Scaling-up of protected cultivation in Himachal Pradesh, India

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Himachal Pradesh (HP) is a hill state where a majority of marginal and small farmers practise traditional farming, which is not remunerative. A manifold increase in the resource-use efficiency in crop production can be obtained through protected cultivation compared to open-field conditions. Protected cultivation can help marginal and small farmers provided the financial and extension services for infrastructural development and transfer of technology are speeded-up to bring the desired technology to the region. In protected cultivation, high-value cash crops, vegetables and flowers are grown and managed under controlled conditions with higher per unit productivity and profitability. Protected cultivation has become a new agri-entrepreneurship in HP with the support of state and central governments. The state government has initiated protected farming through Horticultural Technology Mission and Pandit Deen Dayal Kisan Bagwan Samridhi Yojna. Consequently, a large number of polyhouses (>8000) have been constructed in the state with about 223.2 ha area under protected cultivations. To achieve these targets, the State Departments of Agriculture and Horticulture as well as two State Agricultural Universities through their 12 Krishi Vigyan Kendras have worked hand-in-hand to make this enterprise a great success. This article presents status and promotional programmes on scaling-up of protected cultivation as well as the potential and prospects of this new agri-entrepreneurship in economic development and transformation of rural livelihoods in HP.

Keywords: Agri-entrepreneurship, hill production systems, high-value crops, protected cultivation, small and marginal farmers.

DURING the post-green revolution era, India has become self-sufficient in food-grain production. Today, our approach to agriculture needs to be redefined under changing climate besides limited availability of land and water. In general, livelihood options in rural areas are shrinking due to ecological fragility. At the same time, technological advancements in Indian agriculture play a crucial role in bringing about socio-economic transformation among Indian farmers, especially in the underprivileged areas, for overall economic development of the nation. Though India has become self-sufficient in food-grain production, increasing pressure on natural resources coupled with degradation of land and water are posing serious threats to social, economic, livelihood and environmental security[1]. Thus, biotic and abiotic stresses are the major factors making farming more challenging. In order to overcome these problems, protected cultivation could play a vital role in enhancing quality production per unit area per unit time to meet escalating food demands of the growing population[2,3]. Under protected cultivation, higher productivity with high quality in shorter cycle leads to better farm incomes to improve rural livelihoods.

Himachal Pradesh (HP) is a hill state where a majority of marginal and small farmers practise traditional farming, which is not remunerative[4]. Moreover, hilly topography in northwestern (NW) Himalaya limits the possibility of increasing the cropping area and farm profits. Therefore, polyhouses can make small holdings more viable by producing more high-value crops such as vegetables and flowers from limited land besides escaping vagaries of weather[2,5]. Polyhouse technology imbedded with precision farming principles has led to a new revolution in hill agriculture in HP. Enhanced productivity of vegetables, flowers and other high-value cash crops has helped increase in farm profitability and provide better livelihood to hill farmers, especially marginal and small landholders in the state[5]. These merits of protected cultivation have made this agri-entrepreneurship a viable option for rural masses and unemployed youth besides checking migration of youth to urban areas[2,6]. The technical and financial support of the state government and central

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government has played a crucial role in promoting protected cultivation in HP[7,8]. Today, about 223.2 ha of the area is under protected cultivation in the state[9].

Methodology

The present study is based on primary and secondary data collected from State Departments of Agriculture and Horticulture and two State Agricultural Universities (SAUs) in HP, as well as from sampled farmers using well-structured survey schedules followed by random sampling to ascertain their farm incomes from protected cultivation under different crops, especially vegetables and flowers during 2010–12. In addition to the State Departments of Agriculture and Horticulture, the two SAUs (CSK HPKV & UHF) and their 12 Krishi Vigyan Kendras (KVKs), other line departments involved in rural development, some NGOs as well as progressive farmers are also involved in polyhouse infrastructural development. Thus, it was ensured that the available literature on protected cultivation from different sources in the state was utilized and presented in this article.

