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Tomatoes - cont
2 prod.

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ECONOMICS OF PRODUCTION AND MARKETING OF
TOMATO AND PROCESSED PRODUCTS

BY

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THESSALONIKI, GREECE 1975

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ECONOMICS OF PRODUCTION AND MARKETING OF TOMATO AND PROCESSED PRODUCTS

G.KITSOPANIDIS*, J.KARPAZIS** and E.PAPANAGIOTOU**

I N T R O D U C T I O N***

Tomato growing for processing, covering about 1.0% of the total cultivated area (3.5 million hectares) and the 16% of the corresponding area used for vegetable crops, is an important farm enterprise of our agriculture.

The importance of tomatoes is based not only on the area covered, but also on the establishing in various regions factories for tomato processing, on the one hand for covering home needs and on the other for exports. Indeed, the progressively increased needs in tomato processed products (paste, juice, powder etc.) on home and international level have contributed to the great expansion of tomato growing in various regions in Greece.

Tomatoes for processing are connected with certain problems referring on the one hand to the establishment and operation of tomato processing factories and on the other to the possibilities or not for exporting tomato processed products. More specifically these problems refer to the economics of tomato growing as a raw material for producing tomato processed products, to the competitiveness of this crop in comparison to other crops of each region and to the economic operation of the factories producing tomato processed products compared with corresponding factories in other regions in this country and in other countries.

In other words, the problems of tomato growing for processing refer a) to the production costs of tomatoes as a raw material taking into account the period of transplanting or seeding and consequently of picking of the product connected with the annual operation of the factories, and b) to the amount of the profits and farm income achieved compared with those of the competitive crops.

These problems in relation to the lack of an economic study about the tomato growing for processing there were the basic reasons for undertaking a special investigation in the regions of Serrai and Drama by the Department of Agricultural Economics Research. The selection of these regions was based on the one hand to

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their representativeness for growing tomatoes for processing, and on the other hand to the help provided by the committee of Management of the Cooperative Tomato Processing Factories of Northern Greece for choosing tomato growers.

The methodology used and the analyzed physical and economic data, of a great number of tomato enterprises (256 growers for keeping complete record and account data and 2,351 growers for keeping only yield and size according to period of transplanting or seeding) for a four year period (1971-74), indicate that the results achieved and the conclusions drawn can be applied not only in these regions, but also in any other region in Greece.

In this paper the text is omitted and only tables are given. This was done on the one hand, because the money available in the Department is very limited, and on the other, because all tables and charts are simple and almost self-explanatory.

PRODUCTION AND MARKETING OF TOMATO AND
PROCESSED PRODUCTS

The investigation undertaken refers to the study, by using records and accounts, 256 tomato growing farms of the regions of Serrai and Drama for the year 1973. Additionally, data of tomato yield and size according to period of transplanting or seeding were received by Cooperative Tomato Processing Factories of Northern Greece of 2,351 tomato growers for the four year period 1971-74 (table 1).

T a b l e 1
Number of tomato growing farms according to period of transplanting or seeding and yield

Periods of transplanting or seeding	Classes of yield Tons/hect.	Average yield tons/hect.	Number of farms studied
I. Region of Serrai			
A		47.51	728
A ₁	Up to 50.00	33.58	367
A ₂	50.01-70.00	59.37	216
A ₃	70.01-over	84.27	145
B		44.92	485
B ₁	Up to 40.00	26.66	214
B ₂	40.01-60.00	50.27	161
B ₃	60.01-over	74.58	110
C		36.62	107
D		23.72	60
Total			1380
II. Region of Drama			
A		37.89	611
A ₁	Up to 30.00	21.93	213
A ₂	30.01-50.00	40.07	275
A ₃	50.01-over	61.00	123
B		33.28	437
B ₁	Up to 30.00	20.18	204
B ₂	30.01-50.00	37.21	165
B ₃	50.01-over	60.37	68
C		23.70	80
D		19.68	99
Total			1227
Total			2607

By analysing the collected physical and economic data they were taken into account the following:

a) the region, because they were noted large differences between these two regions, referring on the one hand to the soil and climatic conditions and on the other to the competitive crops,

b) the period of transplanting or seeding, because the yields and the production costs of tomato growing are affected by the period of transplanting or seeding,

c) the range of each class of tomato yield of the various periods of transplanting or seeding, because this range depends on the variation of the yield achieved and on the number of tomato growers included in each period of transplanting

or seeding.

