

The Improved Solar Greenhouse (IGH) under the project “*Learning Income Generation in Himalaya together - LIGHT*”

Case study in Western Indian Himalayas

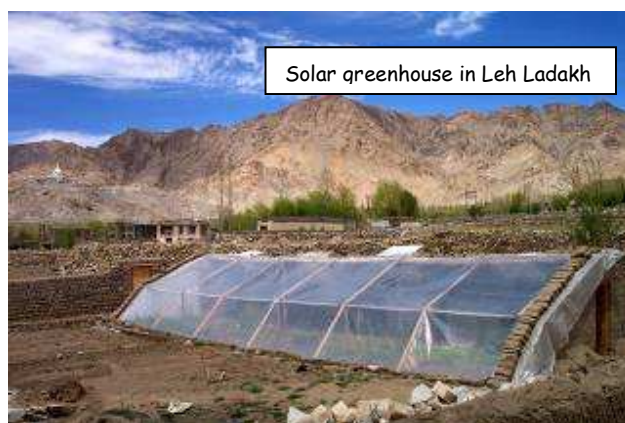


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I INTRODUCTION

The northern parts of the Hindu Kush and Himalayan ranges are a cold desert between 2500 m and 5000 m above sea level. These areas, often called Trans-Himalayas, stretch from the Tajikistan in the West to the Bhutan in the East with the Tibetan Plateau as its central part. The environment is very harsh with the winter temperature frequently falling below -30°C and limited rain and snowfall (less than 300mm per year). In this cold desert, the natural resources are very limited.



During the short summer season the communities devote their energy to stocking firewood for their houses for the winter. Women spend two months per year to collect cow dung in pastureland for domestic purposes like cooking and heating in winter. The way of life and agricultural system of the inhabitants is geared towards surviving the long and harsh winter. The self-subsistence agricultural production is limited in most of the area to one crop per year and is focused on barley and wheat with additional peas, potatoes and sometimes vegetables. The average land area under cultivation is small, less than 1/2 hectare per household. Therefore in this high altitude plateau, the inhabitants are fully dependent on cattle rearing for livelihood. Besides, the poor transportation infrastructure limits the supply of fresh food. In winter, when the snowfall blocks the high passes and the roads are usually closed, the foodstuff is supplied by airplane at a high cost in the main city and is not available in the rural area.

On the other hand, the climate is very sunny, especially during the winter period. The solar radiation can be used not only to warm the domestic houses, schools and dispensaries, handicraft centres, etc but also to develop off-season agricultural activities such as composting, greenhouses, trench greenhouses, poultry farms etc.

Greenhouse in Ladakh

Greenhouse cultivation in Ladakh was started in the early 1980s by using glasses as the glazing material. But due to limited know how and initial high cost factor it remained limited in its extent. In 1989 the department of Agriculture started a low cost design by using local mud bricks and polythene film. Since then thousands of greenhouses of such design have been disseminated all over Ladakh. However due to very slow winter growth, limited training and poor follow up, many farmers were discouraged and today only a few number of such greenhouses are in good working condition.

LEHO with GERES improved the greenhouse design keeping in mind the cost effectiveness, with the materials locally available. 100 improved greenhouses were built and disseminated in the Leh district in 1998. These have been used by the farmers successfully and 80% of them are still running with good condition. From this experience we learnt that the farmers with lower income run the greenhouse more successfully and there is better impact on the household. Based on this success, Ladakhi NGO elaborated the following project for dissemination.

The project:

The project “*Learning of Income Generation in Himalaya Together*” (LIGHT) is funded by European Commission and Foundation Ensemble and is being implemented by an NGO network in two districts of J & K, Leh & Kargil and one district of Himachal Pradesh, Lahol-Spiti. The network consists of five local NGOs - LEHO, LNP, LEDeG, SKARCHEN and STAG, BORDA (a German NGO) and the French NGO – GERES which leads the project.

Enabling farmer to construct and run Improved Greenhouses is one of the major components of the project. It was started in the year 2005. .

The aims:

- To improve the livelihood of the rural population living in the western himalayas.

