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Contract Farming in Tomato: An Economic Analysis

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I

INTRODUCTION

The globalisation of Indian agriculture in recent years has resulted in the need for the production of export-oriented quality products having competitive advantage. To fulfill the commitment of the World Trade Organisation (WTO), the recent dismantling of the system of quantitative restrictions (QRs) on imports by the Union Government has provoked new challenges to the Indian farmers to compete in the world market. The horticulture sector provides a sound platform for establishment of agro-processing industries to help enhance exports by allowing diversification and value addition of agricultural produce. The fruits and vegetable farming for processing is not only employment intensive, but also enhances the gross as well as net returns of the farmers. Tomato (*Lycopersicon esculentum* Mill.) is the world's largest vegetable crop after potato and sweet potato, but it tops the list of canned vegetables. It is most popular in India also because of its high nutritive value, higher production and wide ecological amplitude. As it has greater form utility, the scope for tomato in the processing industry is quite large. Since heavy arrivals in the peak season result in low price for perishable commodities like tomato leading to distress sales, processing through contract farming system gives a guarantee of minimum price to the producers who do not have to bear the price risk. It is also beneficial to the processing units because supply of raw material of desired quality or variety is assured at pre-determined price. Besides, the consumers get the processed agro-products throughout the year at reasonable prices.

With the WTO's demand for trade liberalisation and subsidy-cut to farmers, the Indian farmers especially small and marginal farmers are facing threats to their survival from every quarter. Contract farming could be one of the best solutions which may decrease the polarisation of rich and poor and thus encourage the Indian farmers to compete with the very large, rich and highly indirectly subsidised western farmers. Also, the contract farming system forms the most heartening part of the vision of the National Policy on Agriculture.

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As the contract farming system is a new concept in Indian agriculture, there was a need to assess the impact of corporate sector involvement through agro-processing industries. Keeping this in view, the present study was conducted with the following specific objectives: (a) to examine the cost, returns and resource use efficiency of contract vis-à-vis non-contract farming; (b) to examine the effect of contract farming on price, production and income of the farmers; (c) to analyse the yield and price uncertainty involved in tomato production, marketing costs and losses incurred by the farmers; and (d) to study the various problems faced by the contract farmers and the processing firms.

Based on the importance of the study and the objectives framed to be achieved, the following hypotheses were formulated:

1. Contract farming will be helpful to the farmers in getting higher per hectare net income and increasing resource use efficiency through scale economy and availability of package technology at the doorstep.
2. It will minimise price risk through forward linkages of marketing and processing.
3. The major gains of value addition are likely to be unequally shared between the farmers and the processing firms.
4. Large farmers are likely to benefit more as processing firms would like to have contract with such farmers.
5. The contract farmers are also open to exploitation and harassment by the firms due to their weaker bargaining position.

II

DATA AND METHODOLOGY

The study is based on primary data. For collection of primary data, Ellenabad block of Sirsa district in Haryana was selected purposively as it was the only block in the state in which contract farming of tomato was in operation since 1989. The respondent farmers were selected from six villages out of twelve villages wherein contract farming was in operation, using two-stage random sampling technique.

There were two processing firms, namely, The Hindustan Lever Ltd. (HLL) and The Nijjer Agro Foods Ltd. (NAL), operating in contract farming for tomato. In total, about 75 and 50 farmers were in contract with HLL and NAL respectively in Sirsa district during 1999-2000. A total number of 50 contract farmers, viz., 30 and 20 farmers were selected from HLL and NAL respectively according to probability proportional to size. A matching number of non-contract farmers was also selected randomly from these selected villages, thus making a total sample size of 100 farmers. The data needed for the study were collected from the sample farmers by personal interview method using pre-tested questionnaire. Officials of both the processing firms, viz., HLL and NAL were also contacted to gather required information.

