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Development of agriculture and economy of backward area: a case of Chuhar valley in Himachal Pradesh

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Abstract

The study was carried out in Chuhar valley in Mandi district of Himachal Pradesh to examine the development potential of agriculture and economy of this backward area. Two stage stratified random sampling technique was adopted to select villages and 100 sample households for survey study that was carried out in the year 1999-2000. Linear Programming technique was employed to develop optimum farm production plans. The study revealed that only 9 per cent of the total geographical area in Chuhar was under cultivation due to undulating topography. Foodgrain production occupied a commanding position in the cropping pattern of Chuhar region. Till now, vegetables and fruits were grown on limited scale for local consumption only though there was immense potential for growing them commercially. The yield of pulses (rajmash and mash) was quite good showing the suitability of the region for production of pulses. Similarly, the yield of potato grown in *kharif* season was higher than that of potato grown in *rabi* season showing the prospects of growing seed potato. There was no or low use of fertilizers but higher use of farm yard manure showing the scope for turning the region into organic. The cost structure of different crops clearly revealed the traditional/subsistence nature of farming as human and bullock labour were the major components of the cost. The net returns from colocasia, potato, and pea were much higher than cereals showing the scope for farm diversification and enhancing income through cultivation of these crops. Through linear programming, it has been found that farm income could be increased by 96 percent from the existing level.

Keywords: Agriculture, economy, optimum farm plans, Chuhar valley, Himachal Pradesh.

Introduction

Although, the technological breakthrough as such in Indian agriculture is no longer a new phenomenon, yet it has got a significant relevance particularly for the regions, which are still lying in the embryonic stage of agricultural development. Remote and tribal regions falling under such conditions of agricultural backwardness have not yet been able to benefit from the fruits of technological innovations fully or even partly (Chandra and Singh, 1992).

Hilly regions are characterized by low density of population, small land holdings, weak market infrastructure, traditional production practices, high dependence on natural resources etc. More than 90 per cent of the population of hills earns their livelihoods from farming business. And due to high percentage of illiteracy, the movement of labour force from land-based activities (farming) to urban-based activities (industrial production) is almost negligible (Singh, 1993).

The Chuhar valley, the locale of the present study, has remained the most backward region of Mandi district in Himachal Pradesh. This region has remained alienated from the mainstream of economic development due to inaccessibility and remoteness. Agriculture assumes special significance for this backward and remote area, as almost entire population is dependent on this sector due to lack of other non-farm avenues of employment. However, the land holdings are small and fragmented and the level of economic development has been very low. Even the basic infrastructural facilities like transport and communication, input supply mechanism, output marketing systems, institutional support, etc., are scanty and sporadic.

The farm returns depend not only on the crops grown by the farming community, but also how efficiently the available resources are utilised besides indicating the possibilities of making re-adjustments for increased farm returns. The means and technology do exist, the prime need is to take the same to the doorsteps of people in their farmlands and to follow the development strategy

strictly in the context of the hill specificities (Jodha, 1996). The purpose of this study is to portray the existing scenario of typical agriculture and economy and to develop optimum sustainable farm plans for development of this backward area.

Material and Methods

Two stage stratified random sampling technique was employed to select ten villages (first stage) and 100 sample households (second stage). A simple tabular method of analysis was used for analysing the data. Linear programming technique was employed to develop optimum farm production plans under different set of constraints and available opportunities. The farm production optimization model employed in the study was as under:

$$\text{Maximize } Z = \sum_{j=1}^{k} C_j X_j \quad \text{(Objective function)}$$

Subject to

$A_{ij} X_j <, =, > B_i$ (Resource restriction/ constraints)

$X_j \geq 0$ (Non-negatively restriction)

where,

Z = Objective function (maximization of income)

C_j = Returns/cost per unit of j^{th} activity

A_{ij} = Input-output matrix or i^{th} resource required per unit of j^{th} activity/enterprise

X_j = Level of j^{th} activity/enterprise (crops, livestock, hiring, borrowing, selling, etc.)

B_i = Matrix of resource restriction/constraints

Keeping the food security and sustainability of farm production systems in view altogether, the following six farm plans were developed:

P_0 = Farmers existing plan

P_1 = Existing technology with existing resources

P_2 = Existing technology with borrowing/hiring of resources

P_3 = Existing technology with borrowing/hiring of resources and collection of green and dry fodder from forests/common lands.

P_4 = Improved technology with existing resources

P_5 = Improved technology with borrowing/hiring of resources

P_6 = Improved technology with borrowing/hiring of resources and collection of green and dry fodder from forests/common lands.