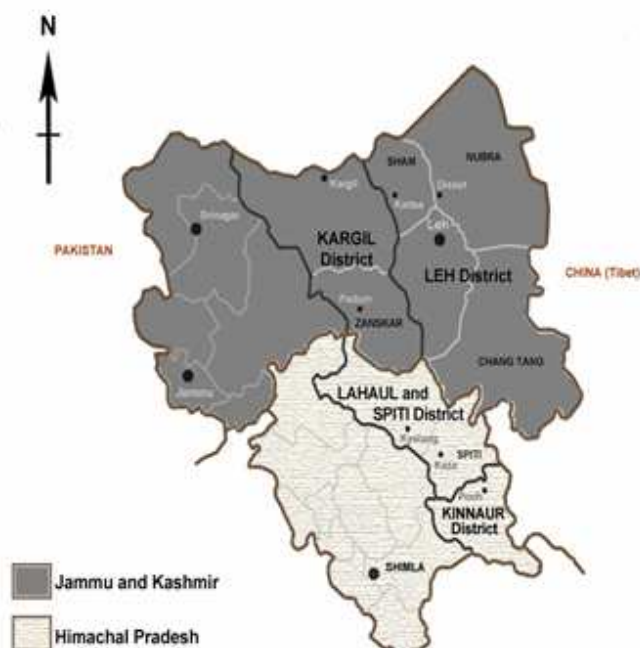
Specific objectives

- Additional Income generation: To increase the household income by 30%.
- Health improvement To double vegetable consumption during winter.
- Women empowerment.

The expected results:

- 500 families enabled to build and run IGH.
- 50 masons trained.
- 150 tons of vegetable produced annually.
- 6 NGOs enabled to disseminate greenhouse.

Project Area



2 States

- Jammu & Kashmir
- Himachal

3 Districts

- Leh districts
- Kargil district
- Lahaul-Spiti districts

II THE TECHNOLOGY

A. Conventional greenhouse

Traditional greenhouse (TGH)

It is constructed with three single walls covered by a south facing polythene sheet.

Tunnel greenhouse

It is above the ground with a polythene sheet in a tunnel shape from all four sides.

Trench greenhouse

It is 2 feet under ground and covered with UVS polythene sheet at the ground level.



B. Improved greenhouse (IGH)

The main characteristics of the improved greenhouse are:



It is **South facing** to pick up the solar radiations through the transparent polythene sheet that covers the greenhouse on the south.

The angles of the polythene are calculated so that the maximum amount of solar radiation can be transmitted inside the greenhouse.

In high altitude **Double polythene** is recommended to reduce heat loss which increases the temperature during night time.

Double wall with insulation: The walls are composed of 3 layers:

- The 6 inch inner layer stores the heat during the day and releases it during the night. It can be built with mud brick, rammed earth or stone.
- An insulation layer of 4 inch (straw, wild bush, sawdust...).
- An outer 12 inch load-bearing wall built with mud brick, rammed earth or stone.

Colour: The colour white reflects solar radiation while the colour black absorbs solar radiation. This simple principle is directly applied to greenhouse design.

- The inner side of the west wall is white washed to reflect the morning solar radiation after the cold of the night.
- The inner side of the east wall is painted black to absorb and store the afternoon solar radiation. This radiation will be released at night to heat the inner space.



Roof

- The slope of the roof is 35°. In winter, as the sun has a low elevation angle, this angle optimises the solar radiation gain. During summer, the sun is high in the sky, thus the roof shades the greenhouse partly and limits the risks of overheating.
- An insulation layer (straw, wild bush...) insulates the roof.
- This shape reduces the interior volume compared to traditional greenhouses, thus the temperature inside is warmer.

Door: The door is located on the wall which is opposite to the flow of wind to reduce the infiltration of cold air.

Ventilation: During sunny days, the air inside the greenhouse can be very warm (over 40°C). This overheating damages vegetable and encourages disease and pests. Manually operated openings are provided at the bottom of both sides (door, wall ventilator) and on top of the greenhouse. As

the warm air rises, the cooler ambient outer air enters the greenhouse through the bottom ventilator, cools the greenhouse and gets warmer; finally rising and exiting the greenhouse through the roof ventilator.