Tabular analysis was adopted to analyse the costs and returns, to determine the resource structure, to analyse the marketing channels, price received, marketing costs and losses, and to study the various problems faced by the farmers. The analysis was done for three categories of small, medium and large for contract and non-contract farmers each. The categorisation of farmers was made based on cumulative frequency method. Accordingly, the farmers were categorised as small (upto 2.50 ha), medium (2.50 to 7 ha) and large (above 7 ha).

Based on the rational significance of the results, the following Cobb-Douglas production function model was chosen as the best fit over linear form to study the efficiency of each variable input in tomato production:

$$Y = a\, X_1^{b_1} \cdot X_2^{b_2} \cdot X_3^{b_3} \cdot X_4^{b_4} \cdot X_5^{b_5} \cdot U$$

where Y = production of tomato (quintals per hectare),
a = intercept,
X_1 = human labour (man-days),
X_2 = machine labour (tractor hours),
X_3 = fertilisers (Rs. per hectare),
X_4 = plant protection expenditure (Rs. per hectare),
X_5 = irrigation expenses (Rs. per hectare),
U = error term,
B_i = (i = 1 to 5) are the regression coefficients of factor inputs.

The resource use efficiency could be judged based on the marginal value productivity (MVP), which indicates the increase in the gross return from the use of an additional unit of a given input while keeping the level of other inputs constant. The marginal value product (MVP) of the i-th input factor was measured by using the following formula:

$$MVP = b_i \left(\frac{\overline{Y}}{\overline{X}_i} \right) P_y$$

where $\overline{Y}$ = average yield of tomato per hectare at geometric mean level of all inputs.
$\overline{X}_i$ = geometric mean level of i-th resource,
b_i = production elasticity of i-th input,
P_y = price of the product.

Resource use efficiency was studied by comparing the MVPs of each resource with corresponding factor costs at which each resource could be procured.

The yield uncertainty ratios (YUR) and price uncertainty ratios (PUR) were calculated as follows:

$$\text{Yield uncertainty ratio (YUR)} = \frac{\text{Average highest probable expected yield} - \text{Average lowest probable expected yield}}{\text{Average most probable expected yield}}$$

$$\text{Price uncertainty ratio (PUR)} = \frac{\text{Average highest probable expected price} - \text{Average lowest probable expected price}}{\text{Average most probable expected price}}$$

III

RESULTS AND DISCUSSION

Mode of Operation of Contract Farming in the Study Area

The processing firms selected the contract farmers based on the locality of the farm, size of holding, field history, economic condition of the farmer, possession of tractor, source of irrigation, his willingness to cultivate at least in 5 acres of land and his level of commitment to the contract. To get the maximum yield of tomato crop, hybrid seedlings were given to the contract farmers by the concerned processing firm. Both the firms charged a sum of Rs. 1,800 per acre as seedling cost from the contract farmers in the year 1999-2000. A set of farm implements consisting of bed makers, fertiliser applicators, spray pumps, chiseller, etc., were also given free of cost to a group of farmers having a contract of 50-60 acres of tomato crop by both the firms. The improved technology of cultivation is being channelised to the farmers with the extension support in the form of regular field visits by the technical staff (field executives) of their respective firms.

The processing firms fixed the procurement price of tomato by working out the cost of cultivation and a minimum profit at average yield. The profitability was compared with its competitive crops also. The contract farmers in the study area had to transport their produce to their respective processing firms. The Hindustan Lever Ltd. (HLL) located at Zahura in Hoshiarpur district and The Nijjer Agro Foods Ltd. (NAL) located at Maharbanpura near Amritsar in Punjab State, are about 350 km far away from the study area. The payment was made to their respective accounts in the State Bank of India within 10-15 days of procurement.

As per the categorywise distribution of the sample farmers, among contract farmers, about 16, 30 and 54 per cent and among non-contract farmers, about 52, 28 and 20 per cent belonged to small, medium and large categories respectively. Thus it can be concluded that the processing firms favoured contract with large farmers.

