Journal of Agricultural Development and Policy, 2021
Volume 31, No. 2, 170-174

Resource Use Efficiency of Capsicum Cultivation Under Open Farm Conditions in Himachal Pradesh

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Abstract

The present study was conducted to study the resource use efficiency in capsicum production in Solan District of Himachal Pradesh. Solan district of Himachal Pradesh was purposively selected for the present study because of its significant contribution to area and production of capsicum i.e, 1217 ha and 34850 MT, respectively of Himachal Pradesh. The sum of the elasticity coefficient was found to be greater than one (1.19), which indicated increasing returns to scale, which suggest the increases in output by 1.19 per cent when all the inputs are simultaneously increased by one percent. The marginal value products (MVPs) and factor price ratios depicted that the among all the variable under study, human labour was being overutilized whereas the remaining variables viz. planting material, FYM, Fertilizers and plant protection chemicals were being underutilized by the farmers in the study area.

Keywords: Resource use efficiency, Production function, MVP, Resources

JEL Classification: D61, N5, D51

Introduction

India ranks second in vegetable production in world after China. The total production of vegetables in India for the year 2016-17 was 178172 thousand tonnes out of 10238-thousand-hectare area (NHB, 2018). Capsicum (Capsicum annum) is called as 'sweet pepper' or 'shimla mirch' and is one of the most popular and highly remunerative annual herbaceous vegetable crops. Capsicum comes under nontraditional categories of vegetables and is very exacting in climatic requirements. It belongs to the family Solanaceae and is a high value low volume crop. Due to its appealing food value with rich vitamins and minerals, it is very popular among Indian folks. Capsicum have mildly pungent, tetra lobed fruits with longer shelf life and are suitable for export. India contributes one fourth of world's production of capsicum. It is one of the cash crops in India and is grown in an area about 24 thousand hectares with an annual production of 306 thousand tonnes (NHB, 2018). The export market for capsicum is also very high and it demands fruits with good size, longer shelf life, attractive color, etc.

The protected or greenhouse cultivation of capsicum has shown a high rate of growth in recent years. But due to majority of farmers belonging to marginal and small farm categories, farmers face several constraints in the form of high investment costs, low capital accumulation capacity, lack of technical guidance and non-availability of skilled labor. To escape these constraints, farmers in the sampled region cultivate capsicum under open field conditions. The off-season open field cultivation of Capsicum is not usually preferred during winters in Himachal Pradesh because of the variability in environment during the cultivation period. (Senthilkumar *et al*, 2018).

Himachal Pradesh ranks first in capsicum production in India with a production of 57.41 thousand tonnes (19.90 %) followed by Karnataka with 56.70 thousand tonnes (19.66 %), Madhya Pradesh with 33.84 thousand tonnes (11.73 %) (NHB, 2018). Himachal Pradesh is a leading supplier of capsicum to the plains during

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summer and rainy seasons. It is mainly grown in mid-hills (800-1500 amsl.) of Solan, Sirmour, Bilaspur, Mandi and lower areas of district Shimla. (Singh et al 2020). Solan district of Himachal Pradesh ranks first in capsicum production with a total production of 34850 tonnes in 1217 hectare, followed by Sirmaur with a total production of 11874 tonnes in an area of 711 hectare, Kangra with a production of 5612 tonnes in an area of 385 hectare, Mandi with a production of 5296 tonnes in 372 hectare and Shimla with a production of 5035 tonnes in an area of 342 hectare.

A resource or input is considered to be used most efficiently if its marginal value product just offsets its cost. (Khatri *et al*, 2011). Resource use efficiency can be defined as the ability to derive maximum output per unit of resource. Resource allocation and productivity is an important aspect to increased agricultural production, which is associated with the management of the farmers, who employ these resources in production. (Vikas *et al*, 2019). The effectiveness and improvements in different variables viz. information source utilization, attitude towards production technology and scientific orientation is required among the farmers to enhance the effective cultivation.