The physical and economic data required by the tomato growing they were received by the sample of 256 farms, while the average yield on the one hand of each period of transplanting or seeding and on the other of each class of yield they were based on the data of 2,351 farms. Taking into account that varies greatly from farm to farm, while the conditions of production are about the same, it can be said that the yield received from a larger number of farms gives a greater value to the financial results achieved.

Estimating production costs of tomato growing for all periods of transplanting or seeding it was taken the whole rent of land, except of fourth period of transplanting or seeding, in which, part of the whole rent of land it was taken for estimating production costs of tomato growing. This happens because the same land is used by two crops in one year. In this case the corresponding land rent to each crop is estimated by taking into account the contribution of each crop to the total output achieved by both crops.

Also, the labour wages they were not considered to be the same for all farm operations, but on the contrary this estimation was based on the kind of work performed and on the period in which the labour is offered. Finally, the costs of certain farm operations of each period of transplanting or seeding, analyzed according to yield, they are considered to be equal, because in actual practice there are not reasons to be unequal.

PRODUCTION FACTORS

A. Land

Table 2
Number of farms according to period of transplanting or seeding and area cultivated.

Classes of Land region (hectares)	<i>Periods of transplanting or seeding</i>							
	Region of Serrai				Region of Drama			
	Period A	Period B	Period C	Period D	Period A	Period B	Period C	Period D
Up to - 0.50	404	330	87	46	203	164	45	65
0.51 - 1.00	296	136	20	14	282	213	33	33
1.01 - over	28	19	-	-	126	60	2	1

B. Labour

Table 3
Labour required in man equivalent hours according to period of transplanting or seeding and yield

Regions	<i>Periods of transplanting or seeding</i>							
	Period A			Period B			Period	Period
	A ₁	A ₂	A ₃	B ₁	B ₂	B ₃	C	D
I. Serrai	1400	1908	2370	1343	1679	2205	1280	1241
II. Drama	921	1255	1653	913	1147	1557	982	920

Table 4

Monthly labour fluctuations in man equivalent hours according to period of transplanting or seeding and yield

Months	Periods of transplanting or seeding							
	Period A			Period B			Period C	Period D
	A ₁	A ₂	A ₃	B ₁	B ₂	B ₃		
I. Region of Serrai								
November-March	71	71	71	22	22	22	9	-
April	162	162	162	119	119	119	19	-
May	268	268	268	330	330	330	174	10
June	145	145	145	200	200	200	214	142
July	207	207	207	88	88	88	163	363
August	381	629	963	179	309	510	41	235
September	163	375	471	351	510	786	355	236
October	3	51	83	54	101	150	305	255
Year	1,400	1,908	2,370	1,343	1,679	2,205	1,280	1,241
II. Region of Drama								
November-March	49	49	49	25	25	25	20	1
April	107	107	107	55	55	55	25	1
May	248	248	248	210	210	210	230	15
June	96	96	96	150	150	150	140	183
July	88	88	88	66	66	66	65	194
August	206	393	527	717	145	305	106	108
September	107	247	488	248	385	604	327	276
October	20	27	50	82	111	142	69	142
Year	921	1,255	1,653	913	1,147	1,557	982	920

Table 5

Participation of each farm operation in the total labour required in man equivalent hours according to period of transplanting or seeding and yield

