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Comparative Analysis of Contract and Non-contract Farming Model in Tomato Production

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Abstract: A comparative analysis is made of the contract and non-contract farming models of tomato production conducted in Biga District of Çanakkale Province is reported. Aspects of input use level, gross-margin and net profit in tomato-growing farms. Farms operating by the contract farming model utilize more input per unit area, technological innovations and obtain greater yields of tomatoes per unit area. The gross margin of contract-farming model farms is 13% while net profit is 19% higher when compared to non-contract model farms. A statistically significant difference was found between the two types of farming models with respect to the number of seedlings, usage of fertilizer, labour wages and amount of production.

Key words: Tomato, unit crop cost, contract farming, gross margin, net profit

INTRODUCTION

The impact of globalization started at the end of the Second World War when farms found different opportunities to sell their crops both on domestic and international markets. One of the most important problems faced in agricultural production was the uncertainty in marketing.

In recent years an increasing awareness by consumers to food security in nutrition has caused a demand for greater quality and safe crops. One of the conditions of safe and quality production is a regular provision of safe and quality raw materials needed by the industrial firms. Contract marketing is getting greater attention in supermarkets particularly.

The dominance of small family farms in Turkish agriculture has resulted in various risks and uncertainties at the marketing stage. The contract farming model implemented the removal of risk and uncertainties especially for small family farms which are unorganized and which individually having no marketing power^[1]. The number of scientific studies related to an analysis of contract farming has been increasing to follow this transition to this type of farming^[1-7].

An important advantage of the contract farming model is the purchasing guarantee for the crop^[8]. Moreover in this model, credit, technical assistance and input provision needed by farmers is made easier and the

utilization of improved production technologies for farmers is made available^[9].

Turkey ranks third in world tomato production behind China and India, with a share of 5.64%. The total tomato production is 8425000 tons in Turkey and the share of Çanakkale province is 4.35% of the total production.

The aims of current study are to make a comparison between non-contract and contract farming tomato growers by calculating unit production cost and to describe positive and negative aspects of the contract farming model to see if there is a difference between non-contract and contract farming tomato farms for various characteristics such as number of seedlings, fertilizer and chemical values, hours of labour manpower, hours of machinery, irrigation fees and amount of production.

MATERIALS AND METHODS

The data was collected from tomato growing farms by non-contract and contract farming models through interviews. The data of study covers the 2001-2002 production period.

The sample size was calculated using the simple coincidence sampling method^[10]. The sample size was calculated to be 57 farms for the contract farming model and 45 for the non-contract model. Average physical and financial values related to the production represent weight averages.

The manpower employed on farms was determined according to gerund and worked period. In the research area soil preparation, planting, irrigation, irrigation plus fertilization, fertilization, chemical spraying and tomato loading and emptying were generally performed by men and planting, hoeing and harvesting were generally performed by women. For the calculation of labour cost, wages paid for foreign workers were taken as the basis of the region. Alternative wages were calculated based on foreign labour wages for family labour. In the calculation of machinery cost, current unit land cultivation fees in the region were taken as the basis where farmers own the machinery they use.

The sprinkler irrigation method was widely used in the research area. Though irrigation tools and equipment were the property of the farms, depreciation and interest costs were included in the cost calculation. The economic life of irrigation tools and equipment was considered and the straight line method was used to calculate the depreciation; the economic life of irrigation equipment and tools was 5% for engine-driven pumps, 10% for electrical-driven pumps and 20% for irrigation pipes^[11].

In the calculation of interest of irrigation tools and equipment capital, the real interest rate was considered to be 5%. The average value of tools and equipment would be equal to half of their costs during the economical life period, so half of their value was considered in interest calculations^[12].

Half of credit interest rate of the Agricultural Bank of Turkey for crop production during 2001-2002 production season was used in the interest calculation of the revolving fund. It was assumed that variable costs were distributed within the production period, so interest calculation was done from their half values according to 50% interest rate. The general administration cost was taken as 3% of the production cost. Simple cost production method was used in the calculation of unit tomato cost^[13].

The profitability level of the production activity per unit area was proposed as the determinant of success in tomato production activity. To assess this goal, the gross margin and net profit of tomato production activity per unit area were calculated^[13].

Variation analysis technique was used most often to determine statistical significance by the ANOVA F test between two or more independent group averages^[14-16]. The null hypothesis was that there was no difference between the contract farming and non-contract farming models in tomato producing farms which was tested in this study.

