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Introducing Innovations in the Apple Value Chain in Himachal Pradesh

Towards the Transformation of Agri-food Systems for Climate Resilience and Economic Diversification

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Bengaluru, January 2025

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CONTENTS

List of Abbreviations

BMZ	Ministry of Economic Cooperation and Development, Federal Republic of Germany
FPC	Farmer Producer Companies
FPO	Farmer Producer Organisations
GHG	Greenhouse Gases
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GIC	Green Innovation Centre for the Agriculture and Food Sector
MoA&FW	Ministry of Agriculture & Farmers Welfare, Government of India

INTRODUCTION

The Technical Cooperation project "Green Innovation Centres in Agricultural and Food Sector India" (GIC India) is part of the Special Initiative (SI) 'Transformation of Agri-food Systems' (earlier SI 'One World, No Hunger'), of the Ministry of Economic Cooperation and Development (BMZ), Federal Republic of Germany. The GIC Project is being implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, in partnership with the Ministry of Agriculture & Farmers Welfare (MoA&FW). It aims at contributing to sustainable rural development in the selected areas through innovations in the agricultural and food sector.

The project is active in 14 African countries, Vietnam and in India. In India, GIC has been working with the tomato and potato value chains in select districts of Andhra Pradesh, Maharashtra, and Karnataka, and the apple value chain in Shimla and Kullu districts of Himachal Pradesh.

The GIC Project is working in Himachal Pradesh to propagate innovations and strengthen the resilience of the stakeholders of the apple value chain. Together with Farmer Producer Organisations, officials of the Government of Himachal Pradesh, scientists and representatives of various private companies and civil society organisations, we focus on transformative approaches in the agri-food sector and climate-smart innovations that can be implemented together as innovation bundles to promote the diversification of farmer's income and support the resilience of farmers when faced with extreme climate events.

These innovation bundles combine individual interventions to tackle multi-dimensional economic, social, and environmental challenges by enabling a systematic approach that considers cross-sectoral linkages across agriculture, nutrition, environment, economy, and the society. Innovation bundles build evidence and promote proven solutions for upscaling through regional and national strategies and policies.

A. Stable Climate and Insect Pollination are Crucial for Apple Production in Himachal Pradesh

Since the 1990s, there has been a consistent increase in apple production in Himachal Pradesh, primarily driven by an increase in production area. Productivity, however, has been stagnant to negative across districts. This can be attributed to reduction in

soil fertility, recurring diseases, and information gaps on advanced apple cultivation techniques and production practices. Climate change, biodiversity loss, and environmental degradation are exacerbating these factors, leading to a steady decrease of farm output and incomes in Himachal Pradesh.

Impacts on Production

Apple growth is dependent on optimum climatic factors specific to different stages of its life cycle. Climate change has been disrupting the optimal climatic conditions, directly impacting yields and quality.

- There has been a clear reduction in chilling hours.
- Total rainfall, snowfall and number of rainy days are decreasing in Shimla and Kullu districts. About 17% decrease in rainfall in Shimla has been observed from 1996 onwards.
- Analysis of past data suggests an increase in the annual minimum and maximum temperatures in the state.
- The projected increase in temperature, rainfall, and rainfall variations and intensities in the state may lead to accelerated summer flows, in turn resulting in situations like floods and flash floods.

The annual economic value provided by pollination in Himachal Pradesh has been estimated to be worth USD 365 million in the year 2012. The apple crop is especially dependent on pollination for fruit quality and farm productivity. However, there has been a consistent decline in the number and diversity of natural pollinators, especially wild insect pollinators, across the Himalayan region.

- Human activities, such as pesticide use, monoculture plantations, combined with climatic factors are responsible for loss of nesting sites and food sources of these important insects.
- Furthermore, economic preference for the exotic honeybee Apis mellifera increases the competition for food with native wild pollinators and native honeybees Apis cerana. It also brings new pests and diseases, which has further contributed to the decline. Research has established a direct link between the decline in pollinators and decline in crop productivity in Himachal Pradesh.

Impacts on Livelihoods

Focusing on one crop and one method for production renders the farmers vulnerable to both climatic and market volatility. For example, a disease epidemic or an extreme weather event can wipe out whole crops, thereby leaving the farmers without any income. Similarly, sudden drops in market prices can also rob the farmers of profits and leave them in debt.

To tackle these impacts on production and livelihoods, there is a need for diversification of crops , products, and incomes, alongside introduction and piloting of regenerative

and alternative good agricultural practices and climate-smart innovations to build the resilience of the farmers in response to such climatic and market shocks.