Results and Discussion

Demographic features

Chuhar Valley is located in the northern side of Mandi district and falls in Drang block. The total geographical area is around 24 thousand hectares that accounts for around 46 per cent of the total geographical area of Drang block (Table 1). Only about 9 per cent of the total geographical area in this region is under cultivation as against 16 per cent in the entire block. The entire area falls in the High Hills Wet Temperate Zone of the state. The topography of the study area is rugged and mountainous. Consequently, the area is sparsely populated as compared to other regions of Mandi district with the density of population just 81 persons/sq km as compared to 141 of the whole block. There are 91 inhibited villages. Uhl is the major river that originates in the Bara Bhangal area passes through the entire length of Chuhar from North to South-East before debouncing into Bias river near Mandi town. However, this river has little significance to the farmers as it meanders through deep gorges making it impossible to use its water for irrigation through gravity kuhls.

Table 1. General information of Chuhar viz-a-viz Drang block in Mandi district

Particulars	Chuhar	Drang	Per cent to Block (Drang)
Total geographical area (ha)	23936	52210	45.85
Net sown area (ha)	2040.75	8302	24.65
Net sown area per cent to total	8.53	15.90	53.65
Population (2001 census)	19475	73583	26.47
Population density (persons/ sq.km)	81	141	-
Total no. of villages	91*	272	33.45

* Excluding DPF villages

Source: Block Development Office, Drang and Patwar Circle Offices, Chuhar

Size of land holding

It can be observed from Table 2 that the average size of holding in Chuhar Valley was very low (1.21 hectares). The size of operational holding was found to be less than one hectare as only 62 per cent of the total holding was operational. Only about 2.48 per cent of the operational holding was irrigated, while most of

Table 2. Land inventory and utilization pattern in Chuhar valley

(ha/farm)

Particulars	IR	UR	Total
Uncultivable land (including ghasni)	-	0.46 (100)	0.46 (100)
Operational Holding	0.03 (4)	0.72 (96)	0.75 (100)
Total holding	0.03 (2.48)	1.18 (97.52)	1.21 (100)

IR = Irrigated; UR = Unirrigated

Figures in parentheses show per cent irrigated and unirrigated lands under different uses

the cultivable area was rainfed due to the lack of irrigation facilities in the study area. The pasture and other un-cultivable lands accounted for about 38 per cent of the total holding. The increasing tendency of nuclear family structure was also found to be the major cause for proliferation of smallholdings in the study area. Tripathi (1993) also revealed that the operational holdings in the hills were becoming small and uneconomic due to perpetual subdivision of inherited landed property from generation to generation.

Cropping pattern and yields

The area and productivity of different crops in Chuhar region has been displayed in Table 3.

Table 3. Area and yield of different crops in Chuhar valley

Crops	Per cent Area	Yield (q/ha)
Kharif Maize	28.32	16.24
Maize+Rajmash	2.24	7.15+3.14
Paddy	8.30	11.91
Kodo	2.79	5.33
Kodo+mash	0.82	4.25+2.47
Rajmash	3.20	5.19
Mash	0.04	4.67
Kulthi	0.10	3.57
Bhindi	0.01	25.00
Potato	4.08	80.33
Pea	0.82	67.40
Colocasia	0.10	75.00
Rabi		
Wheat	38.91	12.28
Barley	2.72	6.64
Mustard	0.37	4.69
Potato	7.06	75.41
Onion	0.12	18.75
Total cropped area (ha)	1.47	
Cropping intensity (%)	197	

It was observed that more than 85 per cent of total cropped area was under foodgrain crops. Among foodgrains, maize in *kharif* and wheat in *rabi* season were the predominant crops of the study area. Guleria (1994) also revealed predominance of maize in *kharif* and wheat in *rabi* season in less developed and non-commercialized districts of Himachal Pradesh. The other important crops were paddy and potato that were grown under irrigated as well as unirrigated conditions. Maize was mainly grown as a sole crop and sometimes as mixed crop with pulses. The *kharif* potato was grown in. higher hills of Northern Chuhar, while *rabi* potato was grown in lower hills of southern Chuhar The cropping intensity was 197 per cent. The average yield of maize was found higher in contrast to other cereals both under irrigated and rainfed conditions. This might be due to the fact that agro-climatic conditions were found favourable to maize production during rainy season. The yield of pulses was higher than other parts of the state and it was observed that agro-climatic and soil conditions were congenial for good production of pulses mainly *mash* and *rajmash*. The yield of *kharif* potato was higher (80.33 q/ha) as compared to *rabi* season potato (75.41 q/ha) obviously due to better rainfall during growth of the crop. The other major vegetable crop was pea, yielding 67 q/ha. It was also found that the average yield of maize under mixed crops was lower than sole crops but the same was duly compensated by the yield of pulses grown mixed with maize.