RESULTS

The average farm size was found to be 17.38 and 15.40 ha in farms using the contract and non-contract model, respectively. The farm size of the contract farming model farms consisted of 36.35% of farmers owning their land, 57.68% of renting their land and 5.97% of land farmed on a share-cropping basis. These respective figures were 38.53, 50.11 and 11.36% for non-contract model farms (Table 1).

It was found that 956.50 h of labour manpower and 20.80 h of machinery power was used per hectare of tomato production. Tomato seedlings were purchased from factories by pre-arrange contracts and also provided fertilizers and agro-chemicals needs from the factories. In addition, factories provided \$73.30 for hoeing and \$91.70-122.20 for harvesting per hectare as labour wages to the farmers. The fees for inputs and labour wages paid for hoeing and harvesting were deducted from farmers after delivery of crop to the factories.

The cost of one kilo of tomato was calculated to be \$0.02. While selling price of one kilo of tomato, was \$0.03 and it was factored in, a profit of \$0.01 per kilo in tomato. The percentage of profit to selling price per unit crop was thus 33.30%.

The data of the research area showed no difference between the contract farming and non-contract models in machinery and equipment used in production activities (Table 2). Farms operating by the non-contract farming model made use of 1119.20 h of labour and 23.70 h of machinery power per hectare of tomato production. The cost of one kilogram of tomato was calculated to be \$0.03. When the average selling price of one kilogram tomato, which is \$0.04, was factored the profit per kilo was \$0.01 in tomato production. The percentage of profit to the selling price was found to be 25%.

Of the total production costs, the share of variable and fixed costs is found to be 81.17 and 18.83%, respectively on the farms operating with contract farming model. Among the variable costs, labor has the highest share with 32.31%, then material costs with 28.29%, revolving fund interest with 21.57%, machinery cost 14.43% and other variable cost with 3.4%. Rent of land has the highest share in the fixed costs with 66.93% and depreciation of irrigation tools and machinery with 15.25%, general administrative costs with 12.93% and interest on irrigation tools and machinery capital follows it, respectively.

The share of variable and fixed cost to the total production cost is 82.18 and 17.82%, respectively on the

Table 1: Physical production inputs and unit costs per hectare of tomato production by contract farming model

Production activities	Process date	Labour and machinery use				Material used			Total cost (\$)	
		Labour		Machinery		Equipment	Kind	Quantity (kg and unit)		Value (\$)
		Hour	Value (\$)	Hour	Value (\$)					
Soil preparation										
First ploughing	Oct.-Nov.	3.30		3.30	49.50	Plow				49.50
Second ploughing	March-April	2.40		2.40	41.90	Plow				41.90
Third ploughing	April	2.30		2.30	0.20	Cultivator				0.20
Fertilizing manually	April	9.80	6.70			By hand				6.70
Fourth ploughing	April-May	2.60		2.60	40.10					40.10
Furrowing	April-May	3.40		3.40	34.40	Cultivator+plow				34.40
Irrigation	April-May	17.00	10.90							10.90
Planting	April-May	66.10	30.00			By hand	Seedling	19 290 unit	269.50	299.60
Cultural practices										
Irrigation+Fertilizing	May-July	41.70	28.10			By hand	Fertilizer	112.60	140.70	
Hoeing	May-June	155.20	66.30			Drawn hoe				66.30
Fertilizing	May-June	0.90	3.30	0.70	16.40	Fert. distributor				19.70
Spraying with back sprayer	May-June	12.20	11.30			Knapsack sprayer				11.30
Spraying with machine	May-June	1.40		1.40	19.40	Trac. driven sprayer	Chemicals	41.00	60.40	
Irrigation	June-Aug.	112.50	76.20							76.20
Treshing										
Harvest	Agust-Nov.	508.20	238.20			By hand				238.20
Transport to market	Agust-Nov.	17.50	12.00	4.70	13.90	Trailer				25.90
Variable cost of irrigation										
Equipment and tools							Dies. oil/elec. fee		50.80	50.80
Interest on revolving fund										322.50
Total variable costs										1495.20
Management costs (A×%3)										44.90
Rent of land										232.20
Depreciation on irrigation										
Equipment										52.90
Interest on irrigation										
Equipment										16.90
Total fixed costs										346.90
Total production cost										1842.20
Tomato production (kg ha ⁻¹)										76160
Total costs (\$ kg ⁻¹)										0.02

non-contract farming model. Labor cost appeared the highest contributor to the variable costs with 35.38%; then followed the Material costs, revolving fund interest and machinery costs with their respective share of 23.86, 21.57 and 15.98%. The total production costs is 2.74% higher on the farms operating under the non-contract model compared to the contract model. Because of more technical support provision in contract farming model was higher than in non-contract farming model. The difference between two models was found less from the aspect of fix costs (Table 3).