B. GIC India's Vision for the Apple Value Chain

In view of the above context and imminent problems faced by apple farmers, the GIC project pursues an approach that promotes innovative models of sustainable change in the apple value chain to lay the groundwork for the transformation of agri-food systems. By integrating principles of climate-smart agriculture and agroecology, the project aims to achieve resilient communities, better incomes, and empowered stakeholders.
Our focus areas and approaches are:

1. Climate Resilience and Agroecology

Increasing climatic shocks as well as impacts of horticulture on local ecosystems call for a balanced approach that lays the groundwork for future agroecological transformation. GIC is promoting climate-smart innovations and technologies that promote resilience and sustainable incomes while avoiding greenhouse gas (GHG) emissions. Multiple technologies that employ renewable energy in pre-production, production and post-harvest loss management, and on-farm mechanization have been piloted. Additionally, pollination management through conservation of wild and managed insect pollinators,and promoting practices and technologies that encourage use of natural inputs in apple cultivation, aim at minimising the harm to local ecosystems while contributing to an increase in yields.

2. Diversification and Sustainability of Products and Incomes

Multiple piloted innovations target the creation of additional livelihood opportunities for apple farmers, while other innovations focus on improving incomes from horticultural production. Solutions for small farmers, like the solar-powered cold storage and solar dryers create options to increase the shelf life of the produce and its processing. Value-addition through food processing and support in market recognition of sustainably produced applesprovide options for diversification of products within apple value chain. Integration of beekeeping enables better pollination and increased yields in apples, while adding honey and its byproducts to the production basket.

3. Sustainability of Capacity Building Measures

To effectively pilot, anchor, and upscale innovations, GIC works with small scale farmers, Farmer Producer Organisations (FPOs), and Government bodies like Department of Horticulture. Training and capacity building measures are key components for technical upskilling and sustainability of measures after the project cycle.

C. Key Areas of Intervention

To implement the vision, GIC is implementing measures in the following areas:

1. FPO Strengthening

GIC has been building capacities of Farmers Producer Companies (FPCs) in Shimla and Kullu GIC has been building capacities of Farmers Producer Organisation (FPO) in Shimla and Kullu districts to strengthen their institutional and organisational capacities and promote their sustainability by developing business models. Assessments on adoption of agroecological practices show that farmers organized in FPO have a higher chance of adopting and scaling agroecological practices, which is why GIC lays the groundwork to allow FPO to explore these alternative practices including potential marketing opportunities.

GIC has worked with two FPOs in Shimla and Kullu districts respectively, to strengthen them through multiple interventions to achieve self-sustainability. This will also facilitate future upscaling and adoption of innovation bundles. The strengthening measures include:

- Capacity Building
- Institutional development and financial prudence for better governance
- Business growth with various revenue and income models

2. Model Farms demonstrating Integrated, Climate Resilient, Contextually Appropriate Innovation Bundles

The GIC project shortlisted farmers who were part of FPOs to pilot appropriate innovations in a cycle of continuous handholding, learning, and feedback. The objective of model farms is to bridge the gap between individual innovations and implementing an integrated, contextually appropriate, climate resilient approach, which includes diversification of livelihoods.

Model farms integrate multiple solutions such as bio-fermenters, solar-powered cold storage and drying solutions, food processing, animal deterrent technology, lure trap, integrated pest management, canopy and nutrition management, and integration of pollination as an ecosystem service, in innovation bundles. Model Farms become suitable models demonstrating climate-smart innovations in apple cultivation to other farmers, public and private stakeholders, as well as development organizations. This and the active involvement of farmers facilitates acceptance, ownership and adoption of transformative interventions by the apple farming community.

In Model Farms, Good Agriculture Practices are implemented through collaboration with the farmers and experts in a bottom-up approach. Farmers are engaged actively in formulating trials, observations, and the monitoring process, under the technical and handholding guidance of local subject-matter experts. A successful model results in higher yields, quality, or income. The farmer who tested the respective innovation will disseminate the generated knowledge directly to their FPO members. Experts have advised on integration of appropriate innovations relevant to individual farm plots. In this way, successful local models are created illustrating a climate smart approach.

3. Sustainable Capacity Building on Good Agricultural Practices

To ensure sustainable skilling program, effective implementation of technical innovations, and sustainability of introduced interventions beyond project cycle, trainings of farmers, Government officials, and FPOs has been undertaken. The farmers were trained on good agricultural practices in apple cultivation. Since there was need to strengthen the capacities of key stakeholders to create the ground for future disseminations of skills and ensure continuity of such training, the focus has shifted from training of farmers to training of trainers. The training material for both farmers and trainers has been developed in collaboration with the local and state of the art international expertise, including from the Department of Horticulture and the YS Parmar University of Horticulture and Forestry and will be further disseminated through trainings of trainers.

4. Promotion of Pollination as an Ecosystem Service

To address the multi-level threats faced by insect pollinators, and their importance in apple cultivation, the GIC project has promoted the adoption of pollination management in on-farm practices.

