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Economics of Tomato Cultivation in Himachal Pradesh

Dr. K.C. Sharma,
Professor & Chairman
Department of Economics
Himachal Pradesh University
Summer Hill Shimla

Sham Singh,
Assistant Professor,
Department of Economics
Govt. P.G. College Una (H.P.)
District Una (H.P.)

ABSTRACT

Tomato (*Lycopersicon esculentum*) is the world's largest vegetable crop and known as protective food both because of its special nutritive value and also because of its wide spread production. Tomato is one of the most important vegetable crops cultivated for its fleshy fruits. Tomato is considered as important commercial and dietary vegetable crop. Tomato is protective supplementary food. As it is short duration crop and gives high yield, it is important from economic point of view and hence area under its cultivation is increasing day by day. Cash Crops cultivation plays an important role in the agricultural economy of India. Marginal, small, medium and large size farmers of India grow vegetable for generating income and increasing nutrient in the diet of people. But limited research was done on profitability and resource use efficiency of tomato which are the major vegetable cash crops grown by farmers in Himachal Pradesh. Study was carried out in 2017-18 on the basis of primary data to know costs, returns and resource use efficiency of tomato cultivation. The study concluded that return per rupee (RPR) in tomato cultivation was Rs.3.57, benefit cost ratio (BCR) at Rs.3.25:1, contribution of margin (CM) at Rs. 368 breakeven point (BEP) at 1.68 tones/ ha. and margin of safety (MS) at 22.68 tones/ ha respectively which was highest to large farm category in both the cash crops and indicated that large farms are more efficient and have more economies of scale (net-returns) due to better management practices, sound financial position and efficient use of resources.

Key words: Cost of Cultivation, Gross Income, Net>Returns, Contribution of Margin, Breakeven Point and Margin of Safety

Introduction

The estimation of the cost of cultivation of tomato crop and return is very important in farm economics as it helps in decision making at various levels for the farmers, researchers, policy makers, bankers and the administrators. The cost of cultivation and returns from tomato crop was computed based on the information collected from the sample villages through rapid rural appraisal approach. The analysis of cost and returns is of great interest to a very wide range of users of cost data and it also assumes significance in the area of planning in a predominantly agricultural economy. Analysis of cost and return is of vital importance both from the point of view of evolving sound production plans and for the formulation of price policy. The enterprise cost study also provides very useful information of practical value in improving the farm efficiency.

Review of Literature A general review of literature of the period shows that the researchers were very much interested in the economics of tomato cultivation. Shende and Meshram (2015) conducted a study on cost benefit analysis and marketing of tomato vegetable in Bhandara district, Maharashtra based on primary data collected from 40 vegetable growers and 10 village traders, wholesalers in four tehsils namely viz., Bhandara, Tumsar, Mohadi and Pavani of Bhandara district in Maharashtra. The result revealed that the cost of cultivation per hectare for Tomato over the cost C_2 was found 76417.41 Rs./ha. The net return over cost C_2 was found to 65139.23 Rs./ha. for Tomato. They concluded that the B:C ratio over cost A_2 was found to be 3.73 for Tomato. However the B:C ratio over C_2 i.e. cost of cultivation was 1.85 for Tomato. The resource use efficiency was estimated by Cobb-Douglas production function. Ulemale and Sarap (2017) conducted a study on economics of production and marketing of tomato of three tehsils namely- Amravati, Achalpur and Anjangaon surji of Amravati District, based on the primary data, collected from 30 samples. They concluded that the per hectare input utilization of tomato was highest in large groups i.e. 173.80 days, and overall was 140.26 labour days. At overall level per hectare cost A and cost B was Rs. 97994.90 and Rs. 128463.00 respectively which was 69.48 per cent and 91.21 per cent of total cost C. The net return at cost C in small, medium and large size group were Rs. 6300.52, Rs. 14110.80, and Rs. 24202.74, respectively, an input-output ratio for overall size groups at cost A, cost B and cost C were 1.56, 1.19 and 1.09, respectively. Kushwaha et al. (2018) conducted a study on profitability of tomato production in some selected areas in Panna District of Madhya Pradesh, based on primary data collected from 60 growers, comprising 20 farmers each from three groups viz. small, medium and large farmers in Panna block of Panna District of Madhya Pradesh. They concluded that the benefit cost ratio was higher in the case of small size group 1:2.11 (maximum) followed by 1:1.83 in medium and 1:1.68 (minimum) in large size group. The net return over cost A_1 , A_2 and net return on cost C_3 was comparatively higher in small size farm. The net return over cost A_1 and A_2 and net return on cost C_3 was comparatively higher in small size farm.