Efficiency is the core of agricultural production. Through efficient use of resources, the agricultural production can be sustained and expanded. In the regions where most of the farmers are resource deficit, efficiency has remained an important topic of empirical investigation. Resource saving activities and credit facilities should be made available to the farmers. (Folayimi *et al*, 2019). The production is not mechanized in agriculture which leads to below potential farm performance. Farmers use various inputs such as land, labour, seeds, FYM, plant protection chemicals for production. The resource use efficiency can be determined by the level at which these inputs are converted to outputs. (Wosor and Nimoh, 2012; Kumar and Kumawat, 2019).

Farmer's field trials and awareness campaigns on improved practices and correct method of use of inputs needs to be undertaken and this will ultimately benefit the producers. Agricultural inputs if made available at right time and affordable prices, can enhance the efficiency along with the provision of improved rural infrastructure. There is a strong requirement to provide scientific knowledge and awareness to farmers regarding the efficient use of productive resources. Inefficient use of resources may happen because most of the farmers are marginal and small and their farming has still not matched with the infrastructural and economic development. Also, the creation of alternative employment opportunities can absorb excessively utilized labour. (Goni et al 2013). Strong efforts are required made through the Krishi Vigyana Kendras to enhance productivity and profitability and to utilize farm resources rationally. (Kiran and Shivkumar 2019). The present study analysed the difference between the effective resource use which would have resulted in increased returns and how those resources were put in use. In the significance of this the present research work is focussed on analysing the resource use efficiency in capsicum cultivation.

Data Sources and Methodology

Multistage Random sampling was adopted to select the ultimate sample of the respondents i.e., the capsicum growers. At the first stage, two development blocks i.e., Kandaghat and Solan out of 5 blocks were selected and a representative sample of 80 farmers having 40 farmers from each block was taken. At the second stage, a list of villages growing capsicum in the selected blocks was prepared and 8 villages from each block were randomly selected. At the third stage, 5 capsicum growers in each of the selected villages were selected for collection of primary data. Thus, a sample of 80 growers were selected for the study. To meet the objective of the present study, data were collected from the sampled growers by survey method using well designed and pretested schedule during the year 2017-18.

Cobb- Douglas production function

The Cobb-Douglas production function was estimated for studying the relationship between output of capsicum and the various input variables for the estimation of resource use efficiency.

The following types of equations were used:

$$Y = \beta_0 X_1^{\beta 1} X_2^{\beta 2} X_3^{\beta 3} X_4^{\beta 4} X_5^{\beta 5} e^u$$

The above function is linearized double log form as below:

$$\text{In } Y = \text{In}\beta_0 + \beta_1 \text{In}X_1 + \beta_2 \text{In}X_2 + \beta_3 \text{In}X_3 + \beta_4 \text{In}X_4 + \beta_5 \text{In}X_5 + u$$

Where,

Y = Gross returns

X_1 = Expenditure on human labour

X_2 = Expenditure on planting material
X_3 = Expenditure on FYM
X_4 = Expenditure on fertilizers
X_5 = Expenditure on plant protection chemicals
β_0 = Intercept
β_1-β_5 = The elasticity coefficients
e^u = The error term

Adjusted coefficient of multiple determination

Adjusted R^2 is a modified version of R^2 that has been adjusted for the number of predictors in the model. Adjusted R^2 adjusts the statistic based on the number of independent variables in the model. That is the desired property of a goodness-of-fit statistic. The adjusted value of R^2 is calculated as follows :

$$\overline{R^2} = 1 - (1 - R^2)\frac{(n-1)}{(n-k)}$$

where,
R^2 = Coefficient of multiple determination
n = Number of sample observations
k = Number of parameters estimated
R^2 = Adjusted R^2

Test for overall significance of regression

'F' test has been used to test the overall significance of explanatory variables whether they affect the dependant variable or not. The expression for the test is as under

$$F\,(k-1, n-k)df. = \frac{R^2}{(1-R^2)}\frac{(n-k-1)}{k}$$

where,
k = Number of parameters
n = Number of observations in the sample
R^2 = Coefficient of multiple determination

Marginal value products (MVPs)

In order to evaluate the economic rationale of resource use on different categories of farms, the marginal value products (MVPs) of different resources were calculated by multiplying regression coefficient of given resources with the ratio of geometric mean of gross returns to the geometric mean of given resources. The marginal value product of a particular resource represents the expected addition to the gross returns caused by an addition of one unit of that resource while other inputs are held constant. For estimation of MVP_{xi} the computational steps followed are as under:

$$MVP_{xi} = \{b_i \frac{\overline{y}}{\overline{x}_i}(P_y)\}$$

where,
$\overline{y}$ = Geometric mean of output
$\overline{x}_i$ = Geometric mean of input
b_i = Regression coefficients
i = 1, 2, 3, ……n
P_y = Price of capsicum (Rs./qtl)