Scope of protected cultivation

Himachal Pradesh is situated in northwestern Himalaya between 30°22′40″–33°12′40″N and 75°45′55″–79°04′20″E with altitude ranging from 350 to 6975 m amsl. Thus, the state is bestowed with varied agro-climatic conditions ranging from subtropical to temperate, serving as an off-season hub for production of quality vegetables in one or the other region throughout the year[10]. A majority of farmers in HP belong to marginal and small-holding categories (87.03%), where traditional farming is no more remunerative[4]. Thus, protected cultivation technology holds special significance. The state government has initiated many schemes for promoting protected cultivation such as Horticultural Technology Mission (HTM) and Pandit Deen Dayal Kisan Bagwan Samridhi Yojna (PDDKBSY)[2,11]. The main aim of this technology is to raise socio-economic condition of farmers by cultivation of high-value cash crops. To fulfil this objective, the Departments of Agriculture and Horticulture as well as 12 KVKs of 2 SAUs have worked together to make this enterprise a great success in the state besides being benefited from KVK–ATMA (Agricultural Technology Management Agency) convergence[12]. Enhanced productivity of vegetables, flowers and other high-value cash crops under protected conditions has helped in increasing farm profitability and better livelihood to hill farmers, especially marginal and small land-holders in the state[5,13].

Status and scaling-up of protected cultivation

The state government has promoted protected cultivation through HTM and PDDKBSY schemes[2,11]. The farmers are being motivated towards protected cultivation using the above schemes and this enterprise has now proved to be a boon for marginal and small farmers with limited land and water resources. A large number of polyhouses have been constructed so far under HTM and PDDKBSY with a provision of 80–90% subsidy[5]. The status of protected cultivation through these schemes is discussed below.

National Horticulture Mission

The main objective of the mission has been to establish convergence and synergy among numerous ongoing governmental programmes; achieve horizontal and vertical integration of these programmes; ensure adequate, appropriate, timely attention to all the links in the production, post-harvest and processing chain; and maximize economic, ecological and social benefits from the existing investment and infrastructure created for horticultural development. In HP, main emphasis is being given to infrastructural development on protected cultivation. Table 1 and Figure 1 present the number of polyhouses constructed district-wise under HTM in HP, including Rashtriya Krishi Vikas Yojna (RKVY).

Pandit Deen Dayal Kisan Bagwan Samridhi Yojna

The Department of Agriculture has launched this scheme with assistance from NABARD. The project is being implemented in all 12 districts of the state with an outlay of Rs 353 crores. This project comprises two parts: production of cash crops through adoption of precision farming practices, i.e. polyhouse cultivation for Rs 155 crores, and a project on ‘Diversification of agriculture through

Table 1. District-wise area in polyhouses under the Horticultural Technology Mission (up to March 2011)

District	Number of polyhouses	Area under protected cultivation (ha)
Bilaspur	270	20.97
Chamba	135	2.29
Hamirpur	99	4.18
Kangra	256	6.58
Kinnaur	0	0.00
Kullu	22	0.57
Lahaul & Spiti	17	0.05
Mandi	204	9.88
Shimla	89	5.84
Sirmour	75	5.42
Solan	127	11.06
Una	50	4.80
Under RKVY	170	9.58
Total	1514	81.22

Source: Directorate of Horticulture, Government of Himachal Pradesh, Shimla.