Cost and returns

The economics of different crops in the study area has been worked out and presented in Tables 4. The cost of cultivation forms the basis for ascertaining economic viability and profitability of any enterprise. Potato (*kharif* and *rabi*) recorded the highest variable cost in which the cost of seed and bullock labour accounted for the major proportion of total cost. The total cost that also included family labour was estimated at Rs 17573 in case of *kharif* potato and Rs.14098 for *rabi* potato. Similarly, the cost of colocasia was also quite high. Among cereals, the cost of cultivation in paddy was higher than maize and wheat. The imputed value of human labour and bullock labour were the major components of total cost in all the cereals, clearly showing the traditional type of farming in the study area as the cost of modern inputs like fertilizers and pesticides was very low. Haffis *et al.* (1998) also revealed

Table 4. Economics of different crops in Chuhar Valley

(Rs./ha)

Crops	Gross returns	Variable cost (VC)	Total cost (TC)	Returns	
				Over VC	Over TC
Kharif crops					
Maize	13188	3959	7532	9230	5657
Maize+rajmash	13570	4956	9902	8614	3668
Paddy	11315	6250	11848	5066	-533
Kodo	7995	3263	6732	4732	1263
Kodo + mash	13785	4222	8050	9563	5735
Rajmash	12975	4913	8003	8062	4972
Mash	20010	4809	7270	15201	12740
Kulthi	9282	5179	8438	4103	844
Pea	47180	6415	14185	40765	32995
Potato	32132	10057	17573	22075	14559
Bhindi	25000	3652	6967	21348	18034
Colocasia	60000	6726	12768	53274	47232
Rabi crops					
Wheat	11667	6779	11362	4887	305
Barley	7379	6747	9550	632	-2171
Mustard	7035	3564	6033	3472	1002
Potato	30117	6732	14098	23385	17020
Onion	11250	3531	6856	7719	4394

that human and bullock labour were major components of total costs in cereals.

The gross and net returns from different crops on an average farm situation as shown in table revealed that the colocasia recorded the highest gross returns (Rs 60,000/ha) followed by off season garden pea (Rs 47180/ha) as the area was found quite conducive for growing these crops. Potato grown both in *kharif* and *rabi* seasons was also found better alternative that was more profitable than cereal crops and could be considered for commercializing farming system of this region in the future. The production potential of *kharif* potato could be harnessed as seed potato at par with adjoining Bara Bhangal area of Kangra district. Among cereals, gross returns from maize were relatively higher than paddy, wheat, millets and pulses. It was visualised that net returns over total cost were negative in case of paddy and barley due to low yields of these crops and excessive use of human and bullock labour. Mehta *et al.* (1993) and Verma and Mishra (1997) also showed negative returns in some cereal crops and the high profitability of vegetables over cereal crops.

Optimum farm production strategies

Different farm plans were developed under existing as well as improved levels of technologies to maximize net returns from farming in Chuhar Valley by employing linear programming technique. In the first optimised plan (P_1), the area under both maize and wheat decreased due to low productivity of these crops, while area under pea, rajmash, potato (*kharif* and *rabi*) and colocasia increased remarkably due to profitability of these crops (Table 5). Singh and Bhati (1992) also revealed that the area under vegetable cultivation increased under optimised plan. The area under barley (fodder) also increased due to high profitability of cross-bred cows that increased from 355 in P_0 to 1848 in P_1. However, slight decrease was observed in the number of sheep and goats in this plan. Under P_2, after allowing capital borrowing, the area under barley (fodder) increased whereas the area under wheat unirrigated and potato *rabi* irrigated decreased. As a result of more availability of green fodder from barley, the number of cross-bred cows increased further to 1913. This clearly shows the role of medium term credit in enhancing the income of farming community. In

P_3, the area under maize further decreased due to shift in area from maize to maize + rajmash. This clearly showed that instead of sole cereal crops, the cereal + pulses proved more beneficial. The area under barley (fodder) decreased marginally in favour of potato (*rabi*) due to additional availability of green fodder (grasses and tree fodder) from forests/common lands. The substantial increase was noticed in the number of cross-bred cows and goats in P_3.