Objectives

The present study has been undertaken to achieve the following objective:-

- (i) To analysis the resource use efficiency of tomato cultivation. (Cobb-Douglas Production Function)
- (ii) To examine the cost and net-return of tomato cultivation grown by the farmers.

Data Source and Methodology Study was carried out in districts of Una and Solan and these have been selected purposively for conducting the present empirical verification on the economics of tomato cultivation in Himachal Pradesh. The study is based on primary data. The required primary data has been collected with the help of pre-tested schedule from 300 sample households of 20 villages during 2017-18 selected randomly from the ten development blocks of the two district, with the help of pre-tested schedule information, different cost and resource use efficiency have been recorded from the survey. The statistical tools have been analyzed through simple percentage and average method.

Cost and Returns Analysis

The cost and returns has been worked out following farm management cost concepts like Cost A₁, Cost A₂, Cost B₁, Cost B₂, Cost C₁, Cost C₂ and Cost D. The definitions of these concepts has been explained below.

Cost A₁ = This cost approximated actual expenditure incurred in cash and kind and included the following cost items:

1. Value of hired human labour
2. Value of bullock labour
3. Value of seed/seedlings
4. Value of manure
5. Value of fertilizers
6. Value of plant protection chemicals
7. Machinery uses
8. Depreciation of farm equipment, taken as 10 percent of the total value.
9. Irrigation charges
10. Land revenue and other taxes
11. Interest paid on working capital or half of the growth period of the crop.

Cost A₂ = Cost A₁ + Rent paid for leased-in land

Cost B₁ = Cost A₁ + imputed interest on owned fixed capital (excluding land)

Cost B₂ = Cost A₂ + imputed rental value of owned land (less land revenue) + imputed interest on owned fixed capital (excluding land)

Cost C₁ = Cost B₁ + imputed value of family labour

Cost C₂ = Cost B₂ + imputed value of family labour

Cost D = Cost C₂ + 10 percent of cost C₂ (management charges)

Gross Income (GR) = (Main Product X Price per unit) + (By Product X Price)

Farm Business Income (FBI) The surplus obtained by deducting Cost A₁ from value of total output is known as Farm Business Income. This is the real measure of earnings of the farmer and his family for management of risk, labour, use of land and capital. Farm Income is the surplus earned over cost D, is another measure of earning of the farmer.

FBI = Gross Income - Cost A₁

Family Labour Income The surplus obtained by deducting Cost B₂ from value of total output is known as family labour Income. This is the real measure of earnings of the farmer and his family for management of risk, labour, use of land and capital. Farm Income is the surplus earned over cost D, is another measure of earning of the farmer.

$$FLI = \text{Gross Income} - \text{Cost } B_2$$

Farm Investment Income The farm investment income is the sum of net income, rental value of owned land and interest of fixed capital.

$$FII = \text{Net Income} + \text{Rental value of owned land} + \text{Interest of fixed capital}$$

Benefit Cost Ratio The benefit cost ratio (BCR) is calculated by dividing the proposed gross income cash by the proposed total cost D of the cash crops.

$$BCR = \text{Gross Income} / \text{Cost } D$$

$$\text{Break Even Point (BEP)} = \text{Fixed cost} / (\text{Price (Rs./Tonnes)} - \text{Variable cost per tonnes})$$

$$\text{Variable Cost Per Tonnes} = \text{Total variable cost} / \text{Total output}$$

$$\text{Contribution Margin} = \text{Price per tonnes of output} - \text{Variable cost per tonnes}$$

$$\text{Margin of Safety} = \text{Total output} - \text{BEP}$$

$$\text{Return Per Rupees (RPR)} = \text{Gross Income} / \text{Cost } C_2$$

1.1 Resource Use Efficiency of tomato Cultivation (Cobb-Douglas Production Function)

Cobb-Douglas type of production function is used to determine the efficiency of input on the output. The model is specified compressively in such way that it can specify adequately the production process of the cash crops. The Cobb-Douglas production function model in the stochastic form may be expressed as.⁷

$$Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} X_7^{b_7} X_8^{b_8}$$

Where,

Y = Output (Yield tons/ ha)

a = Intercepts / Constant

Variables

X₁ = Human Labour (Days/ha.)