Farm operations	Periods of transplanting or seeding							
	Period A			Period B			Period C	Period D
	A ₁	A ₂	A ₃	B ₁	B ₂	B ₃		
I. Region of Serrai								
Seedbeds	91	91	91	41	41	41	27	43
Soil cultivations	22	22	22	21	21	21	28	12
Fertilizing	9	9	9	13	13	13	15	5
Transplanting or seed.	223	223	223	263	263	263	172	254
Inter-row cultivations	290	290	290	355	355	355	291	345
Irrigation	70	70	70	73	73	73	61	72
Spraying	39	39	39	28	28	28	21	33
Picking	586	1,032	1,486	503	811	1,299	613	413
Transportation	70	132	140	46	74	112	52	64
Total	1,400	1,908	2,370	1,343	1,679	2,205	1,280	1,241
II. Region of Drama								
Seedbeds	82	82	82	76	76	76	80	26
Soil cultivations	19	19	19	19	19	19	19	14
Fertilizing	9	9	9	10	10	10	10	16
Transplanting or seed.	154	154	154	152	152	152	152	152
Inter-row cultivations	205	205	205	188	188	188	200	235
Irrigation	49	49	49	61	61	61	50	50
Spraying	26	26	26	24	24	24	24	23
Picking	323	640	986	351	558	911	400	350
Transportation	54	71	123	32	59	116	47	54
Total	921	1,255	1,653	913	1,147	1,557	982	920

Table 6

Capital needed for tomato growing according to period of transplanting or seeding and yield

Capital needed per year (\$/hectare)	Periods of transplanting or seeding							
	Period A			Period B			Period C	Period D
	A ₁	A ₂	A ₃	B ₁	B ₂	B ₃		
I. Region of Serrai								
1. Machinery services	376.67	392.33	397.67	227.67	288.33	352.00	283.67	216.67
2. Seeds, fert. pest.	108.67	108.67	108.67	88.33	88.33	88.33	92.00	45.67
3. Depr., interest etc.	36.67	46.67	60.67	33.33	43.00	52.00	37.67	26.00
4. Taxes for irrigation	17.33	17.33	17.33	17.00	17.00	17.00	17.00	19.33
Total	539.34	565.00	584.34	366.33	436.66	509.33	430.34	307.67
II. Region of Drama								
1. Machinery services	212.33	241.00	359.67	202.67	257.00	292.33	283.33	239.33
2. Seeds, fert. pest.	102.33	102.33	102.33	98.33	98.33	98.33	103.33	92.67
3. Depr., interest etc.	25.00	33.33	42.00	25.67	31.67	40.67	25.00	24.67
4. Taxes for irrigation	8.33	8.33	8.33	7.00	7.00	7.00	8.33	12.00
Total	347.99	384.99	512.33	333.67	394.00	438.33	319.99	268.67

FINANCIAL RESULTS

A. Gross output - Costs of production

Table 7

Gross output and production costs according to period of transplanting or Seeding and yield

Gross output and costs of production	Periods of transplanting or seeding							
	Period A			Period B			Period C	Period D
	A ₁	A ₂	A ₃	B ₁	B ₂	B ₃		
Region of Serrai								
A. Gross output								
1. Yield (tons/hect)	33.58	59.37	84.27	26.66	50.27	74.58	36.62	23.72
2. Price (\$/ton)	36.67	36.67	36.67	36.67	36.67	36.67	36.67	40.00
3. Total (\$/hect.)	1,231.38	2,177.10	3,090.18	977.99	1,843.40	2,734.85	1,342.86	948.80
B. Costs of pro- duction								
1. \$per hect.	1,397.34	1,677.67	1,921.67	1,188.00	1,449.67	1,803.33	1,212.33	1,017.34
2. \$ per ton	41.61	28.26	22.80	44.56	28.84	24.18	33.11	42.89
Region of Drama								
A. Gross output								
1. Yield (tons/hect)	21.93	40.07	61.00	20.18	37.21	60.37	23.70	19.68
2. Price (\$/ton)	36.67	36.67	36.67	36.67	36.67	36.67	36.67	40.00
3. Total (\$/hect.)	804.17	1,469.37	2,236.87	740.00	1,364.49	2,213.77	869.08	787.20
B. Costs of pro- duction								
1. \$per hect.	893.00	1,108.34	1,458.33	855.99	1,049.33	1,332.66	914.67	858.33
2. \$ per ton	40.72	27.66	23.91	42.42	28.20	22.07	38.59	43.61

