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Economic analysis of vegetable production under irrigated conditions of Himachal Pradesh

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Abstract

The present study was intended to analyze the economics involved in cultivation of vegetable crops under irrigated conditions of Himachal Pradesh. It was observed that the state has made a rapid stride in vegetable production. It was found that capsicum recorded higher gross as well as net returns followed by tomato and cauliflower. In this way capsicum, tomato and cauliflower enjoyed a comparative advantage over other crops. Results of Cobb-Douglas production function revealed that except tomato and cabbage, the regression coefficients of seed costs turned out to be positive indicating thereby that this variable has significantly contributed in the improvement of gross returns in selected vegetables. The positive coefficient of fertilization costs confirmed the significant role of fertilizers/manures in the improvement of yield levels and returns *per se*. However, this expenditure showed weak link with the returns from tomato, capsicum and cabbage. Irrigation charges have positive impact on the returns from cabbage and capsicum. The expenditure on pesticides/weedicide has significantly affected the gross returns particularly in case of peas, cabbage, radish and tomato as evident from positive significant coefficients of this variable. The regression coefficient of human as well as bullock labour indicated that these costs should be minimized by improving the efficiency of agricultural labour and partly by replacing them with mechanical labour. On the basis of results it could be concluded that the positive and negative coefficients of various costs should be taken care off judiciously to improve the returns from vegetables grown in the study area.

Introduction

Recently, liberalization and globalization of Indian economy has made it a matter of utmost importance to recognize the potentiality of vegetables. Vegetable is considered more important as it generates more income and employment, promotes equity, improves nutrition and protects and conserves the ecology. Moreover, adoption of this enterprise improves the economic status of the farmers, as this business in recent years has been highly commercialized. According to the estimates of area and production of major crops in India (Ministry of Agriculture, Government of India, New Delhi), the share of vegetable crops in the gross cropped area has increased by about 4 times from 0.58 per cent during TE 1952-53 to 2.29 per cent during TE 1992-93. India has emerged as the second largest producer of vegetables, after China, vegetable production touched the highest level of 93.84 million tones in 2000-01 (Kumar *et al.*, 2005). The studies have shown that the demand for vegetables is expected to grow at an average rate of 9.2 per cent per annum, requiring doubling of vegetable production from 93.84 million tones at present to 185 million tones by 2011-12 (Singh *et al.*, 2004). It has been observed that vegetables grown under normal conditions give four to five times more returns than cereal crops (Srivastava, 1995). However, being seasonal, the production of vegetables in India is highly localized in favoured agro-climatic regions. Vegetable crops in our country have been identified as most viable option for replacing subsistence farming in hills (Kumar *et al.*, 2002). Indian hills are bestowed with internal variability and multiplicity of highly localized and complex agro-systems suitable for various important vegetable crops. Henceforth, the shift of cropping pattern in hills towards vegetables has been tremendously increased in recent years due to its high nutritional value, high remuneration and export potential (Prasad, 2001). Because of natural niche and other favourable conditions, Himachal Pradesh, a model of hill states of the country for agricultural as well as all round development has a vast potential of producing vegetables both during normal and off-season and could make the produce continuously available to the neighboring plains. In Himachal Pradesh, area under vegetable crops has increased to 57664 hectares (2003-04) from about 12000 hectares

(1970-71). Consequently, the vegetable production, which was only 114850 Mt during 1970-71 increased to 957734 Mt during 2003-04. Studies have reported that in Kullu district of the state, the traditional cereal crops have been almost completely replaced by the vegetable crops. Consequently, the general standard of living of the farming community has been perceived to be uplifted (Brij Bala and Sharma, 2005). The state has earned name and fame of producing peas, tomato, cauliflower, cabbage, beans, cucumber, capsicum, radish, cucurbits, etc. besides some uncommon vegetables like asparagus, broccoli, etc. These vegetable crops not only give quick returns in a short period of time but, also fit well in well defined Kharif-Rabi cropping system.

Though, there is a presence of multiplicity of highly localized and favourable factors in Himachal to support vegetable cultivation yet, choice of vegetable enterprise is being constrained by irrigation availability. As a result of various micro and major irrigation schemes, state has achieved partial intensification and diversification of agriculture with high value crops like normal and off-season vegetables. But the development of irrigation has still to go a long towards this direction. In this back drop, the present study was intended to analyze the economics involved in cultivation of vegetable crops under irrigated conditions of Himachal Pradesh.