X₂ = Hired Human Labour (Days/ha.)

X₃ = Labour/Tractor Cost (Day/ Hours/ha.)

X₄ = Seed (Kg/ha.)

X₅ = fertilizer (N.P.K. Kg/ha.)

X₆ = Manure (Quintals / ha.)

X₇ = Plant Protection (Kg/ ha.)

X₈ = No. of Irrigation (No/ha.)

b₁ to b₈ = coefficient

The above function was converted into the linear form through logarithmic transformation of all variables and is written as

$$\log Y = \log A + a_1 \log X_1 + a_2 \log X_2 + a_3 \log X_3 + a_4 \log X_4 + a_5 \log X_5 + a_6 \log X_6 + a_7 \log X_7$$

+ $a_8 \log X_8$

1.1.2 Resource use Efficiency of Cultivation of Tomato

The resource used for the efficiency of cultivation of tomato has been presented in Table 1.1. The intercept/ constant (a) has been worked out at 4.310 among all the sample size of holdings. The intercept/ constant (a) stands at 4.139, 3.621, 5.592 and 5.771 on the marginal, small, medium and large size of holdings respectively.

Table-1.1 shows that the coefficient of family labour (X_1) is observed 0.231 per cent among all the sample size of holdings. The coefficient of family labour account for 0.265 per cent, -0.102 per cent, 0.232 per cent and -0.312 per cent on the marginal, small, medium and large size of holdings. The coefficient of family labour has negative for small and large size of holdings and that is more significant in the 5 per cent level probability on the cultivation of tomato for marginal farmers. The expenditure on family labour is observed to have a negative impact on productivity of tomato. This indicates that 5 per cent increase in utilization of family labour results in a decrease of gross income by 0.102 per cent, and 0.312 per cent for small and large size of holdings respectively.

The coefficient of hired labour (X_2) is observed 0.444 per cent among all the sample size of holdings. The coefficient of hired labour displays -0.281 per cent, -0.111 per cent, 0.389 per cent and 0.182 per cent on the marginal, small, medium and large size of holdings. The coefficient of hired labour has negative for marginal and small size of holdings and that is more significant in the 5 per cent level of probability on the cultivation of tomato for medium farmers. The expenditure on hired labour is observed to have a negative impact on productivity of tomato. This indicates that 5 per cent increase in utilization of hired labour results in a decrease of gross income by 0.281 per cent and 0.111 per cent for marginal and small size of holdings respectively. The coefficient of bullock/ tractor labour (X_3) accounts for 0.605 per cent among all the size of holdings. The coefficient of bullock/ tractor labour is observed 0.292 per cent, 0.296 per cent, -0.286 per cent and 0.537 per cent on the marginal, small, medium and large size of holdings. The coefficient of bullock/ tractor labour has negative for medium farmers and that is non-significant in the 5 per cent level of probability on the cultivation of tomato crop. The expenditure on bullock/ tractor labour has been observed to have a negative impact on