In tomato production the ratio of gross margin to the gross production value was found to be 39.35% on contract farms and 35.61% on non-contract farms. The amount of net profit per manpower utilized per hectare in tomato production was calculated to be \$6.50 for contract farming and \$4.70 for non-contract farming. The ratio of net profit to gross production value was calculated to be 25.28 and 21.65% for the respective farming models (Table 4).

The variation Analysis Technique was used to test if there was a difference between contract farming and non-contract farming in tomato production. The values of the means and standard deviations related to the number of seedlings, fertilizer values, farm chemical values, male labour hours, machinery hours, irrigation fees and production amounts for contract farming and non-contract farming in tomato production were given in Table 5.

The difference between contract and non-contract model farms with respect to the number of seedlings used was very significant at the $p < 0.01$ level and the fees paid for fertilizer was significant and the $p < 0.05$ level. Difference was insignificant between the two types of farms with respect to machinery hours used by farms ($p = 0.77$) and fees paid for irrigation ($p = 0.42$) and chemicals ($p = 0.94$) (Table 5).

For contract model farms the number of seedling used ($X = 17\ 132$ unit) and fees paid for fertilizer ($X = \$196.10$) were higher and the labour hours used per

Table 2: Physical production inputs and unit costs per hectare of tomato production by non-contract farming model

Production activities	Process date	Labour and machinery use				Material used			Total cost (\$)	
		Labour		Machinery		Equipment	Kind	Quantity (kg and unit)		Value (\$)
		Hour	Value (\$)	Hour	Value (\$)					
Soil preparation										
First ploughing	Oct.-Nov.	3.70		3.70	48.60	Plow			48.60	
Second ploughing	March-April	2.90		2.90	42.30	Plow			42.30	
Third ploughing	April-May	2.40		2.40	33.10	Cultivator			33.10	
Fertilizing manually	April-May	8.00	5.80			By hand			5.80	
Fourth ploughing	April-May	2.60		2.60	32.30				32.30	
Furrowing	April-May	4.10		4.10	41.60	Cultivator+plow			41.60	
Irrigation	April-May	18.70	12.20			By hand			12.20	
Planting	April-May	68.90	29.20			By hand	Seedling	14 560 unit	223.70	
Cultural practices										
Irrigation+Fertilizing	May-July	41.60	26.00			By hand	Fertilizer		104.60	
Hoeing	May-June	90.90	39.40						39.40	
Fertilizing	May-June	0.90	1.60	0.60	12.10	Fer. distributor			13.70	
Spraying with back sprayer	May-June	15.10	11.50			Knapsack spray			11.50	
Spraying with machine	May-June	2.00		2.00	15.80	Tractor driven spray	Chemicals		42.90	
Hoeing	July	93.30	40.30			Drawn hoe			40.30	
Irrigation	July-Aug.	112.50	76.20			By hand			76.20	
Threshing										
Harvest	Aug.-Oct.	616.90	283.70			By hand			283.70	
Transport to market	Aug.-Oct.	34.70	24.50	5.40	22.70	Trailer			47.20	
Variable cost of irrigation										
Equipment and tools							Diesel oil/electri. fee		49.90	
Interest on revolving fund									335.50	
Total variable costs									1555.50	
Management costs (Ax%)									46.70	
Rent of land									198.20	
Depreciation on irrigation										
Equipment									68.50	
Interest on irrigation										
Equipment									23.80	
Total fixed costs									337.20	
Total production cost									1892.70	
Tomato production (kg ha ⁻¹)									63240	
Total costs (\$ kg ⁻¹)									0.03	

Table 3: Production costs and distribution per unit area on both types of tomato growing farms

Cost elements	Contract farming			Non-contract farming		
	Value (\$ ha ⁻¹)	(%) of all costs	(%) within cost group	Value (\$ ha ⁻¹)	(%) of all costs	(%) within cost group
Total variable costs	1495.20	81.17	100.00	1555.50	82.18	100.00
-Labour cost	483.00	26.22	32.31	550.40	29.08	35.38
-Machinery cost	215.80	11.71	14.43	248.50	13.13	15.98
-Material cost	423.10	22.97	28.29	371.20	19.61	23.86
-Other variable cost	50.80	2.76	3.40	49.90	2.64	3.21
Interest of revolving fund	322.50	17.51	21.57	335.50	17.72	21.57
Total fixed costs	346.90	18.83	100.00	337.20	17.82	100.00
-Management costs	44.90	2.44	12.93	46.70	2.47	13.84
-Rent of land	232.20	12.60	66.93	198.20	10.47	58.79
-Depreciation on irrigation equipment and tools	52.90	2.87	15.25	68.50	3.62	20.32
-Interest on irrigation equipment and tools	16.90	0.93	4.89	23.80	1.26	7.05
Total production costs	1842.20	100.00		1892.70	100.00	