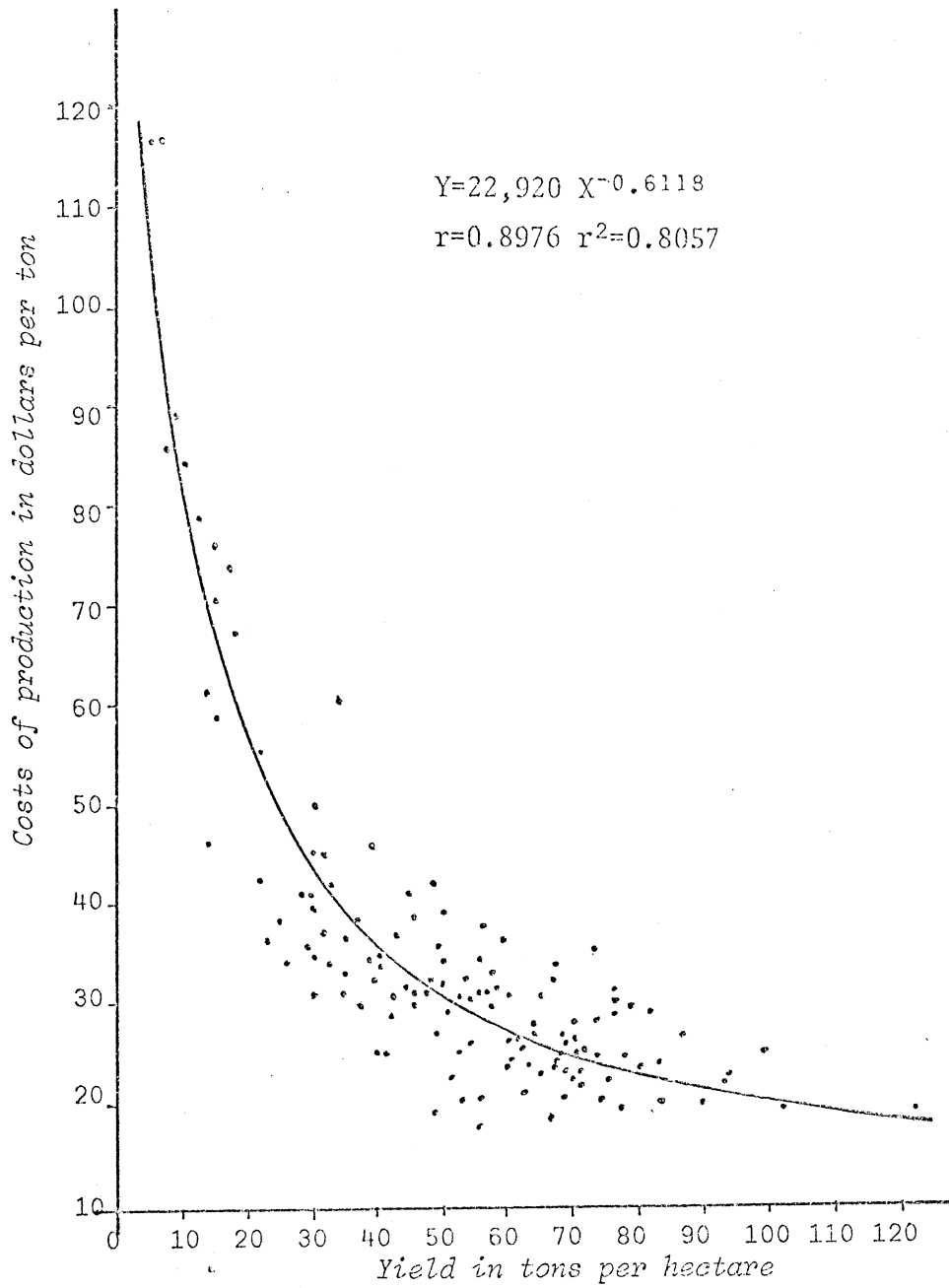


Chart 1. Regression and Correlation analysis between yield and production costs in Region of Serrai

