IMPACT: International Journal of Research in Applied, Natural and Social Sciences (IMPACT: IJRANSS)
ISSN(P): 2347-4580; ISSN(E): 2321-8851
Vol. 4, Issue 11, Nov 2016, 37-42

PRODUCTION: A CASE STUDY OF TOMATO CROP IN VARANASI DISTRICT OF UTTAR PRADESH

G.P. MAURYA, SANTOSH KUMAR & K.K. SINGH

Department of Agricultural Economics, Institute of Agricultural Sciences, Varanasi, Uttar Pradesh, India

ABSTRACT

Tomato is one of the most important solanaceous vegetable crops grown throughout the world. In India tomato is the third largest vegetable next to only potato and brijnal. The study has been conducted using the primary data collected from the sample farmers of the selected areas of Araji Line block of Varanasi district to study the existing farm structure, cost of cultivation, profit measures and resource use efficiency of tomato in the agricultural year 2010-11. Cobb Douglas production function was used to assess the resource use efficiency of tomato in study area. On an average cost of cultivation of tomato per hectare was observed highest on marginal farms (`50316.71) followed by large farms (`47256.55), medium farms (`42155.74) and small farms (`42010.50).

KEYWORDS: Tomato, Farm Structure, Cost of Cultivation, Resource use Efficiency and MVP

INTRODUCTION

Tomato (Lycopersicon esculentum Mill.) is one of the most important vegetable crops grown throughout the world under field and greenhouse conditions (Kaloo, 1986). In India tomato is the third largest vegetable next to only potato and brijnal with the production of about 7.60 Mt (FAO, 2007), India ranks third in area and production after China and Japan. The major tomato growing countries are USA, Italy, Spain, Portugal and Turkey. The cultivated tomato was originated in the Peru –Ecuador-Bolivia is of the Andes (South America). The tomato is a warm season vegetable crop that is the sensitive to frost and is killed by freezing temperatures. Previously tomatoes were grown only in season-wise, but the picture has been changed since last 10-12 years. Now day's tomatoes are grown round the year.

Tomato is one of the mostly widely grown solanaceous vegetable crop which is grown worldwide under outdoor and indoor condition. It is cultivated for freshly fruits. Due to its nature of being short duration and high yield crop, it is becoming an important crop from economic point of view; therefore the area under its cultivation is increasing day by day. The area, production and productivity of tomato in India were 90.70 Mha, 18653 Mt and 20.56 t/ha during 2012 (GoI, 2013). Tomato is an important vegetable crop of the Uttar Pradesh (UP) and influences the economic condition of farmers of eastern UP. The area, production and productivity of tomato during 2010 were 6.40 Mha, 2520 Mt and 39.51 t/ha, respectively (Indian Horticulture Database 2011).

Tomato is considered as an important commercial and dietary vegetable crop. In terms of human health, tomato is a major component in daily diet in many countries, and constitutes an important source of minerals, vitamins and antioxidants (Grierson and Kader, 1986). It has high contents of vitamins A and C and is widely used in various dishes (AVRDC, 1996). Tomato is used for different food preparations such as soup, juice, ketchup, puree, paste and powder. It is known as productive as well as protective food. Tomato is short duration crop and it is fitted in different cropping system

of cereals, grain, pulse and oilseeds and gives higher yields hence is of high economic value. Keeping the above facts in view the present study has been undertaken in Varanasi district of Eastern Uttar Pradesh to study the existing farm structure, cost of cultivation, profit measures and resource use efficiency of tomato, in the study area.

METHODS AND MATERIAL

The study has been conducted using the primary data collected from the sample farmers of the selected areas in the year 2010-11. The one block namely Araji Line having highest area in tomato cultivation in Varanasi district of Uttar Pradesh was purposively selected for this study. A list of all villages falling under the selected block was prepared and arranged in descending order according to area under vegetable crops. Four top ranking vegetable growing villages were selected for the study. In order to select the sample farmers, separate list of farmers in each farm holding category *i.e.* marginal (<1 ha), small (1-2 ha), medium (2-3 ha) and large (3 ha and above) were prepared for all the four selected villages. Finally, 80 tomato growing farmers were selected randomly in proportion to the number of farmers each category in each village.

The data were analyzed by using statistical tools like percentage, simple mean and weighted mean. Cobb Douglas production function was used to assess the resource use efficiency of tomato in study area. The variables include in the production function were as follows:

$Y = aX_1^{b1}. X_2^{b2}.X_3^{b3}.X_4^{b4}. X_5^{b5}. e^u$

Where,

Y = per hector output (ha.)