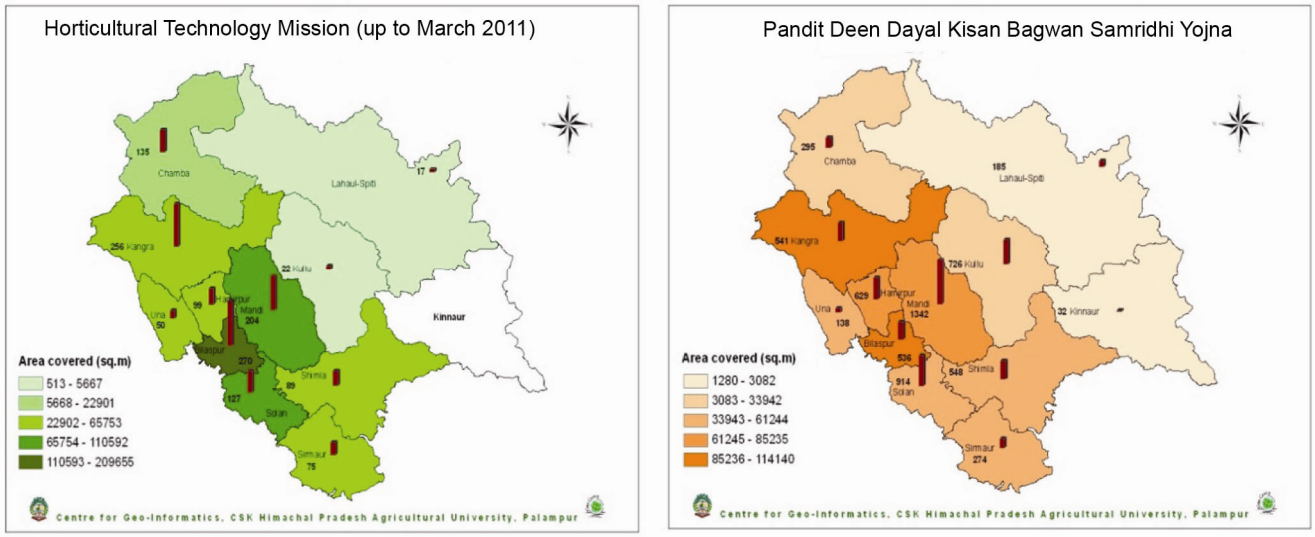

Figure 1. Number of polyhouses constructed district-wise under Horticultural Technology Mission (HTM) and Pandit Deen Dayal Kisan Bagwan Samridhi Yojna (PDDKBSY) in Himachal Pradesh. (Source: ref. 14).

Table 2. District-wise area in polyhouses under Pandit Deen Dayal Kisan Bagwan Samridhi Yojna (till March 2011)

	Poly-tunnels (6 m^2)		Small polyhouses (up to 252 m^2)		Large polyhouses (>252 m^2)		Total	
District	Number	Area (ha)	Number	Area (ha)	Number	Area (ha)	Number	Area (ha)
Bilaspur	233	0.140	177	4.00	126	7.28	536	11.41
Chamba	109	0.065	171	2.56	15	0.77	295	3.39
Hamirpur	365	0.219	356	4.33	28	3.98	629	8.52
Kangra	87	0.052	376	3.95	78	5.85	541	9.85
Kinnaur	–	0.000	32	0.13	–	0.00	32	0.13
Kullu	596	0.358	110	1.41	20	1.23	726	3.00
Lahaul & Spiti	127	0.076	58	0.23	–	0.00	185	0.31
Mandi	1052	0.631	196	1.96	94	4.61	1342	7.20
Shimla	264	0.158	256	3.55	28	1.97	548	5.67
Sirmour	86	0.052	150	3.64	38	2.44	274	6.12
Solan	697	0.418	173	3.15	44	2.27	914	5.84
Una	6	0.004	64	1.51	68	4.29	138	5.81
Total	3622	2.173	2119	30.42	539	34.67	6280	67.26

Source: Directorate of Agriculture, Government of Himachal Pradesh, Shimla.

micro-irrigation and other related infrastructure' for Rs 198.08 crores. The scheme envisages construction of 16,500 polyhouses and bringing 20,000 ha area under minor irrigation. The project with a duration of four years was started in 2009 for strengthening and diversification of farm activities. Also, 80% subsidy is being given for construction of polyhouses and sprinkler/drip irrigation and 90% subsidy is given to BPL families for construction of polyhouses made of local materials like bamboo. Table 2 and Figure 1 present the number of polyhouses constructed district-wise under PDDKBSY in HP.

Promotion of protected cultivation

Current agricultural scenario emphasizes upon greater use of advanced farm technology having the potential to bring about socio-economic transformation in rural areas. Rural livelihoods are currently at stake under changing climate and global market liberalization. Livelihood options are shrinking in rural areas due to fragility of eco-systems such as rainfall deficit, drought and climatic variability, especially in NW Himalaya. In order to overcome these problems, protected farming under controlled environment well equipped with micro-irrigation systems plays a vital role for hill farmers to earn better livelihood. Thus, protected cultivation has emerged as a new agri-entrepreneurship in HP. Under HTM and PDDKBSY, about 148.48 ha area under protected cultivation was covered by March 2011 (Figure 2)[14]. Currently, another project 'Dr. Y. S. Parmar Kisan Sawrozgar Yojna' has also been initiated by the state government for setting-up about 4700 polyhouses and 2150 drip irrigation/sprinkler