Results and Discussion

Production function analysis and resource use efficiency in capsicum cultivation

The production function analysis was carried out to examine the resource use efficiency in capsicum production. Cobb-Douglas production function was estimated and the results have been presented in table 1. It was observed from the table that the coefficient of multiple determinations (R^2) of the function was 0.703, which indicated that 70.30 per cent variations in gross income of capsicum cultivation were explained by the variables under study. F-test (35.04) indicated that the estimated Cobb-Douglas production function was statistically significant at 5 per cent level. The sum of the elasticity coefficient was found to be greater than one (1.19), which indicated increasing returns to scale, which suggest the increases in output by 1.19 per cent when all the inputs are simultaneously increased by one percent.

It is observed that variables like expenses on FYM (2.32), fertilizers (0.12) have shown their positive and significant contribution on gross income of capsicum production. The regression coefficient revealed that one percent increase in expenditure on FYM would have brought about 2.32 per cent increase to the gross income from the capsicum and one per cent increase in expenditure on fertilizers would increase gross income by 0.12 per cent. The coefficient of human labour was found negative (-1.46). This indicated an extreme use of labor by the farmers which in turn leads to reduction in profit obtained. Expenditure on human labour influenced gross income negatively. A percent increase in expenditure on human labour would result in 1.46 per cent decrease in gross income keeping the other resources constant.

Marginal value products (MVPs) and factor price ratios in the sampled households

The marginal value products (MVPs) and factor price ratios in the sampled households were estimated and results have been presented in table 2. The ratio was

Table 1. Estimated coefficients of Cobb-Douglas production function in the sampled households

Particulars	Coefficient	Standard error	t statistics
X_1	-1.46**	0.75	-1.95
X_2	0.10	0.07	1.47
X_3	2.32*	0.75	3.09
X_4	0.12**	0.05	2.55
X_5	0.12	0.09	1.33
$\sum b_i$	1.19		
R^2	0.703		
Adjusted R^2	0.68		
F	35.04		

*Note: *, **Significant at 1% and 5% level of significance*

Table 2. Marginal value products (MVP) and factor price ratios in the sampled households

Particulars	Coefficient	APP	MPP	MVP	r
X_1	-1.46	7.05	-10.32	-10.32	-10.32
X_3	2.32	7.42	17.19	17.19	17.19
X_4	0.12	40.33	4.97	4.97	4.97

Note: Py =1, MFC=1

found to be -10.32 for human labour, 17.19 for FYM and 4.97 for fertilizers. This indicated that the marginal value products (MVPs) and factor price ratios for FYM and fertilizers were greater than unity, it shows that all these resources were underutilized and farmers should use more of these inputs. Whereas the human labour was over utilized in the sampled households which means there was a need to reduce the use human labour in capsicum cultivation.

Conclusion and Policy Implications

From this study it can be concluded that the farmers were not able to utilize the resources at optimum level which could have resulted in greater returns. Inefficient use of resources always leads to higher costs and reduced potential returns. Whereas all these resources if utilized efficiently put a positive impact on gross returns.

It can be implicated from the study that the capsicum cultivators could increase their resource use efficiency and thereby the returns through limiting their expenditure on human labour and increasing the expenditure on planting material, FYM, fertilizers and plant protection chemicals. The excessive use of human labour could be due to improper evaluation of labour requirement by the producer. This could also be due to a high rate of unemployment in the region which forces the people to work in such a high number. Therefore, increased employment rates could result in optimum utilization of labour resources. The other resources like planting material, FYM, fertilizers and plant protection chemicals were underutilized. The reason behind this perhaps could be due to conventional agricultural practices and also due to lack of knowledge and skills in effective utilization of these resources. It should be the duty of Agricultural institutions to provide time to time access to the package and practices and also to conduct different training programs that could be specifically about the optimum use of resources.

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Received: February 21, 2021 Accepted: August 5, 2021