The first step towards this was to raise awareness among farmers and stakeholders on the economic and ecological importance of bees and wild pollinators, and the threats they face from excess pesticide use in apple cultivation, habitat loss and climate change. The second step has been to focus on reduction of chemical inputs through trainings on Good Agriculture Practices, which not only reduce input costs but also minimize harm to pollinators and the ecosystem. Other interventions included are the development of on-farm habitat, nesting sites, and food sources for pollinators round the year through promotion of beehives and ensuring round-the-year availability of bee flora.

Promotion of integrated beekeeping and apple cultivation ensure economic incentives for farmers, while focus on indigenous bees will further local biodiversity. Development of market linkages for honey and other byproducts from beekeeping add additional streams of revenue, ensuring economic incentives for sustainability of the intervention.

5. Post Harvest Loss Management

Since post-harvest losses on farm and during the supply chain pose significant economic losses and environmental impacts, GIC India is intervening at several points in the value chain to mitigate them, especially for women farmers. While solar powered cold storages prevent loss of fresh produce, food processing and solar drying solutions minimize the loss of surplus or unmarketable produce.

Simultaneously, capacity buildings of farmers, financial institutions, and government agencies facilitate adoption of promoted technologies in a holistic manner. Post Harvest Loss Management solutions further contribute to diversification and enhancement of incomes to develop resilience against climate and economic shocks. To promote uptake and dissemination of these solutions in communities, the project has developed evidence to showcase their impact, seen in the form of additional incomes and avoided emissions. To ensure sustainability, business models are being developed to strengthen the value chain. ■

INNOVATIONS promoted by Green Innovation Centre India

Local experts have done extensive field trainings for local farmers in good agricultural practices, such as pruning, for better canopy management.

PARTNERS

- Dr. Y S Parmar University of Horticulture and Forestry
- Department of Horticulture, Government of Himachal Pradesh
- Private partners

01. MANUALS ON GOOD AGRICULTURE PRACTICES

CONTEXT

Traditional orchards make up over 80% of all apple orchards in Himachal Pradesh. Overuse of pesticides, inadequate nutrition and unsuitable canopy management, vulnerability to pest and disease attacks, and decline in insect pollination are leading to low levels of productivity and incomes. Changing climatic conditions are aggravating these existing issues and creating new problems. Climatic projections for Himachal Pradesh show current trends of high temperatures, erratic precipitation and hailstorms are likely to persist. Lack of viable income diversification options, and inadequate post-harvest management technologies further hamper the development of the apple value chain. Knowledge, skill, and information gaps prevent the farmers from effectively adapting to changing framework conditions.

PROBLEM

There are knowledge and information gaps among apple farmers that hinder an increase in their productivity and practice sustainable agriculture.

SOLUTION

The Manual on Good Agriculture Practices contains interventions related to canopy management, nutrition and pollination management, soil health management, and integrated pest management. These practices are based on the latest state-of-the-art knowledge adapted to local conditions. Farmers are trained on and adopt relevant practices based on their individual needs The dissemination of the GAPs is done through trainings, exposure visits, and trainings of trainers.

BENEFITS

The manuals and their dissemination bridge the existing knowledge gaps on best practices in apple cultivation. Adoption of these best practices will lead to better management of traditional plantations, enhancing productivity, resilience, and incomes.

Beekeeping using indigenous bee species Apis cerana is promoted in apple farms for better pollination. Indigenous bees are more suited to local climate and better able to cope with changing conditions, and hence need to be conserved.

PARTNERS

- Department of Horticulture, Government of Himachal Pradesh
- Sustainable Management of Forest Ecosystem Services Project, implemented by GIZ
- Keystone Foundation
- Dr. YS Parmar University of Horticulture and Forestry, Solan
- GB Pant National Institute of Himalayan Environment

02. PROMOTION OF POLLINATION AS AN ECOSYSTEM SERVICE through Promotion of Indigenous Honeybee and Wild Pollinators

CONTEXT

Biodiversity has multiple direct benefits for agriculture, mediated by ecological relationships between natural and agricultural ecosystems. Multiple agricultural practices, chiefly the practice of monoculture and extensive use of chemical inputs, combined with expansion into forests and shifting climate patterns, have negatively impacted wild insect populations. Through the natural process of pollination, these wild insects such as bees, moths, and wasps, make agricultural production possible. Introduction of foreign species further renders native species at risk due to competition. Moreover, local bee species such as *Apis cerana* are better adapted to local climate and conditions.

PROBLEM

The number and diversity of managed and wild insect pollinators is declining. This has directly impacted apple fruit quality and yields negatively.

SOLUTION

Pollination is a Service provided by natural ecosystems and is crucial for apple production. The project promotes the conservation of native pollinators, to make explicit their contribution to apple productivity and promote their scientific management. Multiple activities, which consist of awareness raising, management of availability of bee flora, promoting on-farm nesting sites such as mud hives and bee hotels, integrated beekeeping with a focus on indigenous *Apis cerana* bee, and value-addition and marketing of honey and other related products, ensure provision of adequate pollination for the apple crop, conserve pollinator diversity and populations and create an incentive for farmers to minimize the use of agrochemicals further reducing the harm to pollinators and biodiversity.

