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Emerging Farming Systems in Western Himalaya: A State Level Analysis of Sustainability

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Abstract

This paper examines the role of different components in promotion of Integrated farming systems and the benefits realized by the farmers in Western Himalaya. Integrated farming systems are now a day's major practice that has high potential in hill areas. It is an extension of cropping systems, but with the introduction of perennials together with annual crops. Agricultural wasteland has to be brought under tree-based systems. Under rained condition, mono-crop of cereals (rice, wheat, maize) may give net return of Rs 9,000 to 10,000 per ha, a catchuprabi of pulses and oilseed increases net returns to about Rs 12,000 per ha. Rice-wheat under irrigated conditions can fetch about Rs 25,000 per ha against which vegetable crops can give net returns 4 to 8 times. The area covered under protected cultivation by the NHM has shown that of the total protected cultivation area, 20 per cent is under greenhouses and only 2 per cent is under fan and pad operated greenhouses. Small farmers spend most of their increased income on consumption while large farmers make non-farm investments.

Keywords: Farming systems; Rain fed; Mono-Crop; Western Himalaya; Greenhouses

Introduction

Western Himalaya refers to the western half of the Himalayan Mountain region, stretching from Badakhshan in northeastern Afghanistan/southern Tajikistan, through India (Jammu and Kashmir, Himachal Pradesh, Uttarakhand) to central Nepal. The Jhelum River rises in the PirPanjal Range in Jammu and Kashmir state, India, and flows northwestward through the Vale of Kashmir before entering the Pakistani-administered sector. The highest point is Nanga Parbat (26,660 feet or 8,126 meters), at the northwestern end of the region. Dalhousie, in Himachal Pradesh in the foothills of the range, is a noted hill station.

Climate and Rainfall in Western Himalayan Region

It shows great variation in relief. Summer season is mild (July average temperature 5°C-30°C) but the winter season experiences severe cold conditions (January temperature 0°C to -4°C). The amount of average annual rainfall is 150 cm. Zonal arrange¬ment in vegetation is found with varying height along the hill slopes. Valleys and dons have thick layers of alluvium while hill slopes have thin brown hilly soils. The region is gifted with a number of perennial streams due to high rainfall and snow- covered mountain peaks of which Ganga, Yamuna, Jhelum, Chenab, Satluj and Beas etc. are worthy of mention. These provide irrigation water to canals and cheap hydel power for agriculture and indus¬tries.

Important soil types

While Ladakh and parts of Lahaul and Spiti have skeletal, calcareous soils with alkaline reaction, the rest of the region have soils which are shallow to deep loamy, forest and podzolic brown with medium to high organic matter and acidic in reaction.

Agricultural and Horticultural practice in W-H region

Rice is the main crop of this region which is cultivated in terraced fields along the hill slopes. Maize, wheat, potato, barley are other important crops [1,2]. Temperate fruits like apple and pear etc. are produced in some parts of Jammu and Kashmir and Himachal Pradesh. Similarly tea plantations have started in some areas of Garhwal-Kumaun hills. The horticulture of the region is obsessed with the prob¬lems of financial crisis, long gestation period, lack of improved varieties of plants and high post-harvest losses (about 20 % in packing, storage, marketing and processing).The region has favorable climatic conditions for growing temperate vegetables, flowers, and crops like ginger and saffron. In order to meet the requirement of fuel and fodder, a total area of 30,240 sq. km will need to be afforested in the next 10-15 years.

Temperate Zone in Western Himalayas

The temperate zone (Figure 1) in western Himalayas corresponds to zone III drawn up on agro-ecological basis

by the planning commission. It is physio graphically a largely mountainous tract (1800-2000 m amsl).

Bio-physical features

This zone is characterized by mountainous tracts of varying altitudes, steep slopes etc. A calendar year is generally divided into three main seasons viz. winter (October-February), summer (March-June) and monsoon (July-September) with a brief spring (mid February-March) and autumn (late September-October). Winter temperatures generally remain below 5°C and precipitation in the form of both rainfall and snow result from the western depression. The cold wave sets the migration of the nomadic shepherds to warmer valleys in the Himalayan foothills. Summer temperatures remain above 20°C especially during April-June. The relative humidity remains about 40 per cent and the occasional hailstorms are known to cause extensive crop damage especially to apple, plum, apricot and peach Sen 1983 Rainfall during this period amounts to approximately 30 per cent of total annual rainfall (Figure 2).