A = Constant

X_1 = Total human labour (`//ha)

X_2 = Seed (Rs. /ha)

X_3 = Manure and fertilizer (`/ha)

X_4 = Irrigation charges (`/ /ha)

X_5 = Plant protection (` /ha)

e^u = Error term

The coefficient of multiple determinations (R^2) was estimated and tested for its significance using test. To examine the resource use efficiency, the marginal value products (MVPs) of all those inputs which were significant were worked out at their geometric mean level. The marginal value product of j^{th} input factor was measured by using the following formula:

$$MVPx_j = \frac{b_j \bar{y}}{X_j},$$

Where j =1, 2…., k)

Where,

MVP = Marginal value product of j^{th} input.

b_j = Production elasticity with respect to X_j

$\bar{y}$ = Geometric mean of the dependent variable Y

X_j = Geometric mean of the independent variable X

RESULTS AND DISCUSSIONS

Farm Structure

Table 1 shows that in the study area the average size of holding was found 0.49 ha, 1.12 ha, 1.97 ha, 2.58 ha and 1.03 ha on marginal, small, medium, large and overall average size of farms, respectively. It is clear from the table that out of total cultivated area of sample farms, 21.66 ha (26.37%), 20.15 ha (24.53%), 19.69 ha (23.97%), and 20.64 ha (25.13%) area fall under marginal, small, medium and large farms respectively.

Table 1: Average Land Holding of the Sample Farms under Different Size Groups (in ha)

Sr. No.	Size Group of Farms	No. of Farmers	Cultivated Land	Average Size of Holding
1	Marginal (Below 1 ha)	44	21.66 (26.37)	0.49
2	Small (1<2 ha)	18	20.15 (24.53)	1.12
3	Medium (1<3 ha)	10	19.69 (23.97)	1.97
4	Large (3 ha and above)	8	20.64 (25.13)	2.58
Total / Overall Average		**80**	**82.14 (100)**	**1.03**

Costs of Cultivation

The table 2 indicates per hectare cost on various input factors in tomato cultivation. It can be seen from the table that on an average, the cost of cultivation of tomato per hectare was highest on marginal farms (` 50316.71) followed by large farms (`47256.55), medium farms (` 42155.74) and small farms (` 42010.50). Higher cost on marginal farms was mainly due to heavy expenditure on human labour, bullock labour and irrigation charges.

Table 2: Cost of Cultivation of Tomato (`/ha)

Item	Size of Group				
	Marginal	Small	Medium	Large	Overall
Total Human Labour	25768.22 (51.21)	15488.17 (36.87)	15750.00 (37.36)	18981.47 (40.17)	21524.26 (45.68)
Family Labour	23143.99 (46.00)	11207.14 (26.68)	10000.00 (23.72)	12885.80 (27.27)	17789.38 (37.75)
Hired Labour	2624.83 (5.22)	4281.03 (10.19)	5750.00 (13.64)	6095.67 (12.90)	3735.21 (7.93)
Bullock Labour	1121.50 (2.23)	656.82 (1.56)	93.75 (0.22)	185.08 (0.39)	794.84 (1.69)
Tractor Labour	851.40 (1.69)	1169.87 (2.78)	1525.00 (3.62)	1481.47 (3.13)	1070.26 (2.27)
Seed cost	6472.39 (12.86)	4852.94 (11.55)	5106.25 (12.11)	4899.69 (10.37)	5779.98 (12.27)

Table 2: Cond.,

Manure & Fertilizer	5082.52	5906.75	4382.50	7773.58	5449.58

	(10.10)	(14.06)	(10.40)	(16.45)	(11.56)
Irrigation charge	1477.88 (2.94)	1064.05 (2.53)	1075.00 (2.55)	898.88 (1.90)	1276.51 (2.71)
Plant Protection	1244.78 (2.47)	3658.82 (8.71)	3590.62 (8.52)	5008.45 (10.60)	2457.54 (5.22)
Interest on Working capital	735.32 (1.46)	573.95 (1.37)	551.65 (1.31)	686.50 (1.45)	671.17 (1.42)
Rental Value of Owned Land	5000.00 (9.94)	5000.00 (11.90)	5000.00 (11.86)	5000.00 (10.58)	5000.00 (10.61)
Interest on owned fixed capital	2562.10 (24.18)	3639.13 (8.66)	5080.97 (12.05)	2341.33 (4.95)	3097.21 (6.57)
Grand Total	**50316.71 (100)**	**42010.50 (100)**	**42155.74 (100)**	**47256.45 (100)**	**47121.67 (100)**

(Figures in parentheses denote percentage form to the total)

The study further revealed that overall cost incurred on human labour was 45.68 per cent, followed by seed (12.27 per cent), manure & fertilizer (11.56 per cent), rental value of owned land (10.61 per cent), interest on owned fixed capital (6.57 per cent), plant protection (5.22 per cent), irrigation charge (2.27 per cent), tractor power (2.27 per cent), bullock labour (1.69 per cent) and interest on working capital (1.42 per cent).