Economics of Tomato Production

The costs and returns from tomato production are presented in Table 1. The total variable cost constitutes the costs of human labour, bullock labour, machine power, seed, farmyard manure, chemical fertilisers, plant protection chemicals, irrigation, and interest on working capital. The total cultivation cost was slightly higher in the case of contract farmers compared to that of non-contract ones, which was due to higher costs of variable inputs. The rental value of land was calculated at the rate of Rs. 6,000 per hectare and the irrigation cost was deducted from this amount as it was borne by the landowners.

TABLE 1. COSTS AND RETURNS FROM THE CULTIVATION OF TOMATO ON SAMPLE FARMS

(Rs. per ha)

Sr. No.	Particulars	Contract farmers				Non-contract farmers			
		Small	Medium	Large	Overall	Small	Medium	Large	Overall
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1.	Total variable cost*	25,018.64 (37.89)	24,987.65 (37.86)	24,831.79 (36.12)	24,946.01 (37.27)	17,879.40 (57.13)	18,307.28 (57.04)	18,283.88 (56.99)	18,103.49 (56.93)
2.	Risk and management charges**	5,003.72 (7.57)	4,997.52 (7.57)	4,966.32 (7.22)	4,989.20 (7.45)	3,575.88 (11.42)	3,661.44 (11.40)	3,656.76 (11.40)	3,620.68 (11.38)
3.	Rental value of land	4,567.70 (6.91)	4,645.30 (7.04)	4,850.60 (7.05)	4,687.87 (7.00)	4,987.96 (15.94)	5,080.36 (15.83)	5,048.00 (15.74)	5,079.97 (15.97)
4.	Total cultivation cost	34,590.06 (52.38)	34,630.47 (52.48)	34,648.73 (50.40)	34,623.08 (51.74)	26,442.24 (84.49)	27,049.08 (84.28)	26,988.64 (84.13)	26,804.14 (84.29)
5.	Transportation charges	31,436.98 (47.61)	31,356.48 (47.51)	34,092.48 (49.59)	32,295.31 (48.26)	4,853.84 (15.51)	5,042.67 (15.71)	5,092.25 (15.87)	4,996.25 (15.71)
6.	Total cost	66,027.04 (100)	65,986.95 (100)	68,741.21 (100)	66,918.39 (100)	31,297.08 (100)	32,091.75 (100)	32,080.89 (100)	31,800.39 (100)
7.	Production (qtl)	580.21	577.33	617.31	591.61	271.92	274.64	284.50	277.02
8.	Gross return	1,09,079.48	1,08,538.04	1,16,054.28	1,11,222.68	54,685.83	63,991.12	57,753.50	58,830.73
9.	Return over variable cost	84,060.84	83,550.39	91,222.49	86,276.67	36,806.43	45,683.84	39,469.62	40,727.24
10.	Net return	43,052.44	42,551.09	47,313.07	44,304.29	23,388.75	31,899.37	25,676.61	27,030.34
11.	Benefit-cost ratio (over variable cost)	4.36	4.34	4.67	4.45	3.05	3.49	3.15	3.25
12.	Benefit-cost ratio (over total cultivation cost)	3.15	3.13	3.35	3.21	2.06	2.36	2.13	2.19
13.	Benefit-cost ratio (over total cost)	1.65	1.64	1.68	1.66	1.74	1.99	1.80	1.85
14.	Cost of production (Rs./qtl) (excluding transportation charges)	59.61	59.98	56.13	58.52	97.24	98.48	94.86	96.75
15.	Cost of production (Rs./qtl) (including transportation charges)	113.79	114.29	111.35	113.11	115.09	116.85	112.76	114.79

Note: Figures in parentheses indicate percentage to the total cost.

*Total variable cost comprises human labour, bullock labour, machine power, seed, manuring, fertilisers, plant protection chemicals, irrigation and interest on working capital (12 per cent). Per hectare overall average cost on these items was found to be Rs. 6,061.68, 4,500.40; 0.00, 181.14; 1,091.45, 546.00; 4,500.00, 2,360.31; 143.50, 0.00; 3,467.26, 2,703.96; 6,957.96, 5,866.93; 1,312.13, 920.03 and 1,412.03, 1024,72 on contract and non-contract farmers respectively in that order.