Table-1.1

Resource Use Efficiency of Input on the Output of Tomato Cultivation

Variables	Size of Holdings				
	Marginal	Small	Medium	Large	All
a	4.139	3.621	5.592	5.771	4.310
X₁	0.265** (0.312)	-0.102 (0.185)	0.232 (0.308)	-0.312 (0.254)	0.231 (0.358)
X₂	-0.281 (0.244)	-0.111 (0.182)	0.389** (0.134)	0.182 (0.397)	0.444 (0.389)
X₃	0.292 (0.154)	0.296 (1.609)	-0.286 (1.175)	0.537 (0.434)	0.605 (0.708)
X₄	0.259 (0.141)	-0.068* (0.065)	0.334 (.036)	-0.056 (0.095)	-0.046 (0.022)
X₅	0.296** (0.176)	0.098** (0.093)	0.158** (0.176)	0.935* (0.689)	0.299* (0.179)
X₆	0.111 (0.184)	0.018 (0.089)	-0.020 (0.200)	-0.333 (0.799)	-0.162* (0.087)
X₇	-0.131 (0.177)	0.993 (1.099)	-0.112 (0.971)	0.586 (0.637)	-0.532* (0.564)
X₈	0.201* (0.069)	-0.070* (0.050)	0.269** (0.197)	-0.325** (0.317)	0.120* (.145)
Return to scale	1.012	1.054	0.964	1.214	0.959
R²	0.90	0.91	0.92	0.87	0.91

(i) Figure in parenthesis indicates the standard error estimation)

(ii) Where a = intercept/ constant, bi's=are regression co-efficient, X₁ is family labour in days, X₂ is hired labour in days, X₃ is Bullock and tractor cost in hrs, X₄ is seed in gram/ Kg./ quintal, X₅ is manure in quintal, X₆ is fertilizer (N.P.K. 12-32-16) in kg, X₇ is plant protection in gram/ kg., X₈ is irrigation facilities in hrs.

(iii) Return to scale is sum of regression co-efficient (bi)

(iv) R² is Coefficient of multiple determination

(v) * significant at 1 percent level of probability.

(v) ** significant at 5 percent level of probability.

productivity of tomato. This indicates that 5 per cent increase in utilization of bullock/ tractor labour results in a decrease of gross income by 0.286 per cent for medium farmers respectively.

The Table-1.1 shows that the coefficient of seed (X₄) is observed at -0.046 per cent among all the sample size of holdings. The coefficient of seed account for 0.259 per cent, -0.068 per cent, 0.334 per cent and -0.056 per cent on the marginal, small, medium and large size of holdings. The coefficient of seed has negative for small and large size of holdings and that is more significant in the 1 per cent level of probability on the cultivation of tomato crop for

small farmers. The expenditure on seed has been observed to a negative impact on productivity of tomato cultivation. This indicates that 5 per cent increase in utilization of seed results in a decrease of gross income by 0.068 per cent and 0.056 per cent for small and large size of holdings respectively.

The coefficient of manure (X_5) accounts for 0.299 per cent among all the size of holdings. The coefficient of manure stands at 0.296 per cent, 0.098 per cent, 0.158 per cent and 0.935 per cent on the marginal, small, medium and large size of holdings. The coefficient of manure has positive and that is more significant in the 5 per cent level on the cultivation of tomato. The expenditure on family labour is observed to bear a positive impact on productivity of tomato cultivation. This indicates that 5 per cent increase in utilization of manure results in a increase of gross income by 0.296 per cent, 0.098 per cent, 0.158 per cent and 0.935 per cent on the marginal, small, medium and large size of holdings respectively. The coefficient of fertilizer (X_6) accounts for -0.162 per cent among all the size of holdings. The coefficient of fertilizer is observed 0.111 per cent, 0.018 per cent, -0.020 per cent and -0.333 per cent on the marginal, small, medium and large size of holdings. The coefficient of fertilizer has negative for medium and large size of holdings and that is non-significant in the 5 per cent level of probability on the cultivation of tomato crop. The expenditure on fertilizer has been observed to have a negative impact on productivity of tomato crop. This indicates that 5 per cent increase in utilization of fertilizer results in a decrease of gross income by 0.020 and 0.333 per cent on the medium and large size of holdings respectively. Table-1.1 shows that the coefficient of plant protection (X_7) is observed -0.532 per cent among all the sample size of holdings. The coefficient of plant protection account for -0.131 per cent, 0.993 per cent, -0.112 per cent and 0.586 per cent on the marginal, small, medium and large size of holdings. The coefficient of plant protection has negative for marginal and medium size of holdings and that is non-significant in the 5 per cent level of probability on the cultivation of tomato crop. The expenditure on plant protection has been observed to have a negative impact on productivity of tomato cultivation. This indicates that 5 per cent increase in utilization of plant protection results in a decrease of gross income by 0.131 and 0.112 per cent on the marginal and medium size of holdings respectively.