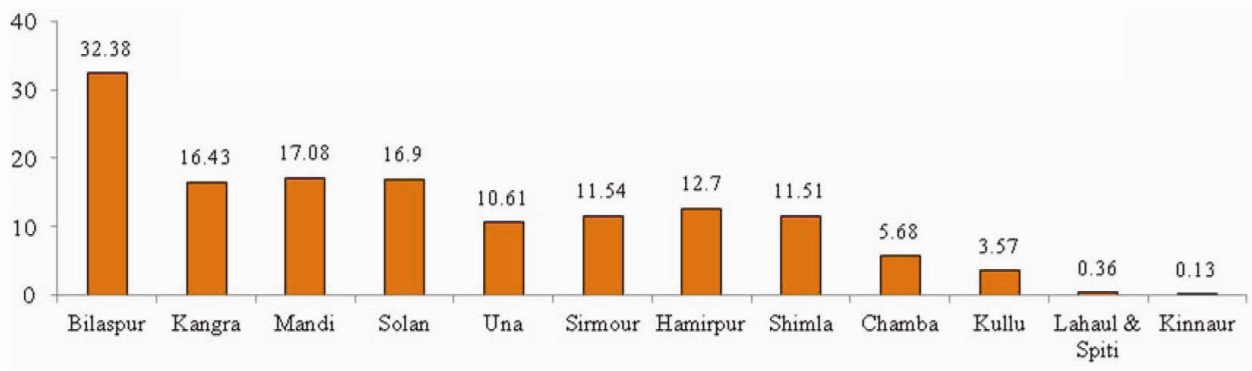

Figure 2. District-wise area (ha) under protected cultivation in HP under HTM and PDDKBSY till March 2011. (Source: ref. 14).

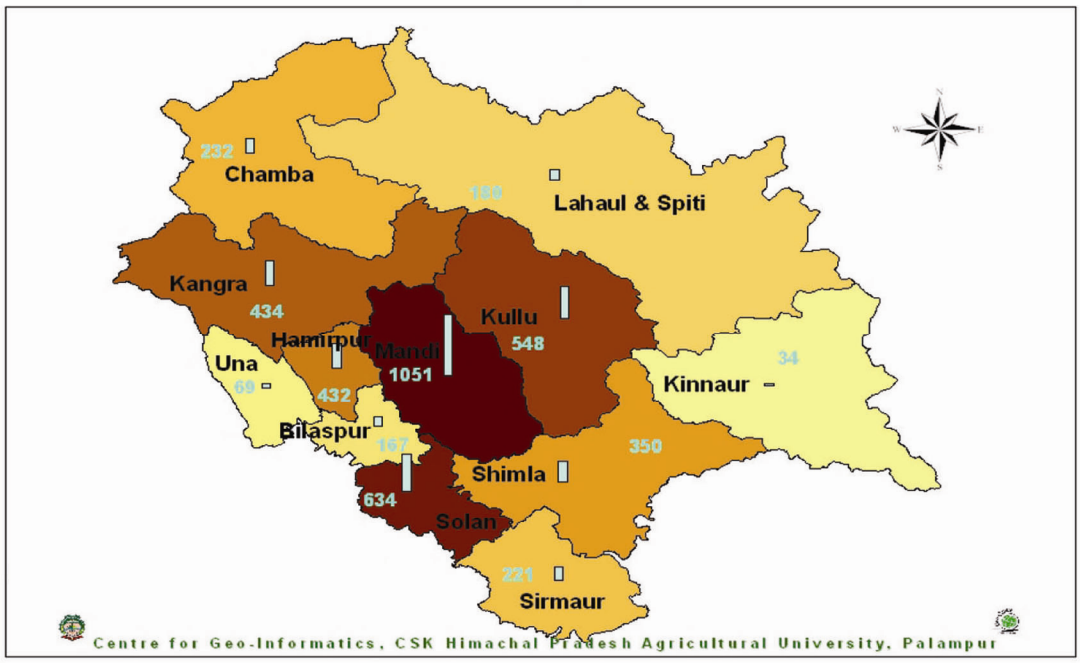

Figure 3. Total number of polyhouses in HP. (Source: ref. 14).

units in the next four years with an outlay of Rs 111.2 crores to promote polyhouse farming in HP.

Overall, with the financial support under HTM and PDDKBSY over 8000 polyhouses have been constructed so far, out of which about 4352 are medium (≥250 m^2) to large-sized (≥500 m^2) (Figure 3). At present, about 223.2 ha area is covered under protected cultivation in HP with the government support, NGOs and personal efforts of farmers (Figure 4)[9]. The technological interventions of two SAUs and their 12 KVKs in collaboration with line departments have played a pivotal role in horizontal spread of protected cultivation technology in the state (Figure 5).