**Risk and management charges have been calculated at the rate of 10 per cent each of the total variable cost.

It was distressing to note that the contract farmers incurred very high transportation charges (about 48 per cent of their total cost). The charges were Rs. 5,500 per truckload, which was uniform for all the farmers. The produce loaded in one truck varied from 90 to 100 quintals. Hence, the total cost in the case of contract farmers was almost double that of the non-contract farmers.

The per hectare yield and gross returns under contract farming were also double that of non-contract farmers. The net returns were also very high in the case of contract farmers compared to that of non-contract farmers, which was due to difference in their yields. Similar profits from cultivation of tomato were also reported by Khemnar *et al.* (1994), Haque (2000) and Singh (2000). Though the per rupee returns over variable cost and over total cultivation costs were much higher in the case of contract farmers, the returns over total cost were slightly lesser than those of the non-contract farmers which may be attributed to exorbitant transportation charges. However, the cost of production including transportation charges was almost the same among all the categories of the sample farmers. Thus it can be concluded that contract farming for tomato was highly profitable for the farmers.

Resource Use Efficiency in Tomato Production

The ordinary least squares (OLS) estimates of the Cobb-Douglas production function for different size-groups, the standard error of the estimates, coefficient of multiple determination (R^2) and the sum of coefficients of independent variables (Σb_i) are presented in Table 2. The small category of contract and the large category of non-contract farmers were omitted from statistical analysis, as their sample size was very small. The variable machine power was dropped from the production funct-

TABLE 2. ESTIMATED PRODUCTION FUNCTION FOR TOMATO ON SAMPLE FARMS

Particulars	Contract farmers			Non-contract farmers		
	Medium	Large	Overall	Small	Medium	Overall
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	4.7214	2.1833	2.4024	0.3223	-0.3031	-0.6162
Human labour	0.8726**	0.3216	0.0481	-0.7488*	0.2357	0.3704
(man-days/ha) (X_1)	(0.3678)	(0.2852)	(0.1868)	(0.3202)	(0.2032)	(0.2345)
Machine power	-	-	-0.0004	-0.0033	0.0363	0.0153
(tractor hrs/ha) (X_2)			(0.0215)	(0.0220)	(0.0239)	(0.0227)
Fertiliser expenses	0.0917	0.3389**	0.4428**	0.6948**	0.5336**	0.1102**
(Rs./ha) (X_3)	(0.2001)	(0.1577)	(0.1049)	(0.1228)	(0.0634)	(0.0427)
Plant protection expenditure	-1.1755**	-0.7510**	-0.5770**	0.1224	0.0816	0.2897*
(Rs./ha) (X_4)	(0.2862)	(0.2265)	(0.1601)	(0.2614)	(0.1666)	(0.1503)
Irrigation expenses	0.1611	0.5314**	0.2975**	0.2301*	0.0453	0.2983**
(Rs./ha) (X_5)	(0.1645)	(0.1469)	(0.0757)	(0.1207)	(0.1355)	(0.1176)
R^2	0.7634	0.5489	0.6278	0.7855	0.9620	0.5745
Σb_i	-0.0501	0.4409	0.2109	-0.2952	0.9325	1.0839

Note: Figures in parentheses indicate standard errors of estimates.
** and * Significant at 5 and 10 per cent level respectively.

ion analysis of medium and large farmers as it showed higher degree of multi-collinearity with other explanatory variables. The coefficients of plant protection chemicals in the case of contract farmers were negative and significant at 5 per cent level indicating excessive use of these inputs. Similarly, the coefficients of fertiliser expenses in the case of all the categories of non-contract farmers were positive and significant indicating lesser use of the same. The R^2 values indicated that the independent variables included in the production function explained about 54 to 96 per cent of the variations in the production of tomato among different categories of sample farms. The returns to scale ($\sum b_i$) did not depict a uniform pattern with the size of land holdings. It was more than unity in the case of overall category of non-contract farmers indicating increasing returns to scale. On the other hand, it was less than unity in all other categories of both contract and non-contract farmers indicating diminishing returns to scale. Similar results were also reported by Raghuvanshi *et al.* (1999).