The coefficient of irrigation facilities (X_8) accounts for 0.120 per cent among all the size of holdings. The coefficient of irrigation facilities is observed 0.201 per cent, -0.070 per cent, 0.269 per cent and -0.325 per cent on the marginal, small, medium and large size of holdings. The coefficient of irrigation facilities has negative for small and large size of holdings and that is more significant in the 1 and 5 per cent level of probability on the cultivation of tomato crop among all the size of holdings. The expenditure on irrigation facilities has been observed to have a negative impact on productivity of tomato cultivation. This indicates that 1 and 5 per cent increase in utilization of irrigation facilities results in a decrease of gross income by 0.070 and 0.325 per cent for small and large size of holdings respectively.

Table-1.1 shows that the return to scale has been worked out at 0.959 among all the sample size of holdings. The return to scale has been observed at 1.012, 1.054, 0.964 and 1.214 on the marginal, small, medium and large size of holdings. This indicates the increasing return to scale from the cultivation of tomato crop on the marginal, small and large size of holdings respectively. The input used in the parameter explains that the 0.91 per cent variation for

tomato crop as revealed by R^2 among all the sample size of holdings indicates that the Cobb-Douglas production function was best fitted to the dependent and independent variables. The value of R^2 has been deduced as 0.90 per cent, 0.91 per cent, 0.92 per cent and 0.87 per cent on the marginal, small, medium and large size of holdings respectively in the cultivation of tomato. This indicates that all the variables are considered and are best fitted to explain the R^2 values.

1.2 Cost of Tomato Cultivation

The cost of cultivation of tomato crop among all the sample size of holdings has been presented in the Table 1.2. It has been observed from the total cost of cultivation profile of the sample size of holdings that the per hectare cost of cultivation of tomato crop has been worked out Rs.41183 among all the sample size of holdings. The table reveals that cost per hectare on tomato has been worked out Rs.41982, Rs.41351, Rs.41287 and Rs.40578 on the marginal, small, medium and large size of holdings respectively. The Table-1.2 also, depicts that the cost per hectare has been decreased with increase in the size of holdings and decline in number of holdings mainly owing to intensive use of family labour, manure produced domestically, rental value of land and other inputs which have higher share in the cost of cultivation.

It has been found from the cost of cultivation profile that the family labour accounts for 9.27 per cent to the total cost on growing tomato crop per hectare among the sample size of holdings. The cost of this component is highest mainly because of intensive use of family labour. The table also shows that the cost of family labour accounts for 22.57, 12.14, 5.42 and 2.97 per cent on the medium, small, marginal and large size of holdings respectively. It is because of the fact that the medium, small and the large size of holdings have disguised unemployment in the farm sector which has also been intensively utilized. The average cost per hectare incurred on hired labour has been worked out 18.91 per cent cost among all the sample size of holdings. Whereas the proportion of hired labour has been found 24.38, 23.19, 16.40 and 6.16 per cent on the large, medium, small and marginal size of holdings in respectively due to their respective higher paying capacity as wages.

The cost of the bullock labour/ tractor accounts for 11.92 per cent on the cultivation of tomato crop per hectare among all the sample size of holdings. The share of bullock labour/ tractor has been worked out 12.03, 12.02, 11.82 and 11.73 per cent on the medium, large, small and marginal size of holdings respectively. The proportion cost of seed has been worked out 6.72 per cent among all the sample size of holdings. The Table-1.2 further, shows that the cost on seed has been worked out 6.83, 6.82, 6.81 and 6.61 per cent on the small, marginal, large and medium size of holdings. The Table-1.2 reveals that the cost of manure accounts for 9.13 per cent on the cultivation of tomato crop per hectare among all the sample size of holdings. The proportion of the cost of manure has been worked out 9.68, 9.15, 9.06 and 8.79 per cent per hectare on the marginal small, large and medium size of holdings. The cost of the fertilizer accounts for 1.51 per cent on the cultivation of tomato crop per hectare among all the sample size of holdings. The share of fertilizer has been worked out 1.52, 1.53, 1.52 and 1.44 per cent on the marginal, small, medium and large, size of holdings respectively. Similarly the cost of the plant protection material accounts for 6.76

per cent on the cultivation of tomato crop per hectare among all the sample size of holdings. The share of plant protection has been worked out 6.79, 6.77, 6.76 and 6.74 per cent on the marginal, medium, small and large, size of holdings.