Table 4: Gross margin and net profit per unit area on contract farming and non-contract model farms

Cost and income elements	Contract farming value (\$ ha ⁻¹)	Non-contract farming value (\$ ha ⁻¹)
Gross production value	2465.40	2415.60
Variable costs	1495.20	1555.50
Production costs	1842.20	1892.70
Gross margin	970.20	860.10
Net profit	623.20	522.90

hectare found lower than for non-contact model farms. This result was very striking when labour, one of the most important production factors, was considered. On the other hand tomato-growing farms operating with the contract farming model produced 7, 340 kg ha⁻¹ of tomatoes compared to non-contract model farms, a production value that was successful by comparison. In

Table 5: Descriptive statistics of variables taken for contract farming and non-contract model farms in tomato production

Variables	Groups	$\bar{x} \pm S_x$
Seedling (unit ha ⁻¹)	Contract farming	17.13±79.5 ^{**}
	Non-contract farming	14.63±50.5 ^b
Fertilizer cost input (\$ ha ⁻¹)	Contract farming	196.10±1.06 ^{a*}
	Non-contract farming	168.50±0.70 ^b
Chemicals cost input (\$ ha ⁻¹)	Contract farming	69.70±0.67
	Non-contract farming	69.00±0.79
Manpower hours (hour ha ⁻¹)	Contract farming	957.80±3.78 ^{**}
	Non-contract farming	1097.60±4.16 ^b
Machinery hour (hour ha ⁻¹)	Contract farming	23.90±0.18
	Non-contract farming	24.70±0.16
Irrigation fee (\$ ha ⁻¹)	Contract farming	94.10±0.89
	Non-contract farming	109.30±1.79
Production (ton ha ⁻¹)	Contract farming	69.47±0.22 ^{a*}
	Non-contract farming	62.13±0.22 ^b

* p<0.05 ** p<0.01, Difference between group averages are significant shown with different letter for same variable

spite of the greater utilization of seedlings and larger payments for fertilizers, farms operating with the contract farming model produced more tomatoes compared to the other group through more efficient use of technology and of labour.

DISCUSSION

The following differences were observed between farms operating with the contract and non-contract farming models:

- The average farm size of the contract farming model farms was greater than for non-contract model farms and tomato production was typically done on land owned by the farmer.
- Although there was no significant difference between the two types of farming models with respect to production procedures and utilization of machinery and tools, the contract farming model utilize more technological innovations, were more efficient with their use of labour, use more inputs per unit area (seedling, fertilizer, chemical) and produce more crop per unit area.
- Unit crop cost was lower for contract farming model farms.
- The contract farming model farms earned 13% more in gross margin and 19% more in the net profit.
- There was a statistically significant difference between the two types of tomato farming in terms of the number of seedlings, fertilizer fees, labour wages and amount of production. Similar findings were also reported in studies which examined other aspects of contract farming, such as the level of physical input used and unit crop cost, as well as gross margin and net profit earned per unit area^[5,7,15,17-19].

In contract farming model has some advantages such as price and marketing guarantees for their crops, receiving material and cash support and getting technical information support, also had some disadvantages. For instance, crop prices were fixed and there was a late payment of crop prices although a high inflation rate prevailed in the country. Contracts were also written so as to provide the least loss to factories and greater losses to farms. Another disadvantage was that crops were often bought from non-contract farming model farms rather than contract farms with the area of this research study.

These disadvantages of the contract farming model can be minimized or eliminated by improvements in the model with consideration given to following:

- Contracts should be prepared by direct (face-to-face) negotiations between farmers and factories, with farmers organizations established to assist farmers in the negotiating process.
- Instead of contracts which fix product price, there should be a transition towards determining prices at the time of crop delivery, which would factor in changes to input prices.
- In order to prevent losses to the farmer originating from late payment for crops a program should be introduced for delayed interest payments.
- Steps to curb or discourage the practice of farms operating on a non-contract basis might be useful.

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