The resource use efficiency was assessed by computing the ratio of marginal value product (MVP) and factor cost (opportunity cost) (MFC) and the results are presented in Table 3. It is evident from the table that the ratio of MVP to MFC in the

TABLE 3. THE MARGINAL VALUE PRODUCT (MVP) AND MARGINAL FACTOR COST (MFC) OF IMPORTANT INPUTS IN TOMATO CULTIVATION ON SAMPLE FARMS

	Contract farmer			Non-contract farmer		
Particulars	Medium	Large	Overall	Small	Medium	Overall
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Human labour						
MVP (Rs.)	225.66**	84.72	12.53	-196.09**	71.44	102.44
MFC (Rs.)	60.00	60.00	60.00	60.00	60.00	60.00
MVP:MFC	3.76	1.41	0.21	-3.26	1.19	1.70
Machine power						
MVP (Rs.)	-	-	-0.28	-3.15	35.39	14.59
MFC (Rs.)			150.00	150.00	150.00	150.00
MVP:MFC			-0.001	-0.02	0.23	0.09
Fertiliser						
MVP (Rs.)	13.53	49.98**	65.09**	99.60**	88.11**	16.62**
MFC (Rs.)	1.00	1.00	1.00	1.00	1.00	1.00
MVP:MFC	13.53	49.98	65.09	99.60	88.11	16.62
Plant protection expenditure						
MVP (Rs.)	-157.97*	-103.27**	-85.92**	15.88	12.32	39.82**
MFC (Rs.)	1.00	1.00	1.00	1.00	1.00	1.00
MVP:MFC	-157.97	-103.27	-85.92	15.88	12.32	39.82
Irrigation						
MVP (Rs.)	26.74	91.17**	54.96**	38.21*	8.69	52.23**
MFC (Rs.)	1.00	1.00	1.00	1.00	1.00	1.00
MVP:MFC	26.74	91.17	54.96	38.21	8.69	52.23

Note: ** and * Significant at 5 and 10 per cent level respectively.

case of human labour for medium holding size contract farmers was negative and significant indicating its excessive use. Except in the case of medium-sized contract farmers, the MVP to MFC ratios of fertiliser for all other categories of sample farms were positive and significant indicating considerable scope for increased use of this input. A similar trend was observed in irrigation also. However, the ratios of plant protection expenditure in all the categories of contract farmers were negative and significant suggesting the need to curtail their excessive use.

Uncertainty in Tomato Production

Uncertainty refers to future events where the parameters of probability distribution cannot be determined empirically or quantitatively. Though it is very difficult to measure the uncertainty with any acceptable degree of accuracy, an attempt has been made to estimate the yield and price uncertainty ratios. The yield uncertainty ratios of tomato for different farm size-groups are presented in Table 4. It is evident from the table that the yield uncertainty was lower in the case of HLL contract farmers (0.46) than that of their NAL counterparts (0.51). In the case of non-contract farmers, it was as high as 0.82, 0.79 and 0.75 respectively for small, medium and large farmers. Thus the contract farmers had less yield uncertainty than that of non-contract farmers, which may be due to improved quality seedlings supplied and a steady guidance by the field executives of the processing firms.