Material and Methods

The present study was a humble endeavour to analyze the scenario of vegetable production and the economics involved therein, under irrigated conditions of Himachal Pradesh. The study was based on both primary and secondary information. Primary data were collected by personal contact method employing well designed and pre-tested* schedule for the year 2004-05. Based upon the agro-climatic diversity states' agriculture was divided into food-grain based, fruit based and vegetable based farming systems. This study was carried out in vegetable based farming system. The vegetable based farming system was divided into main-season and off-season based sub-systems. Selection of blocks, villages and farmers formed the first, second and third stage of multi-stage sampling. In the first stage of sampling, one block representing each sub-farming system was identified randomly on the bases of dominant cropping pattern. In the second stage of sampling, two villages from each selected block were selected randomly, thus, making a total of four villages. In the final stage of sampling, fifteen farmers representing both small ($\leq$ 2 ha) and large farmers (>2ha) were randomly selected from each selected village by employing proportional allocation method, thus, making a total sample of 60 respondents. However, the informations obtained from the two farm categories showed little variations, therefore, these informations were pooled for further analysis. Besides, secondary data regarding area and production of vegetables were obtained from Directorate of Agriculture, Shimla (HP).

To work out the cost and return following cost concept were used:

Cost concepts

Cost A_1: Value of hired human labour, bullock labour, machinery, seed, plant protection measures, irrigation charges, land revenue, other taxes, interest on fixed capital, and interest on working capital.

Cost A_2: A_1 + rent paid for leased-in land

Cost B_1: Cost A_1 + imputed interest on owned fixed capital (excluding land)

Cost B_2: Cost A_2 + imputed rental value of owned land (less land revenue) + imputed interest on owned fixed capital (excluding land)

Cost C_1: Cost B_1 + imputed value of family labour

Cost C_2: Cost B_2 + imputed value of family labour

Cost D: Cost C_2 + 10 per cent of Cost C_2 (management charges)

Impact analysis

In order to find out the impact of cost variables on gross return Cobb-Douglas production of following form was employed:

$$Y = bo X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} V^t$$

Where, Y = Gross return (Rs/ha.)

X_1 = Cost on seeds (Rs/ha.)

X_2 = Cost on fertilizer/manures (Rs/ha.)

X_3 = Cost on irrigation (Rs/ha.)

X_4 = Cost on plant protection (Rs/ha.)

X_5 = Cost on labour (Rs/ha.)

X_6 = Cost on bullock/tractor labour (Rs/ha.)

V^t = Error term

b_0 = Constant

b_1 to b_6 = Regression coefficients

* Pre-tested in Saralu, Tanda and Patti villages of Tanda Panchayat, District Kangra.

Results and Discussion

Realizing the importance of vegetable crops in agricultural development, the state has made a rapid stride in vegetable production. The area, production and yields of important vegetables have been presented in the Table 1. It can be seen from the table that peas alone occupied about 27 per cent of the total area under vegetables in the state followed by potato and tomato. However, comparatively lower area was under brinjal. As far as the production of the vegetables in the state is concerned, tomato accounted for about 31 per cent, which was higher in comparison to other vegetable crops grown in the state. The yield was found higher in case of tomato followed by cabbages and cucurbits. Further, the figures in the parentheses indicated that there has been an appreciable increase in area as well as production of vegetables over the years. The yield levels of vegetables also showed an increase of about 19 per cent from 1990-91 to 2003-04. The substantial increase in the vegetable production could be attributed partly to the expansion of area under vegetables and improvement in yield levels and partly to the research and development in vegetable breeding and other improvement programmes.

