inputs for improving crop productivity in open fields. Technologies for protection (windbreaks, irrigation soil mulches) or structures (green house, tunnels, and row-covers) may be used or without heat. The primary emphasis is on producing high-value horticultural crops (vegetables, fruits, flower, woody ornamental and bedding plants). Protected cultivation practices can be defined

as cropping technique where in the micro climate surrounding the plant body is controlled practically/ fully as per requirement of the plant species grown during their period of growth. Our country is self dependent on food grain production but to full fill the nutritional security, the gap between increasing demand of horticultural produce has to be filled. This gap can be filled by the traditional horticulture which required large area under to increase the production for the ever growing population.

Among the greatest constraints in horticultural crop production are a lack of sunlight, temperature that are either too hot or too cold, moisture deficiencies in soil nutrients, excessive wind velocity and atmospheric carbon dioxide. Most of these are climatic factors or directly related to them. Many of these constraints have been alleviated or lessened by protected cultivation or controlled environments.

Considering the socio-economic condition of farmers, land holding and natural resources in



hills, a demonstration was conducted in low cost polyhouse at Lohaghat, district Champawat to demonstrate vegetable production under polyhouse–cum-drip irrigation system. A gable type polyhouse structure size 20m x 5m x 3m was selected for cultivation of hybrid capsicum (var. tanvi) and tomato variety Rashika, from March to October. About 360 plants were grown at 50cm x 50cm spacing in polyhouse. A poly-tank (made by UV stabilized, blue colour silpauline sheet of 250GSM) of 20,000 liter capacity was constructed (tank size was 5.1m x 5m x 1.5m) in upper side of polyhouse structure so that sufficient water due to gravity can be available for drip irrigation system. Rain water harvested from the roof of nearby building (effective roof area 120m²) was collected in poly-tank by filter and plastic pipes. A drip irrigation system (dripper discharge 2.5 liter/hour) was installed to this poly-tank for irrigation.

About 74 irrigations were required during March–October. The drip irrigation system was opened half an hour a day to maximize the

uniformity. It was observed that maximum of 15 irrigations were given to these crops in May and June. Total quantity of irrigation water required for 400-500 sqm polyhouse area was 92,500 liters to grow capsicum and tomato from March to October and this quantity of water was harvested from a single roof area of 120 m² in the similar rainfall area. The total yield of capsicum and tomato from 100 m² polyhouse was recorded as 1,050 and 1,250 kg respectively, which gave total return of Rs. 45,000 (capsicum @ Rs. 25 kg and tomato @ Rs. 15 kg). However, total income obtained from the same area (100m²) by the traditional method under open field condition was only Rs. 2500. Thus the farmers had obtained significantly high income, i.e. as much as 18 times higher than the traditional method by adopting the polyhouse technologies. The poly-tank of 20,000 liter capacity coupled with drip irrigation system is adequate for irrigation of capsicum and tomato in 100 m² area prevailing the similar rainfall pattern

Following this example, large number of



farmers are adopting this technology and getting net profit of Rs. 1,00,000/- to 1,20,000/- per year in off-season from 400-500 sqm size of low cost polyhouses irrigated with harvested rainwater in this area.

Keeping in view of youth unemployment, the protected horticulture technology thus has been proven new employment platform by skilled up the youth in relation to polyhouse technology. Inputs like suitable varieties, Hi-Tech Nursery, Integrated Nutrient Management (INM), Integrated Pest Management (IPM) and to operate drip

irrigation and fertigation system under polyhouse conditions for harvesting 3 to 5 times high quality yield per unit area in comparison to open field conditions are required to be given to sustain the productivity.

D.K.Singh,

Professor Vegetable Science,

G. B. Pant University of Agriculture &

Technology Pantnagar,

Shashank Shekhar Singh,

Ph. D Scholar, SHUATS, Allahabad, and

Vidyawati,

MBA Scholar, DSMNRU, Lucknow.

Major Events of TIME-LEARN Programme during the year 2017-18

- 1) Launched 20 Projects in the North Western Himalayan states (J & K, HP, & UK).
- 2) Planning & Execution Workshop was held on 22nd - 23rd May, 2017 at WII, Dehradun.
- 3) Field visits of experts' team for different project sites.
- 4) Documentation of annual progress reports of projects under the programme.
- 5) The Annual Group Monitoring Workshop (AGMW) with Technical Advisory Expert Group (TAEG) committee was held on 7th - 8th December, 2017 at SKUAST-J, Jammu, Jammu & Kashmir, and the brochure of TIME-LEARN Programme was released by Shri N.N. Vohra the honourable governor of Jammu & Kashmir, on 7th December, 2017 at SKUAST-J, Jammu.
- 6) The TIME-LEARN Programme website was launched on 8th December, 2017 by Prof. Tej Partap, the chairman of TAEG committee at SKUAST-J, Jammu, Jammu & Kashmir.
- 7) The TIME magazine both in English and Hindi have published.



Field visit by expert members of TAEG committee.



Exhibition visit by the honourable Governor of J&K and experts.



Dr. Sunil K. Agarwal, DST briefing about the TIME-LEARN Programme.



Inaugural speech by the chairman, TAEG committee, Prof. Tej Partap.



Inaugural speech of AGMW of TIME-LEARN Programme by Shri N. N. Vohra, the honourable governor of J&K.



Launching of TIME-LEARN Programme website by Prof. Tej Partap, chairman, TAEG committee.



Release of TIME-LEARN Programme brochure by Shri N. N. Vohra, the honourable governor of J&K along with TEAG committee members and DST officials



Exhibition visit by experts

For any suggestion/comment please contact :

Himalayan Environmental Studies & Conservation Organisation (HESCO),
Vill. Shuklapur, P.O. Ambiwala, Via-Premnagar, Dehradun, Uttarakhand, Pincode-248001

Contact : 9410394873/9761651454.

Email: rakeshkumar_hesco@rediffmail.com, hescotime44@gmail.com