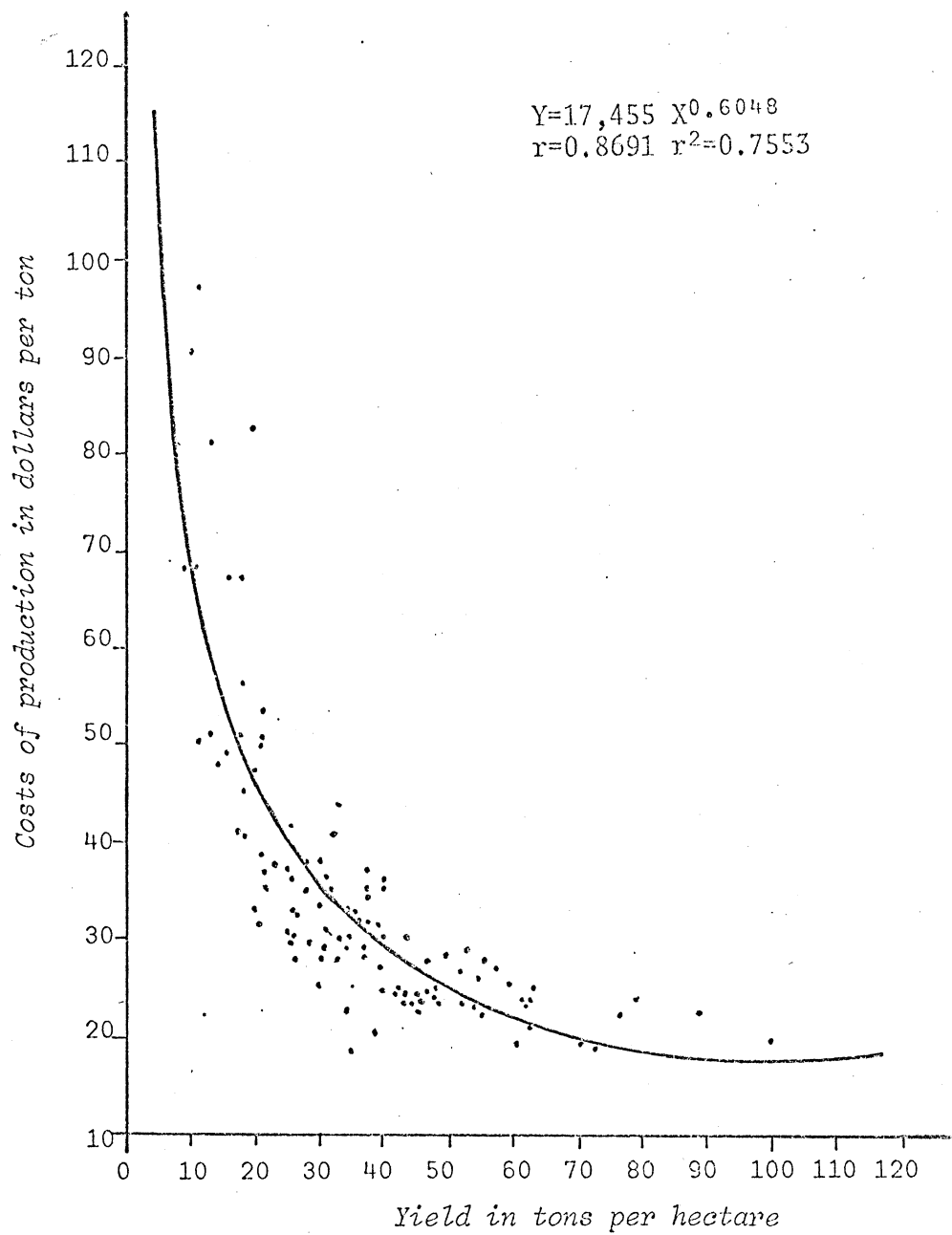


Chart 2. Regression and Correlation analysis between yield and production costs in Region of Drama

Table 8

Participation of each production factor in the total costs according to period of transplanting or seeding and yield