The cost of irrigation charges and land revenue taxes per hectare has been worked out 8.01 and 0.01 per cent relating to irrigation charges among all the sample size of holdings. The similar proportion of cost of irrigation charges per hectare has been observed 8.16, 8.01, 7.98 and 7.95 per cent on the marginal, small, large and medium size of holdings and land revenue taxes per hectare has been observed 0.01 per cent on the all size of holdings. Regarding the cost of land revenue taxes per hectare which has been observed almost negligible of the study period. The interest on the working capital on an average accounts for 1.24 per cent cost per hectare among all the sample size of holdings. The interest cost has been worked out 1.36 per cent per hectare highest on the small, followed by 1.28, 1.35 and 0.95 per cent on the large medium, and marginal size of respectively. The higher cost of the interest on working capital has been observed because of higher rate of interest 9.00 per cent annually in 2017-18. The total variable cost of per hectare has been worked out 73.52 per cent among all the sample size of holdings. The similar proportion of total variable cost of per hectare has been observed 74.44, 74.01, 73.53 and 72.69 per cent per cent on the marginal, small, medium and large, size of holdings.

Table-1.2

Per Hectare Cost of Cultivation of Tomato Among the Sample Households (Value in Rs.)

Input Utilization Items	Size of Holdings				
	Marginal	Small	Medium	Large	All
Family Labour	9475 (22.57)	5022 (12.14)	2237 (5.42)	1207 (2.97)	3819 (9.27)
Hired Labour	2588 (6.16)	6783 (16.40)	9573 (23.19)	9892 (24.38)	7786 (18.91)
Bullock Labour/ Tractor	4925 (11.73)	4887 (11.82)	4967 (12.03)	4877 (12.02)	4909 (11.92)
Seeds/ Seeding	2863 (6.82)	2826 (6.83)	2730 (6.61)	2765 (6.81)	2790 (6.72)
Manure	4063 (9.68)	3783 (9.15)	3630 (8.79)	3676 (9.06)	3760 (9.13)
Fertilizers	663 (1.58)	634 (1.53)	626 (1.52)	585 (1.44)	620 (1.51)
Plant Protection Chemical (insecticides and pesticides)	2850 (6.79)	2796 (6.76)	2796 (6.77)	2734 (6.74)	2784 (6.76)
Irrigation Charges	3425 (8.16)	3313 (8.01)	3283 (7.95)	3239 (7.98)	3300 (8.01)
Interest on working Capital for half of the growth period of the crop @ 9 per cent	401 (0.95)	563 (1.36)	518 (1.25)	521 (1.28)	510 (1.24)
Total Variable Cost	31251 (74.44)	30606 (74.01)	30359 (73.53)	29495 (72.69)	30278 (73.52)
Depreciation of farm Equipment, farm Store and Machineries	1555 (3.70)	1680 (4.06)	1860 (4.51)	2070 (5.10)	1837 (4.46)
Land Revenue / Taxes	5 (0.01)	5 (0.01)	5 (0.01)	5 (0.01)	5 (0.01)

Rental value for owned land	5000 (11.91)	5000 (12.09)	5000 (12.11)	5000 (12.32)	5000 (12.14)
Interest on fixed capital	354 (0.84)	301 (0.73)	309 (0.75)	318 (0.78)	318 (0.77)
Total Fixed Cost	6914 (16.47)	6986 (16.90)	7174 (17.38)	7393 (18.22)	7161 (17.39)
Management cost	3817 (9.09)	3759 (9.09)	3753 (9.09)	3689 (9.09)	3744 (9.09)
Cost A₁	23336	27269	29987	30363	28301
Cost A ₂	23336	27269	29987	30363	28301
Cost B ₁	23690	27570	30296	30682	28619
Cost B₂	28690	32570	35296	35682	33620
Cost C ₁	33165	32591	32533	31889	32438
Cost C ₂	38165	37591	37533	36889	37439
Cost D	41982 (100.0)	41351 (100.0)	41287 (100.0)	40578 (100.0)	41183 (100.0)

Note: Figure in parenthesis shows the percentage to the average cost hectare

The table also reveals that the total variable cost per hectare has been decreased with increase in the size of holdings.