Enhanced productivity of vegetables, flowers and other high-value cash crops with gradual adoption of protected cultivation has helped in increasing the farm profitability and provide better livelihood to hill farmers. Protected cultivation is an alternative farm enterprise to fetch higher returns with quality production, thus bringing new vistas in rural employment in the state. Being a new precision farming enterprise, extension functionaries have a vital role in dissemination of latest technical know-how to farmers for effective management. With these technological interventions, farmers are now growing coloured capsicum, tomato, cucumber and other high-value cash crops under protected conditions. Based on 'on-farm' experimentation of 12 KVKs of the two SAUs, technology inventories on site-specific protected cultivation technologies for vegetable and flower growers have been successfully developed so far[15]. These refined technologies are being disseminated among polyhouse farmers by the KVKs in collaboration with line departments. Through 'on farm trials', suitable coloured capsicum, cucumber and tomato hybrids have also been identified by KVKs

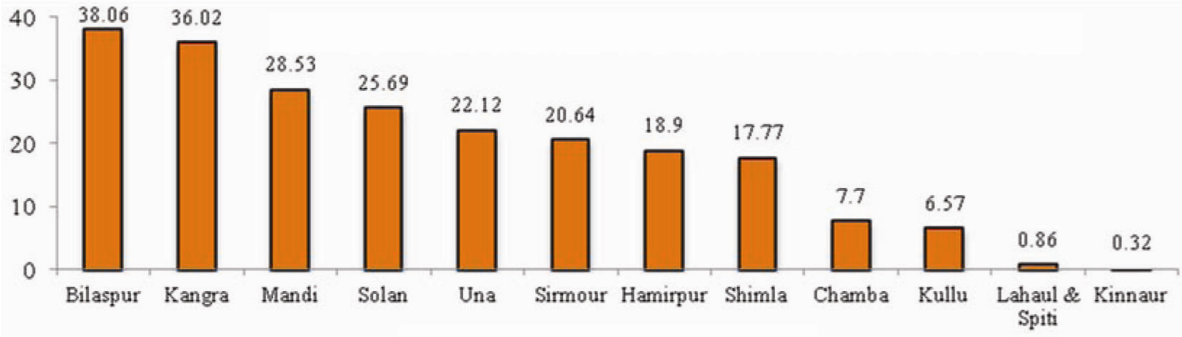

Figure 4. District-wise area (ha) under protected cultivation in HP (2013–14). (Source: Spehia[9]).

Figure 5. Pictorial view of polyhouses in Himachal Pradesh (Source: Res. 14).

Table 3. Income earned by farmers from different enterprises under protected conditions (n = 56)

Particulars	Unit size (m^2)	Net income (Rs/annum)	
		Range	Average
Flower cultivation (carnation and roses)	500	40,000–303,030	164,040
Vegetable cultivation (coloured capsicum, tomato, cucumber)	500	50,000–350,000	117,763

Source: Choudhary *et al.*[2].

and SAUs[15]. Site-specific protected technology has been standardized by the KVKs, besides developing technology inventories, technology documentation and literature. KVK Sundernagar has been the pioneer in developing a technical bulletin on protected cultivation in the state. This KVK has also developed an electronic scroll board on protected cultivation. It has also documented the protected cultivation technologies of the two SAUs, in collaboration with Zonal Project Directorate (ZPD) of KVKs of Zone-I (ICAR) for capability building of extension functionaries for intensive technology transfer among farmers and unemployed rural youth. Besides this, all the state KVKs have played a leading role in capacity building of extension functionaries and Krishak Mitras in HP[15].

A study by KVK Sundernagar on economic analysis of protected cultivation has revealed that average annual income from cut-flowers and vegetables under protected conditions in the state is around Rs 164,040 and Rs 117,763 per 500 m^2 polyhouse unit (n = 56) respectively

(Table 3)[2]. In addition, protected cultivation has also generated employment among rural masses in terms of polyhouse construction, vegetable transport and marketing. From this field study, it has been realized that coloured capsicum, cucumber and tomato are the favourite choice of farmers (size 250–500 m^2). Protected cultivation has helped in increasing the income of farmers by producing higher yields with 2–3 crops in a year. Hence, protected cultivation technology has great potential in bringing about socio-economic transformation in the livelihoods of hill farmers in NW Himalaya.

Conclusion

In HP, a majority of hill farmers have fragmented marginal and small land-holdings not enough to earn sustainable livelihoods. Protected cultivation has great potential in the state to increase quality production per unit area per unit time. Thus, timely efforts by the state government under HTM, PDDKBSY and RKVY schemes have scaled-up protected cultivation and have proved to be a boon to small and marginal hill farmers. The State Departments of Agriculture and Horticulture, SAUs, KVKs as well as some NGOs have worked together to make this enterprise a great success. Today, more than 223 ha area is under protected cultivation, making it a new agri-entrepreneurship for unemployed youth and rural masses of HP.

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