BENEFITS

Adequate pollination enhances fruit quality and yield, leading to an increase in farmer incomes. The sale of honey and other byproducts from beekeeping provides additional livelihood options. Increased native wild pollinator diversity also assures the provision of pollination services and their resilience to climate change.

Rajesh is a beekeeper and apple farmer from Khopni village in Kullu, Himachal Pradesh. He has been tending his apple orchard since 20 years, which he inherited from his parents. Some of the trees here are several decades old. Since the pandemic, he is also practicing rearing the indigenous honeybee, the skills for which he picked up in a beekeeping training. He makes his own boxes, experiments with mud and log hives, ensures there is a diversity of bee flora in and around the apple trees, and says these bees are the best at pollinating his apple crop. His biggest challenge, however, remains the continued use of chemical inputs around his farm, which are harmful for the bees.

Solar-powered cold storage in Shiladesh village, Rohru, Shimla.

PARTNERS

- CoolCrop Technologies Pvt. Ltd.

03. DECENTRALISED SOLAR-POWERED COLD STORAGES delievered in a 'Cooling as a Service' Business Model

CONTEXT

10-11% of apple harvest is lost annually along the value chain as post-harvest losses. In Himachal Pradesh, most of the cold storages are located away from farms and controlled by private players and large farmers. During the apple harvesting season, there is a significant decrease in prices due to increased supply. The prices shoot up just after the harvest season when the supply is reduced, giving an advantage to big farmers. The smallholder farmers either do not have access or lack negotiation capacity for higher prices, leaving them with few options for the sale of their produce.

PROBLEM

Smallholder farmers have to sell all their produce during peak season at low prices. They are not able to access cold storages due to high upfront investments and geographical isolation.

SOLUTION

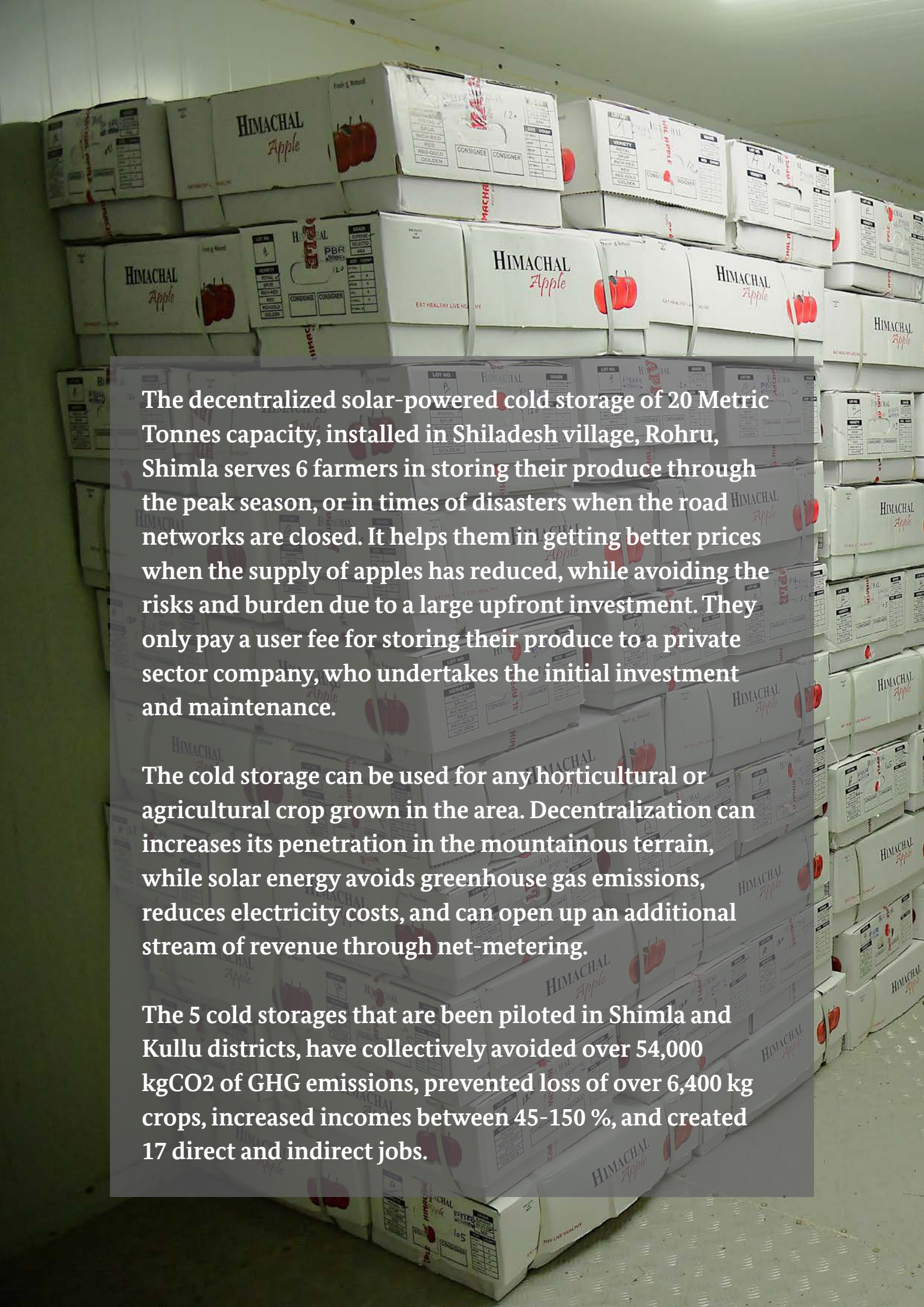
Decentralised solar-powered cold storages at or near farmgate minimize loss of fresh produce and increase its shelf life prior to sale. They increase the penetration of cold chains in comparison to traditional large cold storages, at the same time avoiding emissions from non-renewable energy sources.