Cropping pattern and yield levels

The cropping pattern of different crops grown in the study area presented in Table 2 revealed that vegetable alone occupied about 65 per cent of the total cropped area in the study area while, about 26 per cent of the total cropped area. The higher proportion of cropped area under vegetables was due to assured irrigation facilities and favourable agro-climatic conditions in the study area. Studies have also shown that vegetable based farming system of Himchal Pradesh have comparatively higher endowment of water resources which has prompted vegetable cultivation under this farming system (Baba, 2006, Sharma *et al.*, 2003). The cropping intensity of the study area was about 228 per cent indicating thereby that the farmers are taking up more than two crops in a year. This was mainly due to multiple cropping of vegetable crops under irrigated conditions. Panday and Gaglani (1992) also revealed that cropping intensity was higher on irrigated farms as compared to un-irrigated farms.

Table 1. Area, production and yield of vegetables in Himachal Pradesh (2004-05)

Vegetable	Area (ha)	Per cent of total area	Production (MT)	Per cent of total production	Yield (MT/ha)
Pea	15441	26.78	162144	16.93	10.50
Potato	14100	24.45	151918	15.86	10.77
Tomato	8973	15.56	300976	31.43	33.54
Beans	2608	4.53	26684	2.79	10.23
Onion	1290	2.24	21664	2.26	16.79
Cabbage	2889	5.01	88927	9.28	30.78
Cauliflower	1808	3.14	34445	3.60	19.05
Radish/Turnip/Carrot	1269	2.20	23130	2.42	18.23
Bhindi	1420	2.46	14489	1.51	10.20
Cucurbits	2021	3.50	46925	4.90	23.22
Capsicum & Chilli	1834	3.18	19455	2.03	10.61
Brinjal	624	1.08	11121	1.16	17.82
Others	3387	5.87	55856	5.83	16.49
Total	57664 (162.39)	100.00 -	957734 (211.51)	100.00 -	16.61 (18.72)

Figures in the parentheses indicate per cent increase during 2004-05 over 1990-91.
Source: Directorate of Agriculture, Shimla.

Table 2. Cropping pattern and yield levels of different crops in the study area

Crop	Area (ha)	Per cent of total cropped area
Cereals	0.56	26.42
Pulses	0.03	1.41
Spices	0.10	4.72
Oilseeds	0.03	1.41
Fodder	0.02	0.94
Vegetables	1.38	65.10
Total cropped area	2.12	100.00
Total operational	227.96	-

Source: Field survey, 2004-05

Looking across different vegetable crops, the cauliflower enjoyed a special status in terms of higher area occupying about 28 per cent of total area under vegetables. The higher proportion of area under this crop might be due to its higher demand in neighboring northern states. Peas came next in area after cabbage and capsicum (Table 3).

Table 3. Area under selected vegetable crop and yield levels

Crop	Area	Per cent	Yield
Peas	0.13	9.42	78.49
Cauliflower	0.34	24.64	137.73
Cabbage	0.21	15.22	176.44
Capsicum	0.14	10.14	121.12
Tomato	0.07	5.07	193.75
Radish	0.09	6.52	106.48
Others	0.40	28.98	-
Total	1.38	100.00	-

Source: Field survey, 2004-05

Comparatively lower area was allocated under tomato. With regards to yields, tomato leads all vegetables followed by cabbage and cauliflower. Comparatively higher yield levels from vegetable crops were also reported by Singh and Bhati (1992).

Costs and returns

The comparative economics of selected vegetables have been shown in Table 4. The results in the table revealed that the net returns of selected crops ranged from Rs 28027 in case of cabbage to Rs 52281 per hectare in case of capsicum. Capsicum recorded higher gross as well as net returns followed by tomato and cauliflower. In this way capsicum, tomato and cauliflower enjoyed a comparative advantage over other crops. Further, the off-seasonal nature of these vegetables fetches lucrative prices to the farmers. But it is interesting to note that despite the higher profitability of tomato, the area under this crop was less in comparison to other vegetables. This might be due to high incidence of diseases and difficulties in its marketing due to its perishability. Moreover, tomato was more capital-intensive crop, therefore, farmers could not manage large area under this crop. Radish was found to be comparatively less profitable.