Therefore, it is quite evident that the support land system could enhance the economic well-being of farming community in backward region. The optimum farm production systems

Table 5. Production systems, fertilizer purchasing, income and employment under different optimum plans

Particulars	P_0	P_1	P_2	P_3	P_4	P_5	P_6
Crops (area in %)							
Maize UR	28.3	21.91	21.91	18.87	-	-	-
Paddy UR	7.42	-	-	7.53	-	-	-
Rajmash UR	3.2	10.51	10.51	-	18.52	18.52	18.52
Maize+pulses UR	2.24	-	-	5.83	15.03	15.03	15.03
Kodo+mash UR	0.82	2.04	2.04	2.43	1.02	1.02	1.02
Colocasia UR	0.1	2.67	2.67	2.67	2.67	2.67	2.67
Potato kharif UR	4.08	10.67	10.67	10.67	10.67	10.67	10.67
Pea Kharif IR	0.82	2	2	2	2	2	2
Wheat UR	37.55	30.97	28.52	29.58	23.2	23.2	28.38
Barley UR	2.72	17.03	19.47	18.42	19.47	19.47	19.47
Potato rabi IR	1.07	1.78	0.25	0.91	2.00	2.00	2.00
Potato rabi UR	5.03	-	-	-	5.33	5.33	0.15
Other minor crops	6.65	1.96	1.96	1.09	0.09	0.09	0.09
Total	100	100	100	100	100	100	100
Cropping intensity (%)	197.05	200	200	200	200	200	200
Livestock (Nos.)							
Crossbred cow	355	1848	1913	3750	1729	2637	3224
Local cow	1365	-	1090	-	-	-	-
Sheep	8187	6823	6823	6823	3689	3689	3689
Goat	8596	8187	8187	9707	5761	5761	5761
Other livestock	10943	5049	5049	5049	5049	5049	5049
Total	29828	21907	24062	25329	17308	17136	17723
Fertilizer purchasing							
CAN							
Kharif	113.30	89.62	89.62	77.18	-	-	-
Urea							
Kharif	1675.07	1634.94	1634.94	1725.44	1980.45	1980.45	1980.45
Rabi	324.22	223.70	205.58	213.41	2836.41	2836.41	2931.92
SSP							
Kharif	-	-	-	-	5783.55	5783.55	5783.55
Rabi	-	-	-	-	4326.25	4326.25	4326.25
MOP							
Kharif	-	-	-	-	557.98	557.98	557.98
Rabi	-	-	-	-	808.45	808.45	808.45
Farm Income							
Net returns (Rs. lakh)	656.10	732.22	771.16	808.79	1087.57	1215.98	1287.68
Increase over P0 (%)	-	11.78	17.54	23.72	65.76	85.33	96.26
Farm Employment	-						
Total labour used (mandays)	280205	299836	315463	329125	345710	502223	509727
Increase over P0(%)	-	7.01	12.58	17.46	23.78	79.23	81.91

IR = Irrigated; UR = Unirrigated

under improved technology displayed through P_4, P_5 and P_6 revealed reallocation of resources and adjustments in the level of different enterprises. In all these plans, there was no area under sole maize crop which got shifted to mixed cropping of maize + pulses. The area under potato (*kharif*) and rajmash also increased significantly due to higher profitability of these crops over cereal crops. In *rabi* season wheat, barley and potato (*rabi*) were the major crops under improved technology. The number of cross-bred cows showed marked increase from 1729 (P_4) to 2637 (P_5) and 3224 (P_6) which was mainly due to provision of borrowing of medium-term capital and more green fodder availability on the farm supplemented by fodder collection from forests. Saini (1982) also revealed high profitability of cross-bred cows over other milch animals. However, the number of sheep and goats drastically reduced under improved plans. As such, the number of livestock also decreased drastically due to replacement of local animals with improved breeds.

It was found that under P_0 (sub-optimal plan) farmers used very less amount of fertilizers under existing technology. Only nitrogenous fertilizers were used in some of the crops, whereas no use of P and K was found. Under P_1, the use of CAN and urea decreased as compared to P_0 due to more area under barley (fodder) in which no fertilizers were applied. In P_2, the requirement of fertilizers was almost same due to no change in cropping pattern. Under improved technology, there was discernible increase in nitrogenous, phosphatic and potassic fertilizers. The total fertilizer requirement in P_4 was 1980.45 q and 2836.41 q urea during *kharif* and *rabi* seasons, respectively. The requirement of single super phosphate (SSP) was to be tune of 5783.55 q and 4326.25 q in *kharif* and *rabi* seasons, respectively. Similarly the requirement of Muriate of potash (MOP) was estimated at 557.98 q and 808.45 q during the two seasons, respectively.