They also increase the smallholder farmer's capacity to negotiate better prices during off season by allowing them to store their produce at or near farmgate. During times of crisis when transportation channels are not available, these cold stores prevent post-harvest losses. These cold storages have been provided in a service model, where a private technology-cum-service provider bears the costs of upfront investment and installation, and the farmers pay only a user fee.

The cold storages are accompanied by an app to manage operations as well as aid market links.

BENEFITS

Successful business models and marketing strategies in close cooperation with private enterprises are being created. Access to cold storages empower smallholder apple farmers while avoiding negative climate impacts.



The decentralized solar-powered cold storage of 20 Metric Tonnes capacity, installed in Shiladesh village, Rohru, Shimla serves 6 farmers in storing their produce through the peak season, or in times of disasters when the road networks are closed. It helps them in getting better prices when the supply of apples has reduced, while avoiding the risks and burden due to a large upfront investment. They only pay a user fee for storing their produce to a private sector company, who undertakes the initial investment and maintenance.

The cold storage can be used for any horticultural or agricultural crop grown in the area. Decentralization can increases its penetration in the mountainous terrain, while solar energy avoids greenhouse gas emissions, reduces electricity costs, and can open up an additional stream of revenue through net-metering.

The 5 cold storages that are been piloted in Shimla and Kullu districts, have collectively avoided over 54,000 kgCO2 of GHG emissions, prevented loss of over 6,400 kg crops, increased incomes between 45-150 %, and created 17 direct and indirect jobs.


HIMACHAL
Apple
The World's Finest Apples
PBR

The bio-fermenter helps reduce the need for manual labour in making bio-inputs for natural farming. It is being piloted in GIC-promoted model farms and other plots practicing natural farming for apple.

PARTNERS • INOTECH Agri Innovations / GUKSS Industries

04. SOLAR-POWERED BIO-FERMENTER for preparation of biological soil inputs

CONTEXT

There is an increasing push from government as well as interest for farmers to adopt natural farming, including in apple cultivation, for its soil health, economic, and climate benefits. This involves on-farm preparation of biological inputs such as jeevamrutam, amritpani, and brahmastra, from natural raw materials. This is a labour-intensive process, involving 30-60 minutes of labour per day for stirring, depending on the quantity and the plot holding size. Farmers need to put extra manual effort over and above their regular farming activities. Alternatively, they must employ wage labourers, which adds to the input costs.

PROBLEM

Transition to natural farming is a labour-intensive process. Mechanisation options based on non-renewable energy carry the risk of increased greenhouse gas (GHG) emissions.

SOLUTION

A solar powered bio-fermenter automatizes the fermentation process for preparation of biological inputs for natural farming. The solution consists of two tanks (fermentation and filtration), a battery-powered motor, and a time controller.

The solution can be adopted by individuals, or by a community where one farmer becomes the entrepreneur and provides the service to the community for a nominal fee.

BENEFITS

Economic benefits include reduced manual labour and drudgery for the farmers, reduced costs of employing wage-labour, while improving output quality of the product through uniform stirring.

Environmental benefits include avoided GHG emissions compared to mechanization solutions employing fossil fuels, and also easing the adoption of natural farming for apple farmers.

Gyan Chand Thakur is an apple farmer from Riyada, a village in Kullu district of Himachal Pradesh. He has been practicing natural farming since many years, having learnt it from the pioneers in the field.

Installation of the solar-powered bio fermenter in his field has made the preparation of bio-inputs much easier for him, which was earlier done manually. This has also allowed preparation of a larger quantity of inputs which will help him practice natural farming on a larger piece of land, bring down labour costs, and increase the quality and consistency of the inputs. Over 25 such biofermenters have been piloted across Shimla and Kullu districts.