Production Factors	Periods of transplanting or seeding							
	Period A			Period B			Period C	Period D
	A ₁	A ₂	A ₃	B ₁	B ₂	B ₃	C	D
I. Region of Serrai								
1. Land (rent) (\$/hect.)	223.67	236.00	249.67	207.00	236.00	266.00	197.33	139.67
2. Labour (expenses) (\$/hect.)	595.00	807.00	988.67	583.33	718.00	940.33	541.67	539.67
3. Capital (expenses) (\$/hect.)	578.67	634.67	683.33	397.67	495.67	597.00	473.33	338.00
3.1. Machinery services	376.67	392.33	397.67	227.67	288.33	352.00	283.67	216.67
3.2. Seed, Fertil., Pest.	108.67	108.67	108.67	88.33	88.33	88.33	92.00	45.67
3.3. Deprec., Interest etc.	36.67	46.67	60.67	33.33	43.00	52.00	37.67	26.00
3.4. Taxes for production and irrigat.	56.66	87.00	116.32	48.34	76.01	104.67	59.99	49.66
Total	1,397.34	1,677.67	1,921.67	1,188.00	1,449.67	1,803.33	1,212.33	1,017.34
II. Region of Drama								
1. Land (rent) (\$/hect.)	124.33	145.67	179.33	108.33	124.33	167.33	150.00	160.00
2. Labour (expenses) (\$/hect.)	395.00	530.67	695.00	390.33	487.33	656.00	417.00	403.33
3. Capital (expenses) (\$/hect.)	373.67	432.00	584.00	357.33	437.67	509.33	347.67	295.00
3.1. Machinery services	212.33	241.00	359.67	202.67	257.00	292.33	183.33	139.33
3.2. Seed, Fertil., Pest.	102.33	102.33	102.33	98.33	98.33	98.33	103.33	92.67
3.3. Deprec., Interest etc.	25.00	33.33	42.00	25.67	31.67	40.67	25.00	24.67
3.4. Taxes for production and irrigat.	34.01	55.34	80.00	30.66	50.67	78.00	36.01	38.33
Total	893.00	1,108.34	1,458.33	855.99	1,049.33	1,332.66	914.67	858.33

Table 9

Participation of each farm operation in the total costs according to period of transplanting or seeding and yield

Farm operations	<i>Periods of transplanting or seeding</i>							
	Period A			Period B			Period	Period
	A ₁	A ₂	A ₃	B ₁	B ₂	B ₃	C	D
I. Region of Serrai								
Seedbeds	59.33	59.33	59.33	27.00	27.00	27.00	16.67	22.67
Soil cultivations	55.00	55.00	55.00	56.33	56.33	56.33	54.00	34.67
Fertilizing	52.67	52.67	52.67	50.67	50.67	50.67	47.00	12.33
Transplanting or seeding	135.33	135.33	135.33	150.33	150.33	150.33	101.33	160.67
Inter-row cultivations	131.67	131.67	131.67	131.67	131.67	131.67	136.33	152.67
Spraying	54.67	54.67	54.67	51.00	51.00	51.00	59.33	44.33
Irrigation	214.00	214.00	214.00	160.33	160.33	160.33	176.67	155.67
Picking	241.00	412.67	594.33	201.33	324.33	519.67	245.33	165.33
Transportation	154.00	210.00	219.33	87.33	160.00	250.67	96.33	73.00
Rent of Land, deprec., interest, taxes etc.	299.67	352.33	405.34	272.01	333.01	405.66	279.34	196.00
Total	1,397.34	1,677.67	1,921.67	1,188.00	1,449.67	1,803.33	1,212.33	1,017.34
II. Region of Drama								
Seedbeds	50.33	50.33	50.33	42.33	42.33	42.33	36.33	9.67
Soil cultivations	46.67	46.67	46.67	59.67	59.67	59.67	50.00	46.67
Fertilizing	64.33	64.33	64.33	66.33	66.33	66.33	70.00	76.00
Transplanting or seeding	96.67	96.67	96.67	97.67	97.67	97.67	91.00	78.67
Inter-row cultivations	89.00	89.00	89.00	67.00	67.00	67.00	86.67	110.33
Spraying	33.67	33.67	33.67	31.67	31.67	31.67	31.33	29.00
Irrigation	113.00	113.00	113.00	129.00	129.00	129.00	120.00	57.00
Picking	132.67	256.33	397.67	139.33	223.33	363.67	161.33	140.00
Transportation	91.67	132.67	274.00	65.33	132.67	137.00	65.33	101.00
Rent of Land, deprec., interest, taxes etc.	174.99	225.67	292.99	157.66	199.66	288.32	202.68	209.99
Total	893.00	1,108.34	1,458.33	855.99	1,049.33	1,332.66	914.67	858.33