TABLE 4. YIELD UNCERTAINTY RATIOS OF TOMATO

Holding size-group	Average expected yield (qtl/ha)			Uncertainty ratio
	Highest probable yield	Most probable yield	Lowest probable yield	
(1)	(2)	(3)	(4)	(5)
HLL-contract farmers	738.28	601.64	456.78	0.46
	(6.24)	(9.71)	(10.23)	
NAL-contract farmers	621.74	518.69	356.43	0.51
	(13.64)	(8.34)	(14.28)	
Contract farmers				
Small	637.33	565.41	362.68	0.48
	(8.74)	(6.78)	(13.36)	
Medium	669.26	579.43	393.12	0.47
	(10.65)	(11.28)	(12.63)	
Large	727.45	609.42	458.32	0.44
	(12.74)	(18.28)	(3.26)	
Overall	678.01	584.73	404.70	0.46
Non-contract farmers				
Small	291.14	228.72	102.15	0.82
	(16.22)	(22.38)	(19.26)	
Medium	304.23	230.31	120.30	0.79
	(10.36)	(13.43)	(13.78)	
Large	328.68	245.78	143.46	0.75
	(6.63)	(9.48)	(8.97)	
Overall	308.01	234.93	121.97	0.79

Note: Figures in parentheses indicate coefficients of variation.

The price uncertainty ratios of tomato for different farm size-groups are worked out in Table 5. In the case of contract farmers the price uncertainty ratio was nil because of fixed procurement price paid by their respective processing firms. Even if the farmers desire for higher prices, they do not have any option to sell in the open market as they are bound by the contract. Similarly, both the processing firms give the assured price, which was fixed before the planting season as they were also bound by the contract with their farmers. In the case of non-contract farmers, the price uncertainty ratios were as high as 0.93, 0.91, 0.89 and 0.91 for small, medium, large and overall size-groups respectively. Chandel (1994), Dixit *et al.* (1999, p. 59; 2000, p. 7) have also made similar observations.

TABLE 5. PRICE UNCERTAINTY RATIOS OF TOMATO

Holding size-group	Average expected price (Rs./qtl)			Uncertainty ratio
	Highest probable price	Most probable price	Lowest probable price	
(1)	(2)	(3)	(4)	(5)
HLL-contract farmers	188.00	188.00	188.00	0.00
NAL-contract farmers	188.00	188.00	188.00	0.00
Non-contract farmers				
Small	482.82	276.28	224.43	0.93
	(27.34)	(18.25)	(11.27)	
Medium	446.78	256.13	212.64	0.91
	(12.14)	(6.38)	(5.34)	
Large	419.70	243.21	201.78	0.89
	(5.89)	(8.73)	(13.47)	
Overall	449.76	258.54	212.95	0.91

Note: Figures in parentheses indicate coefficients of variation.

Marketing Aspects of Tomato

The marketing aspects include analysis of marketing channels, price received, costs and losses incurred by the farmer. The marketing channels found operating in the study area were as follows.

Channel-I - Producer ⟶ Contractors /Processing firms.

Channel-II - Producer ⟶ Commission agent ⟶ Retailer ⟶ Consumer-cum-wholesaler.

Channel-III - Producer ⟶ Retailer ⟶ Consumer.

Channel-IV - Producer ⟶ Consumer.

In channel-I, the producer is the contract farmer who directly sold the produce to their respective processing firms. The processing firms make tomato paste which in turn used to make sauce, ketchup, etc. The HLL sells its products under the brand name "Kissan" which are packed at Bangalore unit in Karnataka. The NAL supplies

the tomato paste to The Nestle India Ltd. which sells its products under the brand name "Maggi".

The sale of tomato through the other three channels by non-contract farmers is reported in Table 6. The table indicates that a majority of small farmers preferably sold their produce directly to retailers, followed by wholesalers and consumers. But the farmers preferred to sell their produce directly to the wholesalers, followed by retailers and consumers. On the other hand, all the large farmers sold their major part of produce directly to the wholesalers and about 40 per cent of them sold directly to the retailers but none of them sold directly to the consumers. Similar results were also reported by Subrahmanyam (1982), Raikar (1990), Nagaraj and Chandrakanth (1992) and Sarkar *et al.* (1992).