A hydro-powered water pump, installed in 2021 in Gumma village in Shimla, is serving multiple farmers for their irrigation needs.

PARTNERS

- SELCO Foundation
- aQysta Crops and Farming Solutions

05. WATER PUMPS: Harnessing hydropower for Irrigation

CONTEXT

The majority of apple cultivation in Himachal Pradesh is rainfed. Farmers are vulnerable to increasing variability and uncertainty in precipitation patterns due to climate change. The rivers and streams are one potential source of irrigation, if accompanied by water efficient irrigation systems to prevent overuse. Rising fuel costs and GHG emissions are major disadvantages of conventional water-lift pumps powered by diesel or electricity. Similarly, borewells additionally deplete groundwater resources. The associated continuous operational costs further put them out of the reach of smallholder farmers.

PROBLEM

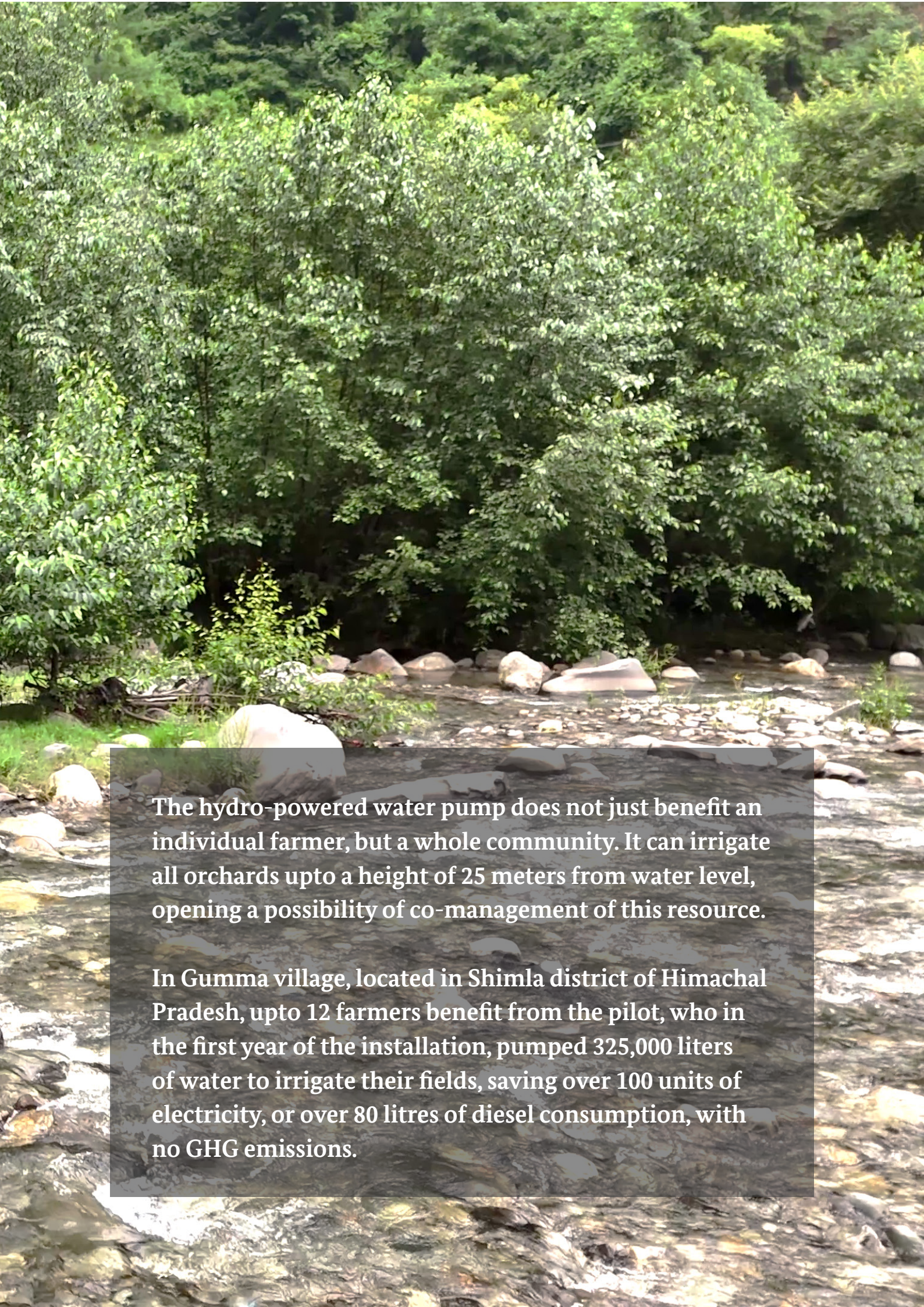
Apple orchards require affordable, cost-efficient, and climate-smart irrigation solutions.