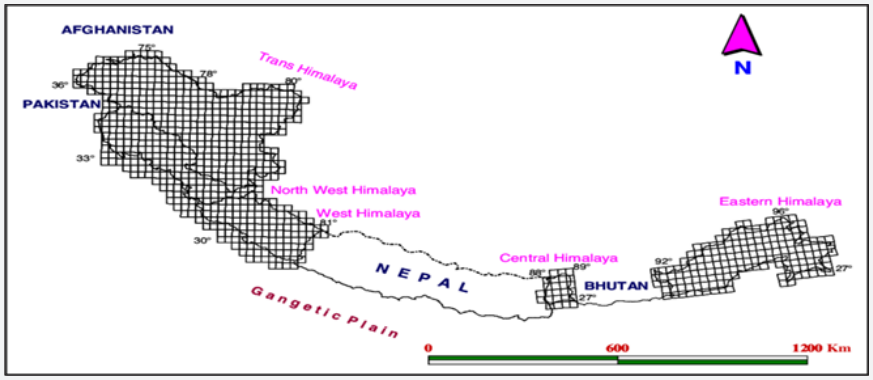

Figure: 1.

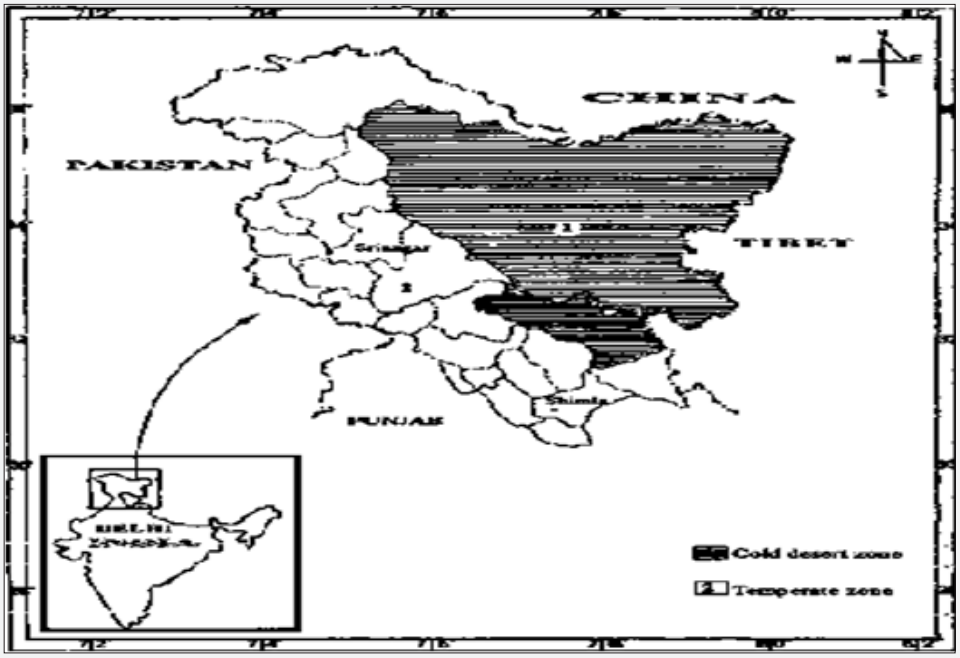

Figure: Map of the North-West Indian Himalayas..

Farming System

Agro forestry is another practice that has high potential in hill areas. It is an extension of cropping systems, but with the introduction of perennials together with annual crops. Agricultural wasteland has to be brought under tree-based systems. Among the options for agro forestry are high density plantations of fruit trees [3]. An example of this is an agro forestry model on 2.0 ha land demonstrated in the Garhwal hills where multipurpose trees were in tercropped with turmeric and cardamom. Similarly, in Chamoli district, species *suchas Alnusnepalensis* and *Dalbergiasissoo* have been included in different plantations.