Impact of cost variables

To find out the impact of cost variables, Cobb-Douglas production function was fitted and the results have been depicted in Table 5. Except tomato and cabbage, the regression coefficients of seed costs turned out to be positive indicating thereby that this variable has significantly contributed in the improvement of gross returns in selected vegetables. In this way, further expenditure on improved seeds could increase the returns. The positive coefficient of fertilization costs confirmed the significant role of fertilizers/manures in the improvement of yield levels and returns *per se*. However, this expenditure showed a weak link with the returns from tomato, capsicum and cabbage. Irrigation is considered to be a critical input for the agricultural growth. Irrigation charges have positively influenced the returns from cabbage and capsicum while, non-significant coefficients of this variable in case of other vegetables showed the optimum use of irrigation facilities. The expenditure on pesticides/weedicides has significantly affected the gross returns particularly in case of peas, cabbage, radish and tomato as evident from positive significant coefficient of this cost. The returns could be improved by the application of these chemicals according to scientific recommendations. The coefficient of human as well as bullock labour indicated that these costs should be minimized by improving the efficiency of agricultural labour and partly by replacing them with mechanical labour. It has been observed that assured irrigation facilities in any area was complementary with new technologies and mechanization (Singh, 1980), therefore, farmers should be encouraged to use best quality and disease resistant seeds of vegetables and various input technologies to harness potential of vegetable production.

Table 4. Economics of important vegetable crops grown under irrigated conditions of Himachal Pradesh

Crop	Gross return	A_1	A_2	B_1	B_2	C_1	C_2	D	Net return*
Peas	66672	15155	15295	15790	17760	30590	32560	35716	30956
Cauliflower	82638	13660	13810	14305	16290	30755	32740	36114	46524
Cabbage	61754	12711	12952	13340	15520	28390	30570	33727	28027
Capsicum	84784	12390	12520	13025	15030	27525	29530	32503	52281
Radish	40995	10486	10610	11140	132120	21590	23570	25827	15168
Tomato	87187	14618	14750	15230	17120	30180	32070	35677	51510

* denotes return over cost-D.

Table 5. Estimates of Cobb-Douglas production function

Regression coefficients	Peas	Cauliflower	Cabbage	Capsicum	Radish	Tomato
Constant (b)	7.352	2.881	2.821	2.619	1.993	1.897
Cost of seeds (b_1)	0.232**	1.365*	-0.221	0.694*	0.758**	1.333
	(0.126)	(0.523)	(0.240)	(0.150)	(0.344)	(1.001)
Costs of fertilization (b_2)	0.214**	0.997*	0.077	-0.053	0.712*	0.881
	(0.113)	(0.402)	(0.210)	(0.228)	(0.233)	(0.570)
Irrigation charges (b_3)	0.014	-0.005	0.310*	0.591**	-0.074	0.777
	(0.012)	(0.058)	(0.091)	(0.267)	(0.186)	(0.621)
Pesticides/weedicides	0.521*	0.552	0.423**	0.003	0.088***	1.329*
charges (b_4)	(0.157)	(0.581)	(0.198)	(0.021)	(0.053)	(0.326)
Human labour (b_5)	-0.411*	-0.800***	0.171	-0.032	-0.412*	0.723*
	(0.111)	(0.521)	(0.119)	(0.132)	(0.143)	(0.088)
Bullock/tractor labour (b_6)	-0.172**	-0.202**	-0.321	-0.094*	-0.089	0.906
	(0.103)	(0.099)	(0.201)	(0.022)	(0.297)	(1.222)
Adjusted R^2	0.48	0.50	0.59	0.49	0.52	0.61

* and ** denote significance at 0.01 and 0.05 levels of probability, respectively

Conclusion

The area and productivity of vegetables have shown an appreciable increase in the post-reform era. Moreover, use of the latest technology, favourable agro-climatic conditions and high demand of these crops has led to the improvement of returns from vegetables. Majority of farm households belongs to small farm category (82%). Diversification of agriculture with vegetables in view of their higher returns and labour intensive nature could improve the income and employment of the farmers operating small land holdings. Moreover, the demand conditions in the northern areas offer a bonus to them for raising off-season crops of these vegetables. Government should play an active role in the form of investment on agricultural research for developing promising varieties of vegetables to be grown under wide range of agro-climatic conditions. Due attention should be given to the expand irrigation capacities, by constructing tube-wells, water harvesting structures, etc. Quality inputs should be made available well in time at nominal rate. Necessary infrastructure like market yards and roads should be built to facilitate easy sale of the produce. Further, farm level processing of vegetables should also be encouraged to supplement the income of farmers.

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