Cost of Production

Table 3: Measures of Cost and Return of Tomato (□ /ha)

Items	Size Group of Farms				
	Marginal	Small	Medium	Large	Overall Average
Cost A1/A2	19610.62	22164.23	22074.77	27029.42	21235.08
Cost B1	22172.72	25803.36	27155.74	29370.75	24332.29
Cost B2	27172.72	30803.36	32155.74	34370.75	29332.29
Cost C1	45316.11	37010.50	37155.74	42256.55	42121.35
Cost C2	50316.11	42010.50	42155.74	27256.55	45121.35
Cost C3	55347.72	46211.55	46371.31	51982.20	51833.48
Gross income	113796.41	116911.76	111093.75	111111.11	113891.00
Net income	58448.69	70700.21	64722.44	59128.91	62057.52
Family labour income	86623.69	86108.40	78938.01	76740.36	84558.71
Farm business income	94185. 79	94747.53	89018.98	84081.69	92641.07
Farm investment income	66010.79	79339.34	74803.41	6647.24	64172.44
Cost of production (□/qt)	364.87	294.45	313.06	350.89	341.15
Input-output ratio					
On Cost “A1/A2” basis	1:5.80	1:5.27	1:5.03	1:4.11	1:5.42
On Cost “B2” basis	1:4.18	1:3.79	1:3.45	1:3.23	1:3.91
On Cost “C1” basis	1:2.51	1:3.15	1:2.98	1:2.63	1:2.72
On Cost “C2” basis	1:2.26	1:2.78	1:2.63	1:4.07	1:2.60
On Cost “C3” basis	1:2.05	1:2.52	1:2.39	1:2.13	1:2.21
Yield (qt/ha)	151.69	155.88	148.12	148.14	151.83

It is clear from the table 3 that an overall average, cost A1/ A2, cost B1, cost B2, cost C1, cost C2 and cost C3 were found □ 21235.08, □ 24332.29, □ 29332.29, □42121.35, □45121.35, and □ 51833.48, respectively. An overall average gross income, were worked out □ 1113891.00, it was estimated □ 113796.41, □ 116911.76, □ 111093.75 and □ 111111.11 on marginal, Small, medium and large farm, respectively. Overall average net return came to □ 62057.52, it was highest on small farms (□ 70700.21) followed by medium farms (□ 64722.44), large farms (□ 59128.91) and marginal farms (□58448.69). An overall average family labour income, farm business income and farm investment income

were worked out to be □ 84558.71, □ 92641.07 and □ 64172.44, respectively. Family labour income shows the inverse relationship with the increasing size of land holding. Farm business income was found highest on small farms □ 94747.53 followed by marginal farms (□ 94185.79), medium farms (□ 89018.98) and large farms (84081.69). Farm investment income was highest on small farms □ 79339.34 followed by medium (□ 74803.41) large (□ 66470.24) and marginal farms (□ 6010.79). The highest cost of production was observed in case of marginal farms *i.e.* □ 364.87 followed by large (□ 350.89), medium (□ 313.06 and small farms (□ 296.45), whereas the average cost of production of tomato crops was found □ 341.15/ha. An average of input-output ratio was found 1:5.42, 1:3.91, 1:2.72, and 1:2.21 on cost A_1/A_2, cost B_2, cost C_1, cost C_2 and C_3 basis, respectively. The input-output ratio on cost A_1/A_2, and cost B_2 basis was found higher on marginal farms as compared to small, medium and large farms. In case of small farms input-output ratio on cost C_2 and C_3 basis was found higher as compared to medium, large and marginal farms. On an overall average yield per hectare was found 151.83 quintal, same was observed to 151.69, 155.88, 148.12 and 148.14 quintals on marginal, small, medium and large farms, respectively. The yield per hectare was found higher on medium farms as compared to marginal, small and large farms.

Resource Use Efficiency and Marginal Value Productivity

It is evident from the table, that the coefficient of multiple determinations (R^2) on marginal, small, medium and large farmers was found 90.83, 92.26, 94.83 and 92.51 per cent, which indicates that all the variables viz. human labour, seed, manure &fertilizer, irrigation and plant protection jointly explained more than ninety per cent variation in dependent variable.