TABLE 6. SALE OF TOMATO THROUGH DIFFERENT AGENCIES BY NON-CONTRACT FARMERS

Holding size-group	Tomato sale through different agencies									Overall average price received (Rs./qtl)
	Producer-wholesaler			Producer-retailer			Producer-consumer			
	Average quantity (qtl)	Per cent	Average price received (Rs./qtl)	Average quantity (qtl)	Per cent	Average price received (Rs./qtl)	Average quantity (qtl)	Per cent	Average price received (Rs./qtl)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Small	158.50 (16)	58.28 (61.53)	170.75	68.74 (19)	25.28 (73.07)	194.25	44.68 (11)	16.44 (42.30)	238.33	201.11
Medium	182.50 (11)	66.45 (78.57)	190.34	73.25 (6)	26.67 (42.85)	205.58	18.89 (3)	6.88 (21.42)	298.08	233.00
Large	227.64 (10)	80.02 (100)	191.26	56.86 (4)	19.98 (40.00)	214.74	-	-	-	203.00
Overall	189.54 (37)	65.90 (74.00)	185.78	66.28 (29)	23.05 (58.00)	204.85	31.78 (14)	11.05 (28.00)	268.20	219.61

Note: Figures in parentheses indicate frequency of the farmers and their percentages.

The contract farmers belonging to both the processing firms received a procurement price of Rs.188 per quintal. The table further reveals that the price received was the highest where the produce was directly sold to the consumers, followed by retailers and wholesalers. Also the overall market price of Rs. 219/qtl was much higher than the contract price of Rs. 188/qtl. It can also be concluded that the larger the marketing channel adopted, the lower is the price received by the producers.

The marketing costs incurred by the sample farmers are presented in Table 7. It may be noted from the table that the contract farmers of both the processing firms had to bear very high transportation charges of Rs. 55/qtl which were about three times that of the non-contract farmers, though their loading and weighing charges were very less. Such high transportation charges were on account of location of these processing firms at a very distant place. The non-contract farmers had to bear grading, packing in *tokris*, unloading, commission and other charges. The total marketing

cost was the highest in the case of large farmers, followed by medium and small farmers which may be due to the sale of produce to distant places by large farmers.

TABLE 7. MARKETING COSTS INCURRED BY THE SAMPLE FARMERS

(Rs./qtl)

Sr. No.	Particulars	Contract farmers*		Non-contract farmers			
		HLL	NAL	Small	Medium	Large	Overall
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Grading and packing in *tokri*	-	-	10.00	11.00	14.00	11.66
2.	Loading	1.00	1.00	1.00	1.00	1.00	1.00
3.	Weighing charges	0.20	0.20	-	-	-	-
4.	Transportation charges	55.00	55.00	17.85	18.36	17.89	18.03
5.	Unloading	-	-	1.00	1.00	1.00	1.00
6.	Commission and other charges	-	-	2.00	3.00	3.00	2.66
	Total	56.20	56.20	31.85	34.36	36.89	34.36

Note: * The marketing costs in the case of contract farmers were the same irrespective of the size of holdings.

Table 8 illustrates the average marketing losses incurred by the sample farmers. The transportation losses incurred by the contract farmers are very high as the bulk loading of the ripened produce leads to heavy juice leakage over a long distance. The NAL contract farmers faced a compulsory cut in weight on their produce for which they had borne an additional product loss of about 28 qtl/ha. In the case of non-contract farmers, large farmers incurred more storage loss, followed by medium and small farmers as they transported to distant places.

TABLE 8. AVERAGE MARKETING LOSSES INCURRED BY THE SAMPLE FARMERS

(qtl/ha)

Sr. No.	Particulars	Contract farmers		Non-contract farmers			
		HLL	NAL	Small	Medium	Large	Overall
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Transportation losses	12.54 (13.84)	11.12 (7.38)	3.50 (10.24)	5.00 (4.40)	8.35 (12.32)	5.61
2.	Cut in weight	-	27.84 (21.15)	-	-	-	-
3.	Storage and other losses	-	-	4.74 (7.22)	6.38 (11.11)	12.76 (5.24)	7.96
4.	Total loss of the produce	12.54	38.96	8.24	11.28	21.11	13.57
5.	Value of the produce (Rs.)	2,357.52	7,324.48	1,657.14	2,651.54	4,285.33	2,864.67

Note: Figures in parentheses indicate coefficients of variation.