The net returns could be increased from Rs. 656.10 lakh in the existing plan practised by the farmers to 1287.68 lakh in P_6. The increase in net returns over existing farmer's plan ranged from 11.78, 17.54, 23.72, 65.76, 85.33 and 96.26 per cent under P_1, P_2, P_3, P_4, P_5 and P_6, respectively. The generation of gainful employment for surplus farm labour also forms the major agenda of the optimum farm planning. It is vividly clear that increase in human labour employment over P_0 varied from 7.01 per cent in P_1 to 81.91 per cent in P_6. The total human labour employment almost doubled from 2,80,205 man days in P_0 to 5,09,727 mandays in P_6 These results also coincide with the findings of Kulkarni (1980) who stressed upon optimum allocation of resources with the inclusion of HYVs for increasing farm income and employment. This clearly shows that human labour employment can be increased substantially in the study area.

Development potential and constraints

Chuhar valley has immense development potential for cultivation of off-season vegetables like potato, peas and temperate fruits. Particularly, potato and peas can be successfully taken up for commercial cultivation in the area as climatic conditions are ideal for growing seed potato and off-season garden peas.

The technological gap in major crops presented in Table 6 shows that farmers were growing local varieties of major cereal crops, except wheat where gap was relatively low. In case of potato, maximum area was still under local variety. However, in pea entire area was under improved varieties as seed was supplied by Agricultural Department or purchased from seed suppliers in market though farmers were not aware of the variety grown. It was observed that in maize, wheat and paddy, the farmers used higher seed rates than the recommended level as these crops were grown by following broadcast method of sowing. However, they were found to use less seed rates in pea and potato crops to save cost ignoring the fact that this practice would result in lower income.

Majority of farmers used FYM almost near the recommended level in the study area as there was plenty of indigenous livestock wealth in the area. However, the level of fertilizers (NPK) use was grossly below the recommendations made by Agricultural University in almost all the crops. The farmers were commonly using nitrogenous fertilizers (urea, CAN) only that too far below the recommended level. The technological gap in case of P and K nutrients was 100 per cent, as no farmer was found to use fertilizer brands containing these nutrients. This clearly shows that farmers, in general, were not aware of the balanced use of fertilizer nutrients. Thakur and Sharma (1984) also observed the low use of critical inputs in cereal crops and that due to low adoption of HYV seeds and low use of critical inputs, the yield of different crops was much below the potential level. The yield gaps in different crops varied from 46 to 62 per cent in

Table 6. Technological gaps of major crops in study area

(per cent)

Particulars	Maize	Wheat	Paddy	Kharif potato	Rabi potato	Kharif pea
HYV seeds	98.42	22.26	76.00	69.60	59.56	0.00
Seed	-206.45	-18.55	-80.15	77.20	77.08	29.41
FYM	3.29	11.655	-2.26	33.46	18.10	19.50
Fertilizers						
N	3.02	85.56	76.63	8.30	72.65	72.40
P	100.00	100.00	100.00	100.00	100.00	100.00
K	100.00	100.00	100.00	100.00	100.00	100.00
Yield	58.42	55.91	61.76	46.45	54.25	46.08

Technological gap shows percent deviation from recommended level

the study area. The yields of maize, paddy and wheat could be increased 2 to 3 times with the use of recommended technology. Similarly, the productivity of potato and pea could be doubled in the study area.

Conclusion

The yields of crops in Chuhar region were found even below the state average which can be increased considerably provided due attention is given to R & D endeavours in agriculture. The net returns were very low or even negative in cereal crops due to low yields. However, the net returns from colocasia, potato, pea and mixed cropping of cereals+pulses were much higher than sole cereal cropping. The programming technique vividly revealed the scope for enhancing income and employment with optimum utilization of resources and crop-mix. It has been found that farm income could be increased to the extent of 96 per cent from the existing level. There is immense development potential for cultivation of off-season vegetables and temperate fruits. Particularly, potato and peas can be successfully taken up for commercial cultivation in the area as climatic conditions are ideal for growing seed potato and off-season garden peas. Besides these crops, there is wide scope for the cultivation of fruits like apple, pear, apricot, etc., in the study area.

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