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Livestock and Poultry Production

The contribution that livestock production can make towards enhancing socio-economic status of hill farmers is well recognized. In this regard, goat keeping and back yard poultry are ideally suited for small holdings. Unfortunately, well focused programmes for their promotion are not much evident [4,5]. The forward linkages for marketing have concentrated on milk. Marketing channels for goat, rabbit and poultry products have remained largely traditional and are ill equipped to handle larger volumes UNDP [6]. Even in the case of dairy, value added products like ghee are neglected. The organic nature of animal products in Uttarakhand are not emphasized enough to create a niche market for them. Under rain fed condition, mono-crop of cereals (rice, wheat, maize) may give net return of Rs 9,000 to 10,000per ha, a catchuprabi of pulses and oilseed increases net returns to about Rs 12,000 per ha. Rice-wheat under irrigated conditions can fetch about Rs 25,000 per against which vegetable crops can give net returns 4 to8 times. Three crops of vegetables can be taken during the season, the important rotations being [7,8]; (Table 1).

Table 1: Agro-ecological regions and livelihood production systems in the Western Himalayan zone.

Region	Climate, altitude (m, amsl)	Livelihood production system	Parts of the State covered		
			Jammu and Kashmir	Himachal Pradesh	Uttaranchal
Region I Sub-montane and Low Hills	Sub-tropical 200-800	Agri-livestock Fish-horticulture	Jammu and plains of Udhampur district	Una, Bilaspur, Hamirpur and parts of sirmaur, Kangra Solan and Chamba districts	Parts of Pauri Garhwal Dehra Dun, Almora and pithoragarh districts
Region II Mid Hills	Sub-humid 801-1,800	Agri-horti-livestock Fish	Hilly areas of Doda, Udhampur, Rajauri and Punch districts	Kangra tehsils of Palampur and Shimla district, and parts of Mandi, Solan, Kullu, Chamba and Sirmaur	Parts of all districts
Region III High Hills	Temperate 1,800-2,200	Agri-horti-livestock-pasture-fish	Srinagar, Budgam, Anantnag,Pulwama,Baramula and Kupwara district, Leh and Kargil district	Shimla District (except Rampur the sil) an parts of Kullu Mandi,Solan, Kullu, Chamba and Sirmaur districts	Major parts of Pithoragrah , Uttarkashi and small parts of Chamoli, and trehri Garhwal
Region IV Very High Hills	Temperate dry>2,200	Livestock-silvipasture-agriculture	Leh and Kargil district	Kinnaur, Lahaul and Spiti, and Pangi and Bharmour tehsils of Chamba	Parts of Uttarkashi, Chamoli, Pithoragrah and Almora districts

Table 2: Altitude Specific Mountain Farming Systems in W Himalayas.

No.	Altitude Grouping	Appropriate Farming System
1.	High Altitude 2,500-3,500 m above msl	Livestocks based farming systems Fruits and Vegetables farming systems Food crops pseudo-cereals based farming systems Protected cultivation-vegetables and specialty Medicinal and Aromatic Plants
2.	Mid-high Altitude 1,750-2,500 m above msl	Fruits and Vegetables farming systems Livestocks based farming systems Food crops pseudo-cereals based farming systems Protected cultivation-vegetables and specialty Medicinal and Aromatic Plants Secondary Agriculture
3.	Middle Altitude 1,500-1,750 m above msl	Food crops and Vegetables farming systems Fruits based farming systems Livestocks based farming systems Protected cultivation-vegetables and specialty Medicinal and Aromatic Plants Secondary Agriculture
4.	Mid-Low Altitude 1,200-1,500 m above msl	Food crops, Fruits, Vegetables, Livestocks based farming systems Secondary Agriculture
5.	Low Altitude 1,000-1,200 m above msl	Field crops, Livestocks and Fruits based farming systems Secondary Agriculture

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a) Tomato-tomato-cauliflower.

b) Tomato-cauliflower-radish, cabbage.

c) Cabbage-cauliflower French bean-French bean cauliflower.

d) Capsicum/brinjal-cabbage-radish, tomato-pea (Table 2).