Night insulation: A piece of cloth or polythene sheet is used to cover the greenhouse during the night to reduce heat-loss through the polythene and to maintain the night temperature and to increase the efficiency.

C. Agro results

Comparison of an IGH and a traditional GH

Month	02	03	04	05	06	07	08	09	10	11	12	01
Trad GH (1)	Grow very limited	Few leafy vegetables	Spring Vegetable seedlings	Polythene removed : GH used as a surface of an open-field				leafy vegetables			Grow very limited	
IGH (2)	Leafy vegetables 2 times harvest/ month		Spring and summer vegetables	Maturation of summer vegetables in the IGH, or polythene removed				Mongol + leafy vegetables Tomato up 15 th Nov				

	Total cost (Rs)	Promoter investment (Rs)	Total yearly production of leafy vegetable (Kg)	Total yearly income (Rs)	Payback period for promoter investment (years)	Production of vegetable in winter	Possibility to grow seedling in spring
Trad GH	16.000	10.000	150	5.000	3,2	- < 3000 m :low - between 3000 and 3500 m: very low; - above : nil	Yes...but lack of ventilation
IGH	30.500	12.000	300	10.000	3	- < 3500m : high - between 3500 and 4000 m : medium - Above: low.	Yes
Difference between IGH and GGH (%)	+90%	+20%	+100%	+197%	-66%	-	-

An IGH costs more than a traditional GH, but production is double (+100%), income is double (+100%). The payback period is less than 3 years.

III THE NGO NETWORK

As the Western Himalayas is spread over a large area, village are scattered and cultures differ from one area to another. One NGO can not cover the entire area and therefore the project is being implemented by a network of 5 NGOs.

This network is based on

- Resource NGO that is experienced on implementation, methodology and techniques
- Proximity NGO that are responsible for implementation in their own area where they have good rapport with community .

Role of resource NGO (LEHO):

- Organization of workshops (jointly with GERES)
- Set up posters as a support for proximity NGO during promoter mobilization (explanation of criteria, design, materials required, running plan...),
- Organization of training when required;
- Visit other areas when required (especially during construction and trainings in remote areas)
- Collection, compilation and analyzing of data from follow up;
- Research and development (test on different designs) with government.

Role of proximity NGO:

- Implementation of the project in the field
- Promoter selection
- Follow up

The area distribution is :

- Ladakh Ecological Development Group (LEDeG) responsible for Durbuk block in Changthang, Sham, Kargil and Zaskar with its branches in Kargil and Zaskar,
- Leh Nutrition Project (LNP) for Nyoma block of Changthang, Gya-Meru, Kharu-Sakti and Markha valley,
- Ladakh Environment and Health Organization (LEHO) for Leh area,
- SKARCHEN for Nubra Valley
- Spiti Trans-Himalayan Action Group (STAG) for Lahol-Spiti.

The project also involves the community as resource persons in the implementation to ensure the cost effectiveness and to improve quality of implementation and follow up. 4 types of resource persons collaborate with the project.

“**Co-ordinator**”: Access to very remote area can be very difficult (Turtuk) or even impossible in winter when roads are blocked by snow (Sapi, Rangdum). In this case, a local coordinator is engaged part-time by the NGO : He conducts to visit per month, supervise the proper running of the greenhouse, collects data, inform NGO in case of problems and send reports to NGO

“**Agro-training**” resource person: He conducts agro training for the promoters.

“**Running Follow-up**” resource person: He looks after the greenhouses in his cluster by visiting every 2 weeks to each promoter to provide advice and correct running mistakes.

Construction resource person: He follows up the greenhouse construction in his area by enabling masons and owners to construct their greenhouse according to the design.

IV THE TARGET GROUP

Keeping in view the best social impact and chance to succeed, the project aims to enable families who have limited access to cash income to generate additional income and to enable them to build and run IGH. Since we are focusing on additional income we are selecting families with lower annual income but who are motivated and experienced in growing vegetables. The main selection criteria are:

- Social: Farmers who are mostly dependent on agriculture, who have no business activities like shop, restaurant, hotel & taxi and whose family annual per capita income does not exceed 12,000 rupees maximum (210€/year)
- Technical site feasibility (orientation, sun duration water availability.....)
- Agronomical skill and motivation of the farmer

The target group is a “promoter” rather than a “beneficiary”. The promoters are willing to set up a greenhouse activity and are ready to invest. Project fills the investment gap. The promoter invests and the project gives the “contribution”.