SOLUTION

The hydro-powered water pump utilizes the flow of rivers to pump water to farms. It irrigates the field in a cost effective and self-sustaining manner. There is minimal maintenance required due to very few moving parts and electrical components.

BENEFITS

Water-efficient irrigation will lead to better water management during times of scarcity, minimizing moisture stress in plants and the impact of climate variability. Small-scale hydropower avoids GHG emissions while causing negligible damage to the river ecosystem.



The hydro-powered water pump does not just benefit an individual farmer, but a whole community. It can irrigate all orchards upto a height of 25 meters from water level, opening a possibility of co-management of this resource.

In Gumma village, located in Shimla district of Himachal Pradesh, upto 12 farmers benefit from the pilot, who in the first year of the installation, pumped 325,000 liters of water to irrigate their fields, saving over 100 units of electricity, or over 80 litres of diesel consumption, with no GHG emissions.

SWAR units, a sub-surface irrigation system, is connected to the regular drip irrigation system to deliver water directly to the root zone.

PARTNERS • Centre for Environmental Concerns

06. SYSTEM OF WATER FOR AGRICULTURAL REJUVENATION (SWAR)

CONTEXT

Most of the apple cultivation in Himachal Pradesh is rainfed. Farmers are vulnerable to increasing variability and uncertainty in precipitation patterns due to climate change. There is a need for innovative methods of water management and irrigation techniques to manage available water resources.

PROBLEM

Apple orchards require affordable, cost-efficient, and climate-smart irrigation solutions.

SOLUTION

The System of Water for Agricultural Rejuventation (SWAR) system improves the irrigation in apple orchards through drip irrigation at the rootstock. A moisture diffuser slowly releases water in the root zone to optimize moisture distribution. Sensors measure the moisture content of the soil and control the amount of irrigation.

BENEFITS

SWAR promotes water efficiency in apple cultivation. In times of water stress, water efficient irrigation avoids or mitigates the loss in productivity and loss of plants due to moisture stress that would have happened in absence of the technology.

Additional benefits include more efficient use of fertilizers leading to lower input costs, better soil health, improved fruit quality, and prevention of root diseases caused by overwatering.

The piloted root borer trap in apple orchards reduces the incidence of the apple root borer, thereby also decreasing dependence on pesticides.

PARTNERS

- Dr. YS Parmar University of Horticulture and Forestry, Solan

07. LURE TRAP FOR APPLE ROOT BORER

CONTEXT

Apple orchards are under constant threat from many pathogens and insect-pests. Depending on the incidence and severity of infection of these insect-pests, impacts range from unappealing cosmetic appearance, low marketability, and poor quality of fruit, to decrease yield or complete loss of fruit or trees, thus causing huge economic losses. Plant protection products are used to maintain good fruit quality and to keep the trees healthy. But in Himachal Pradesh, excessive use of agrochemicals has led to adverse effects on the environment including soil health.

PROBLEM

The apple root borer (*Dorysthenes hugelii*) has become a major insect-pest for apple trees, and kills the affected plants within a period of 2-3 years, resulting in economic losses.

SOLUTION

The lure trap uses pheromones to attract and trap adult male beetles of the apple root borer. It is designed in such a way that the beetles hit the blades and fall down in the bucket placed below, filled with one-third water by volume.

BENEFITS

While helping to control the incidence and infestation from the root borer, the trap also reduces the use of pesticides, thus saving on input costs and other resultant ecological benefits due to reduced chemical use.

Human-animal conflict leads to losses for farmers, such as damage to bee boxes and attacks on cattle. The animal deterrent mitigates these impacts without harming the wildlife.

PARTNERS

- Katidhan (private sector entity)

08. SOLAR-POWERED ANIMAL DETERRENT

CONTEXT

The persistent threat of predators to farm animals such as cattle and dogs, as well as the crop losses that large wild animals such as wild boars, bears, and elephants can cause, lead to significant financial losses for farmers whose farms are located in and around natural forests. Such threats also lead to human-wildlife conflicts.

PROBLEM

Damage to the apple crop, bee boxes, and farm animals occurs in apple orchards located at the edge of forests due to animal attacks.

SOLUTION

Solar-powered animal deterrent allows farmers to protect their crops from attacks by wild animals, such as bears, leopards, and wild boars. Powered using a small solar PV module integrated with the main unit, the device consists of four LED lights facing four directions and is designed to resemble a human face. The instrument automatically starts blinking as it gets dark every day, with a visibility range of 100-150 meters. The resemblance to human form and constant blinking discourages animals from entering the farm, whereas the use of solar module makes the technology feasible in difficult topography.

BENEFITS

The animal deterrent prevents animal attacks, reduces wildlife-human conflict and avoids economic losses resulting from such attacks.