High value of R^2 was found in case of medium farms (94.83 per cent) which indicated that the included resources in the fitted functions explained higher proportion of the total variation in the yield. In case of marginal and small farms, the elasticity of production with respect to seed cost and irrigation charges were statistically significant at 1 per cent level, while in case of medium farms the elasticity of production with respect to seed cost and plant protection were statistically significant at 1 per cent level, whereas in case of large farms, all variables were non- significant. In case of marginal and small farms, the elasticity of production with respect to human labour and manure & fertilizer were statistically significant at 5 per cent level. In case of medium farms elasticity of production with respect to manure & fertilizer and irrigation charges was statistically significant at 5 per cent level.

Table 4: Resource Use Efficiency in Tomato on Different Size of Sample Farms

Size Group of Farms	Human Labour	Seed Cost	Manure and Fertilizer	Irrigation Charges	Plant Protection	Sum of Elasticities
	Production Elasticity					
Marginal (below 1ha)	0.3694* (0.1597)	0.3563** (0.0664)	0.0730* (0.0717)	0.1753** (0.0432)	0.0069 (0.0109)	0.9809
Small (1<2 ha)	0.1654* (0.0685)	0.4997** (0.1083)	0.0627* (0.0209)	0.1515** (0.0364)	0.0371 (0.0498)	0.9164
Medium (2<3 ha)	0.1793 (0.0661)	0.4137** (0.0480)	0.0673* (0.0232)	0.0740* (0.0178)	0.1487** (0.0288)	0.883
Large (3 ha & above)	0.4605 (0.1515	0.529 (0.3906)	0.0173 (0.0711)	0.1170 (0.0320)	0.2597 (0.0624)	0.9074

Table 4: Cond.,

Size Group	Marginal Value Productivity	R^2

Of Farms						
Marginal (below 1ha)	1.631	6.26	1.644	13.49	0.630	0.9083
Small (1<2 ha)	1.248	12.038	1.24	17.016	1.185	0.9226
Medium (2<3 ha)	1.264	9.00	1.706	7.647	4.6007	0.9483
Large (3 ha & above)	2.695	1.199	0.247	7.471	5.76	0.9251

(Figures in parentheses denoted standard error of respective variables) **
And *Significant at 1 per cent and at 5 per cent level of probability

It is evident from the table 4 that MVP of all included factors were greater than one for all the farms except plant protection measures and manures and fertilizers which was found less than one in marginal and large farms, respectively. It is concluded from the above fact that there is further scope of investment on all of these included factors to obtain optimum return. It reflects that simultaneous increase in investment of 1 per cent on included variable factor yields more than 1 per cent in additional output.

CONCLUSIONS

Tomato is one of the mostly widely grown solanaceous vegetable crop which is grown worldwide under outdoor and indoor condition. Present study has been undertaken in Varanasi district of Eastern Uttar Pradesh to study the existing farm structure, cost of cultivation, profit measures and resource use efficiency of tomato. The study indicated that the average size of holding was found 0.49 ha, 1.12 ha, 1.97 ha, 2.98 ha and 1.03 ha on marginal, small medium, large and overall average size of farms, respectively. There was observed direct relationship between different size group of farm and per farm value of farm assets and gross income reflects indirect relationship with the farm size. Return to scale in all farm size was found less than unity in marginal small, medium and large farm, indicated that the production of tomato was characterized by decreasing return to scale in case of all categories of farm. The marginal value product (MVP) to factor cost were found positive indicating that there is further scope for increasing in the investment to realize more return.

REFERENCES

1. AVRDC, 1996. Vegetable research networking in South Asia: Savernet Faze I final report; Asian Vegetable Research and Development Center (AVRDC), Shanhua, Tainan, Taiwan.741, ROC. -76.
2. FAO, 2007. Production Year Book, Food and Agriculture Organization, Rome, Italy.
3. Government of India, 2013. State of Indian Agriculture, Ministry of Agriculture, Department of Agriculture and Cooperation, Directorate of Economics and Statistics, New Delhi, India.
4. Government of India, 2011. National Horticulture Board, Ministry of Agriculture, Department of Agriculture and Cooperation, New Delhi, India.
5. Grierson, D. and Kader, A.A. 1986. Fruit ripening and quality. The tomato crop. Chapman and Hall, London. 240-280.
6. Kaloo, G. 1986. Tomato (Lycopersicon esculentum Mill.). Allied Publishers Pvt. Ltd., New Delhi. 203-220.