Problems faced by Tomato Growers

The study of the problems faced by the farmers on various aspects of production and marketing of tomato revealed that around 80 per cent of the growers in general

opined that there was high infestation of tomato crop by fruit borer (*Helicoverpa armigera*). The majority of the non-contract farmers felt that they lacked knowledge about improved technologies of tomato production. It is further revealed that all the NAL farmers faced a compulsory cut in the weight on their produce. Some of the contract farmers also faced the problem of rejection of their produce. All the contract farmers and about 92 per cent of the non-contract farmers reported that their transportation cost was very high. Delay in payments was encountered by 35 per cent of the NAL contract farmers. Also they sought payment through nearby banks rather than from distant ones. As far as the satisfaction on contract prices is concerned, all the contract farmers reported that the contract price for tomato was low. Lack of credit facilities and inadequate number of processing firms were also greatly felt by a majority of the farmers. Singh (1995), Moravaridi (1995), Chahal *et al.* (1997), Rangi and Sidhu (1999), Haque (2000) and Singh (2000) have also reported similar problems.

It was found from the study that the major problem faced occasionally by both the processing firms was breach of the contract by the farmers selling their tomato in the open market when the prices were very high during lean season. This discouraged the very nature of contract farming system.

IV

CONCLUSIONS AND POLICY IMPLICATIONS

Based on the foregoing discussion of the results of this study, the following conclusions could be drawn. The holding size of the sample contract farmers indicated that processing firms favoured large farmers while selecting for contract. The cost incurred, yield and gross return obtained by the contract farmers were almost double that of the non-contract farmers. Among various categories of farmers, large contract farmers obtained higher net returns, followed by small and medium ones. The functional analysis revealed that there existed a substantial scope to increase the production of tomato through making judicious use of critical inputs particularly fertiliser, irrigation and plant protection chemicals. The contract farming system for tomato considerably reduced the yield uncertainty and completely removed the price uncertainty among its farmers, whereas it was very high in the case of non-contract farmers. The average price received by the non-contract farmers was much higher than the contract price for tomato. The price received by directly selling to the consumers was the highest, followed by retailers and wholesalers in the case of non-contract farmers. Transportation charges formed the major component of marketing cost, which was severely felt by the farmers. Also cut in weight, rejection of the produce, lower contract price, lack of adequate number of processing units were found to be the major constraints in the marketing of tomato.

Keeping in mind the interests of the producers as well as processing firms at the same time, the following measures are suggested to improve the overall production and marketing activities of tomato industry.

It may be made legally obligatory on the part of the contract farmers and the processing firms to strictly adhere to the contract by bringing suitable legislative measures by the government. The critical inputs such as fertiliser and irrigation are under-used, whereas the contract farmers make excessive use of plant protection chemicals. Hence the farmers may be educated to make judicious use of inputs. Further in order to minimise the use of plant protection chemicals which add to production cost and also cause environmental problems, the farmers may be educated to adopt integrated pest management practices which are economical as well as environmental friendly. On an average, the total variable cost in the case of contract and non-contract farmers amounted to about 25,000 and Rs. 18,000 per hectare respectively. Therefore, the processing firms, primary agricultural credit societies and other funding agencies should be persuaded to provide adequate short-term credit facilities to cover the higher cost of variable inputs. The contract farmers irrespective of farm size incurred very high transportation charges, constituting 48 per cent of the total cost on an overall basis. To make contract farming more lucrative, the processing firms may procure the produce at the farmgate or arrange for trucks of their own by charging a reasonable amount from the farmers for transportation of tomato. For a more equitous sharing of benefits, the processing firms may spend part of their profits for the development of infrastructure in the production region, which will indirectly benefit the farming community as a whole. As the tomato crop is very risky, a Crop Insurance Scheme may be introduced to compensate the farmers, even when there is very high occurrence of pest and diseases apart from adverse climatic conditions with a reasonable premium.

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