The cost of depreciation of farm equipment per hectare is concerned, it has been worked out 4.46 per cent cost per hectare among all the sample size of holdings. The cost of depreciation of farm equipment has highest 5.10 per cent on the large, followed by 4.51, 4.06 and 3.70 per cent on the medium, small and marginal size of holdings. The rental value of the owned land has been worked out 12.14 per cent cost per hectare among all the sample size of holdings. The rental value has been found 12.32, 12.11, 12.09 and 11.91 per cent on the large, medium, small and marginal size of holdings respectively mainly because of the sample size of holdings would only like to depart from their holdings at a higher cost.

The proportion of the cost of interest on fixed capital has been worked out 0.77 per cent per hectare among all the sample size of holdings. The cost of interest on fixed capital per hectare has been found 0.84, 0.78, 0.75 and 0.73 per cent on the marginal, large, medium and small size of holdings respectively. The total fixed cost of per hectare has been worked out 17.39 per cent among all the sample size of holdings. The similar proportion of total fixed cost of per hectare has been observed 18.22, 17.38, 16.90 and 16.47 per cent per cent on the large, medium, small and marginal size of holdings. The table also reveals that the total fixed cost per hectare has been increased with increase in the size of holdings.

The management cost per hectare accounts for 9.09 per cent cost per hectare among all the sample size of holdings as well as each size of holdings due to addition of 10 per cent of cost C₂ to cost D (total cost).

Table-1.3

Net Return from the Different costs among the Sample Household

Particular	Size of Holdings				
	Marginal	Small	Medium	Large	All
Gross Income	130625	127877	133100	139976	133816
Net Returns / Farm Business Income Over Cost A	107289	100609	103113	109612	105515
Net Returns Over Cost B ₁	106935	100308	102804	109294	105197
Net Returns / Family Labour Income Over Cost B ₂	101935	95308	97804	104294	103308
Net Returns Over Cost C ₁	97460	95286	100567	108087	101378
Net Returns Over Cost C ₂	92460	90286	95567	103087	96377
Net Returns/ Net Income Over Cost D	88644	86527	91813	99398	92633
Farm Investment Income	93998	91828	97122	104716	97952
Returns Per Rupee of Investment	3.42	3.40	3.55	3.79	3.57
Input- Output Ratio/ Benefit-Cost Ratio	3.11:1	3.17:1	3.22:1	3.45:1	3.25:1
Contribution of Margin	523	364	402	267	368
Break Even Point	1.65	1.67	1.69	1.70	1.68
Margin of Safety	22.06	21.58	22.51	23.75	22.65

1.3 Gross Income and Net-Return of Tomato Cultivation

The results of gross income of tomato crop among all the sample size of holdings has been presented in table. It has been found that the gross income at value of the total output Rs.133816 per hectare among all the sample size of holdings. The gross income from the tomato has been worked out Rs. 139976, Rs. 133100, Rs. 127877 and Rs. 130625 per hectare on the large, medium, small and marginal size of holdings respectively. The net returns/ farm business income at cost A deduced from the cultivation of tomato has been worked out Rs.105515 per hectare among all the sample size of holdings. The net return are varied from Rs.109612, Rs.107289, Rs. 103113 and Rs.100609 on the large, marginal, medium and small size of respectively. Similarly the net returns at cost B₁ of tomato has been deduced Rs.105197 per hectare among all the sample size of holdings whereas it has been worked out Rs.109294, Rs.106935, Rs. 102804 and Rs.100308 per hectare on the large, marginal, medium and small size of holdings. Under the cultivation of tomato the net returns/ family labour income at cost B₂ per hectare has been