The solar dryers are currently being piloted to gauge their potential in food processing and developing micro-enterprises. Successful pilots will reduce post harvest losses in not just apple but other crops too.

PARTNERS

- S4S technologies

09. SOLAR-POWERED DRYER

CONTEXT

10-11% of apple harvest is lost annually along the value chain as post-harvest losses. Reasons for this include a lack of market access, low prices at the time of harvest, limited knowledge and availability of processing options, as well as a lack of adequate financing schemes. These significantly limit the economic potential for small and marginal producers across the value chains.

PROBLEM

There are limited opportunities for apple farmers to create value-added apple products which can fetch them better prices and mitigate post-harvest losses.

SOLUTION

Solar dryers harness solar energy to dry fresh produce isntead of the traditional open-air sun drying. Farmers can use it to dry fruits such as apples, pears, and other stone fruits, vegetables, meat products, etc. for domestic consumption as well as for sale in the market. Several solar dryers were installed in farmers' households to develop potential business models for upscaling.

BENEFITS

Value-addition through drying increases the shelf life and creates a new product that can be sold on the market. This will mitigate post-harvest losses as well as bring additional income. By replacing traditional open-air drying, the process is made faster in a climate-friendly manner.

Exposure visits and trainings to FPCs enhance their technical capacities and facilitate cross-learning from different geographies on experiences of sustainable farming and marketing.

PARTNERS

- Department of Horticulture, Himachal Pradesh
- Jujurana Farmer Producer Company
- Jamdagni Farmer Producer Company

10. COLLECTIVISATION AND MARKETING SUPPORT TO FPOS

CONTEXT

While there is an increased interest in sustainable agriculture and horticulture among government, development, and private sectors, for its myriad benefits to human and environment health, grassroots-level adoption among farmers has been slow. A successful scaling up of requires proven models of not only production, but also marketing. The latter especially remains challenging in the Indian context, where majority of farmers are smallholders, making it difficult to reach economies of scale in a competitive domestic and global market.

PROBLEM

A lack of marketing channels and remunerative pricing for sustainably produced apples and honey creates a barrier for smallholder farmers to transition to sustainable horticulture.

SOLUTION

Collectivisation of smallholder farmers into Farmer Producer Companies for aggregation of produce, handholding support in organisational and business model development, and facilitating access to certifications will enable farmers to access niche markets, increase their bargaining power, and get fair prices for their added efforts in sustainable farming.

Collectives of natural farmers and *Apis cerana* beekeepers in Kullu are being supported in developing common production protocols, developing participatory monitoring mechanisms, technical support in sustainable farming practices through advisory and exposure visits, and trainings in Participatory Guarantee System certifications, for creating standardised products. On the other hand, implementation of recommendations from commissioned studies in marketing and certification opportunities will enable market access for standardised certified products.

BENEFITS

Access to markets and fair prices creates incentives, while collectivisation supports social processes behind scaling up, for farmers to transition to sustainable horticulture practices and increase their incomes. Wider adoption of sustainable horticulture reduces negative impacts on the local ecology and climate.

KEY IMPACTS IN APPLE VALUE CHAIN

- 12 model farms have been created across Shimla and Kullu, which pilot and demonstrate innovation bundles.
- Strengthening of 2 FPCs covering 3000 farmers, with a structured approach towards promoting sustainable practices.
- Over 14000 farmers have been trained on Good Agriculture Practices. Over 200 government officials, extension workers, and farmer representatives trained as trainers to propagate these practices. The practices have seen a 95% adoption rate and have been adopted by non-project farmers too due to a spillover effect.
- Over 80 farmers tained in the piloted integrated beekepeing of Apis cerana with apple farming model, of which a further 40 have been trained in honey processing and value addition.
- 5 solar powered cold storages have been piloted in Shimla and Kullu. Collectively, they have avoided over 54,000 kgCO2 of emissions, prevented loss of over 6,400 kg crops, increased incomes between 45-150 %, and created 17 direct and indirect jobs. The intervention has created a demand for solar cold storage market in Himachal Pradesh.
- Standardisation of technical specifications of solar-powered decentralised cold storages is facilitated with government agencies to enable future subsidies.
- Over 2000 women farmers and 100 Government officials have been trained on post-harvest loss management. 50 farmers have received technology specific training.

ADOPTION & UPSCALING

All innovations listed in the previous pages have been successfully piloted. Various measures to anchor the innovations with the community and stakeholders, primarily through business model development, marketing strategies and linkages, are underway. Additionally, capacity building of the FPCs and local stakeholders for both institution strengthening and technical upskilling will allow them to facilitate and support further adoption of the innovations in future.

Solar-powered Biofermenter, installed in Jangla village, Shimla district, Himachal Pradesh.

Women's Self Help Groups in Shimla and Kullu distrcits have received trainings in post-harvest loss management.

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