The project area is divided in 2 types of zones according to the accessibility to market and climate.

- Development area: Near to market (Leh, Kargil, Keylong..) where the project focus on income generation
- Remote area: Chang Tang, Zanskar, Markey Valley, Sanku., where the project focus on additional income generation and health improvements

V IMPLEMENTATION

Area: Keeping in mind the efficiency, a cluster of 3 - 4 villages are selected. In each village at least 4-5 families are enabled to construct and run greenhouses. Distant villages and “one village one greenhouse” is neither cost effective nor efficient.

Selection Methodology: The stepwise selection methodology is as below:

Firstly, a meeting is held with the village representatives i.e. the Goba, Member or Sarpanch where the project is introduced to them.

Then a village level meeting is held to inform all the villagers and to explain to them the project, its contributions, investments, site constraints, the target group etc. by using posters. At the end of the meeting a list of villagers who are interested is taken..

The third step is to conduct the feasibility of the survey (technical, social) by visiting each farmer mentioned in the list, which is a door-to-door survey.

After the final selection an exposure visit is organized to some existing greenhouse in order to orient them and give them an idea of the structure and to discuss with the promoter about the IGH, which is followed by construction.

At last a resolution is signed with the promoter after the exposure visit, to make them use the greenhouse properly.

The project contribution: The total cost of the greenhouse is between 25,000 to 30,000 rupees depending upon area and material availability. The project contributes door, ventilators, polythene and paints worth 7,000 rupees in the development area where as in the remote area beam is also contributed from the project.

Construction of the IGH: The foundation lines according to the orientation are drawn by the NGO. Design is provided and explained to every promoter and mason. We frequently visit during construction so that the greenhouse is built correctly and according to the design.



Agro-training: There are two agro trainings for the promoters in order to build their capacity: one in early winter and the second one in the spring for seedling production. When the constructions are completed we conduct the winter agro-training, with the help of a resource person, for all the promoters to enable them with the techniques of sowing, watering, thinning or spacing, harvesting and compost making. Then the training on seedlings production is organized in the spring.

Compost making: The project encourages the promoters to build a compost pit to maintain the soil fertility.

Follow-up: After the construction, during the whole winter we follow-up all the greenhouses to check if the promoter using the greenhouse properly and to assist the promoters if they face any problem during running. We try to solve every problem they face.

VI ACHIEVEMENTS/ RESULTS

No of IGH built:

Area	IGH built in 2005	IGH built in 2006	IGH built in 2007	Total
Around Leh	21	26	37	84
Nyoma block of Chang Thang, Gya-meru, Markha valley	22	30	52	104
Tangtse and Sham	7	7	21	35
Kargil	9	19	31	59
Zaskar	9	21	39	69
Nubra Valley	6	5	40	51
Spiti	3	10	16	29
Lahol	0	6	15	21
Total	77	124 (include 15 with SHG/community)	251	452

External evaluation shows that promoters are very satisfied and many even constructed their second IGH. More than 90% are functional after 2 years. It is the first time that fresh vegetable are available in Spiti and Zaskar because of IGH

Production and income in IGH based on follow up:

		Total Production in kg
Development	Best	1150
	Average	470
Remote	Best	430
	Average	170
Average for all area		330

Income

		Income generated	% increase in income
Development	Best	20,600	59
	Average	9,000	26
Remote	Best	7,850	67
	Average	2,600	12
All areas	Total	300,000	-
	Average	5,400	15

Gender

- More than 80% of the IGH are run by women. Women feel more confident with new agro and marketing skills;
- Income are usually managed by women, often for education purpose
- More than 10 women SHGs could built and run IGH.
- For the first time, women in Kargil and Zanskar sell in market vegetable that they produce

Health

- Fresh vegetable consumption in winter is more than double.
- Most of the owners mention health as one the 2 mains impacts with income.
- Meat consumption is reduced by one sheep and animals are saved.

Based on the good results, Himachal Government funds the greenhouse investment in 2007/8 in Lahaul and Spiti.

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