deduced as Rs.103308 per hectare among all the sample size of holdings. The average net returns has been worked out Rs.104294, Rs.101935, Rs.97804 and Rs.95308 per hectare on the large, marginal, medium and small size of holdings respectively. The net returns on the cost C_1 , cultivation of tomato has been deduced Rs.101378 per hectare among all the sample households whereas, it has been worked out Rs.108087, Rs.100567, Rs.97460 and Rs.95286 per hectare on the large, medium, marginal and small size of holdings. The average net returns at cost C_2 from tomato has been worked out Rs.96377 per hectare among all the sample size of holdings. The net returns from tomato has been worked out Rs.103087, Rs.95567, Rs.92460 and Rs.90286 per hectare on the large, medium, marginal and small size of holdings. The net returns at cost D i.e. total cost among all the sample size of holdings has been presented in Table-1.3. It reveals from the table that the average net return on the cultivation of tomato after recovering all cost has been worked out Rs.92633 per hectare among all the sample size of holdings whereas, it has been worked out Rs.99398, Rs.91813, Rs.88644 and Rs. 86527 per hectare on the large, medium, marginal and small size of holdings.

It reveals from the table-1.3 that the farm investment income of cultivation of tomato has been worked out Rs. 97952 per hectare whereas, it has been found Rs.104716, Rs.97122, Rs.93998 and Rs.91828 per hectare on the large, medium, marginal and small size of holdings.

Returns per rupee of investment is one of the effective methods to measure the economic feasibility of any crop. The returns per rupee of investment the cash crop tomato growers among all the sample size of holdings has been presented in Table-1.3. The returns per rupee of investment of tomato has been found Rs. 3.57 per hectare among all the sample size of holdings whereas, it has been worked out Rs.3.79, Rs.3.55, Rs.3.42 and Rs. 3.40 per hectare on the large, medium, marginal and small size of holdings. The large farms were more efficient than medium, small and marginal farms mainly because of lower cost per unit of output. It reveals from the table that the benefit- cost ratio of cultivation of tomato has been worked out Rs. 3.25:1 per hectare whereas, it has been found Rs.3.45:1, Rs.3.22:1, Rs.3.17:1 and Rs.3.11:1 per hectare on the large, medium, marginal and small size of holdings. The contribution of margin on the cultivation of tomato has been worked out Rs.368 per hectare among all the sample size of holdings whereas, it has been worked out Rs.523, Rs.402, Rs.364 and Rs. 267 per hectare on the marginal, medium, small and large size of holdings.

The breakeven point of tomato has been found 1.62 tones production per hectare among all the sample size of holdings whereas, it has been worked out 1.70, 1.69, 1.67 and 1.65 tones production per hectare on the large, medium, marginal and small size of holdings. The large farms were more efficient than medium, small and marginal farms mainly because of lower cost of production per hectare/ tones. The margin of safety of cultivation of tomato has been found 22.65 tones production per hectare among all the sample size of holdings whereas, it has been worked out 23.75, 22.51, 22.06 and 21.58 tones production per hectare on the large, medium, marginal and small size of holdings.

Conclusion

The study concluded that return per rupee (RPR) in tomato cultivation was Rs.3.57, benefit cost ratio (BCR) at Rs.3.25:1, contribution of margin (CM) at Rs. 368 breakeven point (BEP) at 1.68 tones/ ha. and margin of safety (MS) at 22.68 tones/ ha respectively which was highest to large farm category in both the cash crops and indicated that large farms are more efficient and have more economies of scale (net-returns) due to better management practices, sound financial position and efficient use of resources. The average net return on the cultivation of tomato after recovering all cost has been worked out Rs.92633 per hectare among all the sample size of holdings whereas, it has been worked out Rs.99398, Rs.91813, Rs.88644 and Rs. 86527 per hectare on the large, medium, marginal and small size of holdings. The return to scale has been worked out at 0.959 among all the sample size of holdings. The return to scale has been observed at 1.012, 1.054, 0.964 and 1.214 on the marginal, small, medium and large size of holdings. This indicates the increasing return to scale from the cultivation of tomato crop on the marginal, small and large size of holdings respectively. The input used in the parameter explains that the 0.91 per cent variation for tomato crop as revealed by R^2 among all the sample size of holdings indicates that the Cobb-Douglas production function was best fitted to the dependent and independent variables.

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