Feeds and Fodders

Equipment for harvesting of fodder crops, hay baling making silage, feed blocks and feed pallets will be required to be introduced and popularized in future. For efficient use of scarce fodder, feeding chopped fodder should be popularized.

Biomass Management

To support organic farming equipment for mechanized composting, compost palliation, handling, transport and application of manure in the field in liquid and solid forms will be required. Such equipment will be required to be imported/ adopted/developed and popularized (Tables 3 & 4).

Table 3: Cost of carnation cultivation under poly house in Himachal Pradesh (/1000 sq.m).

Cost components	Domestic market	Share %	Export-market	Share, %
Fixed costs				
Infrastructure	658,625	11	552,796	8
Rental value of land	19,800	1	19,800	1
Interest on fixed capital	417,335	7	344,998	8
Total fixed cost	1,095,760	18	917,594	16
Variable cost components				
Planting material	829,400	14	1,140,000	16
Plant protection	287,400	5	435,000	6
Fertilizer	495,800	8	795,000	11
FYM	55,200	1	94,500	1
Labor	2,213,800	37	2,485,500	35
Packaging and transportation	452,070	8	362,400	5
Interest on working capital	520,040	9	633,708	9
Total variable costs	4,853,710	82	5,914608	84
Total cost	5,949,470	100	6,832,202	100

Cost of Cultivation of different IFS model.

Table 4: Economic benefits of carnation cultivation under polyhouse.

Returns components	Domestic Market	Export-oriented
Plants per 1000 sq. m (No.)	186,600	153,000
Flowers per plant (No.)	9.64	10.22
Price per flower (`)	5.00	7.3
Total flowers produced (No.)	1,794,800	1,563,660
Total revenue (`/1000 sq.m)	8,998,267	11,469,333
Net returns (`/1000 sq.m)	3,048,796	4,637,131
Benefit-cost ratio	1.43	1.60
Net present worth (`)	2,002,285	3,167,946
Pay-back period (years)	3rd year	2nd year
		1
		1
Internal rate of return (%)	73	7

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On-farm Post Harvest Technology

Post harvest equipment and technology are needed for cleaning, grading, drying, cooling, evaporative cooling, storage, cold storage and handling of farm produce to improve their quality and shelf-life.

Infrastructural facilities available in the Zone

Rural electrification

While all villages have been electrified in J&K and Himachal Pradesh, only 79 % of Uttaranchal villages have been electrified. However the electric supply is poor and there are frequent cuts.

Research and Training

The region has 12 ICAR Institutional Centers, four Agricultural Universities and one University of Horticultureand Forestry, a large number of research stations and sub-stations and 23 KVKs.

Swot Analysis of Mechanization Programmed in the Region

Strengths

Manufacturing of agricultural machineries and farm tools, implements especially through village. Tradition of custom servicing and hiring exists in the region's artisans, is gaining momentum.

Weaknesses

Land holdings are very small, topography is undulating and terraced irregular shape field's makes mechanization difficult with farm equipment available in the market. Mechanization has still not reached in many of the agricultural and produced management activities because of poor extension in the field of mechanization and agro-processing.

Opportunities

Farmers are keen to have improved tools, implements and machines. Mechanization minimizes drudging to farm workers and removes social taboos associated with certain farm operations thereby facilitating rural educated youth taking agriculture as vocation.

Threats

Failure to carry out a systematic mechanization programmed in Western Himalayas may result in reduced production, productivity and quality of field and horticultural crops. Stunted rural economy and political vulnerabilities.

Conclusion and Policy Issues

The study has shown substantial increase in the area and production of crops grown under protected structures. The floriculture in India is identified as a sunrise industry and the Government has accorded it export-oriented status. The area covered under protected cultivation by the NHM has shown that of the total protected cultivation area, 20 per cent is under greenhouses and only 2 per cent is under fan and pad operated greenhouses. Small farmers spend most of their increased income on consumption while large farmers make non-farm investments. Thus, protected cultivation has made a significant impact on farm households in the hilly region. However, further expansion of protected cultivation will depend on the effectiveness of supporting institutions and market structure.

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