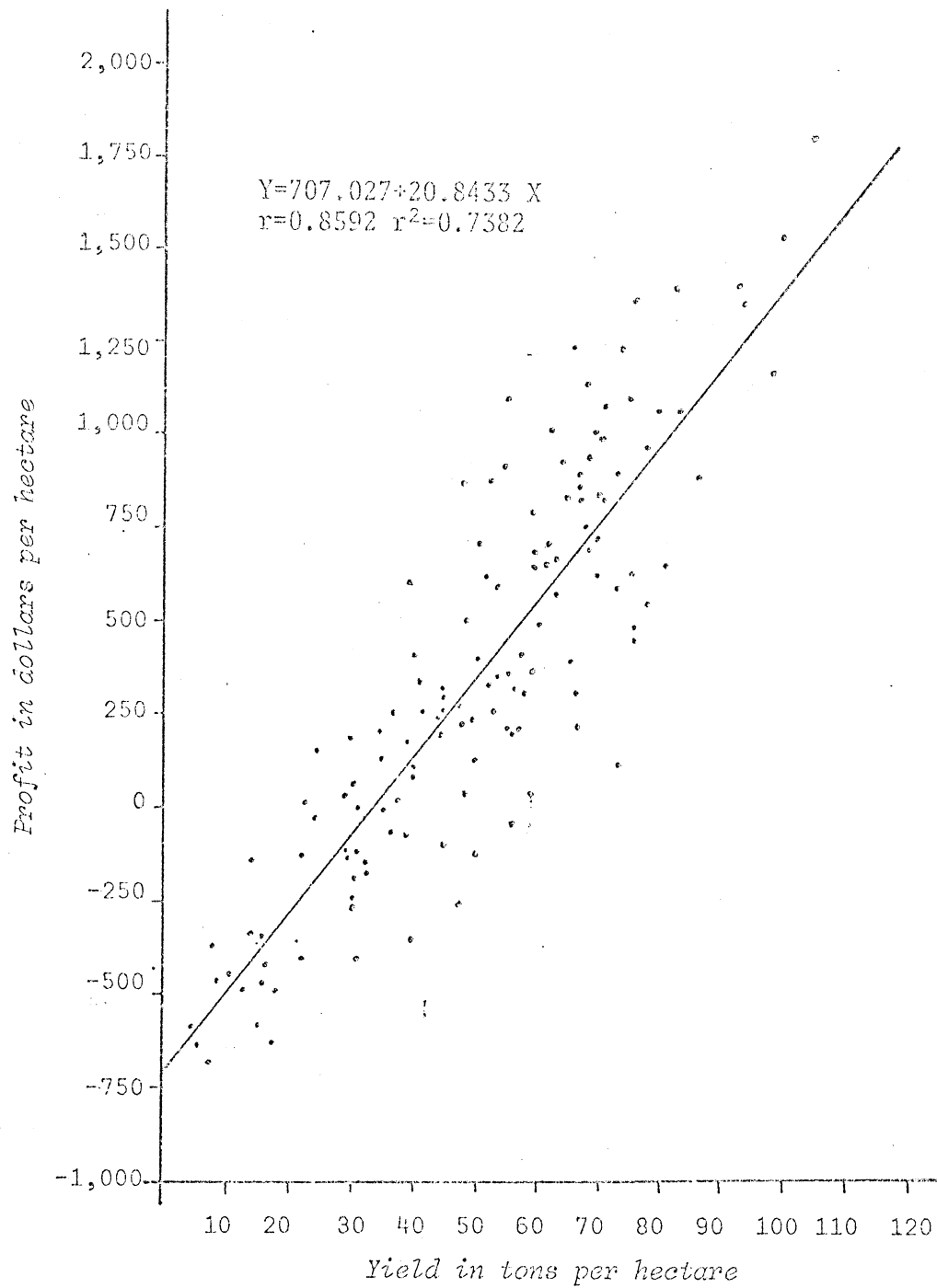


Chart 3. Regression and Correlation analysis between yield and profit or loss in Region of Serrai

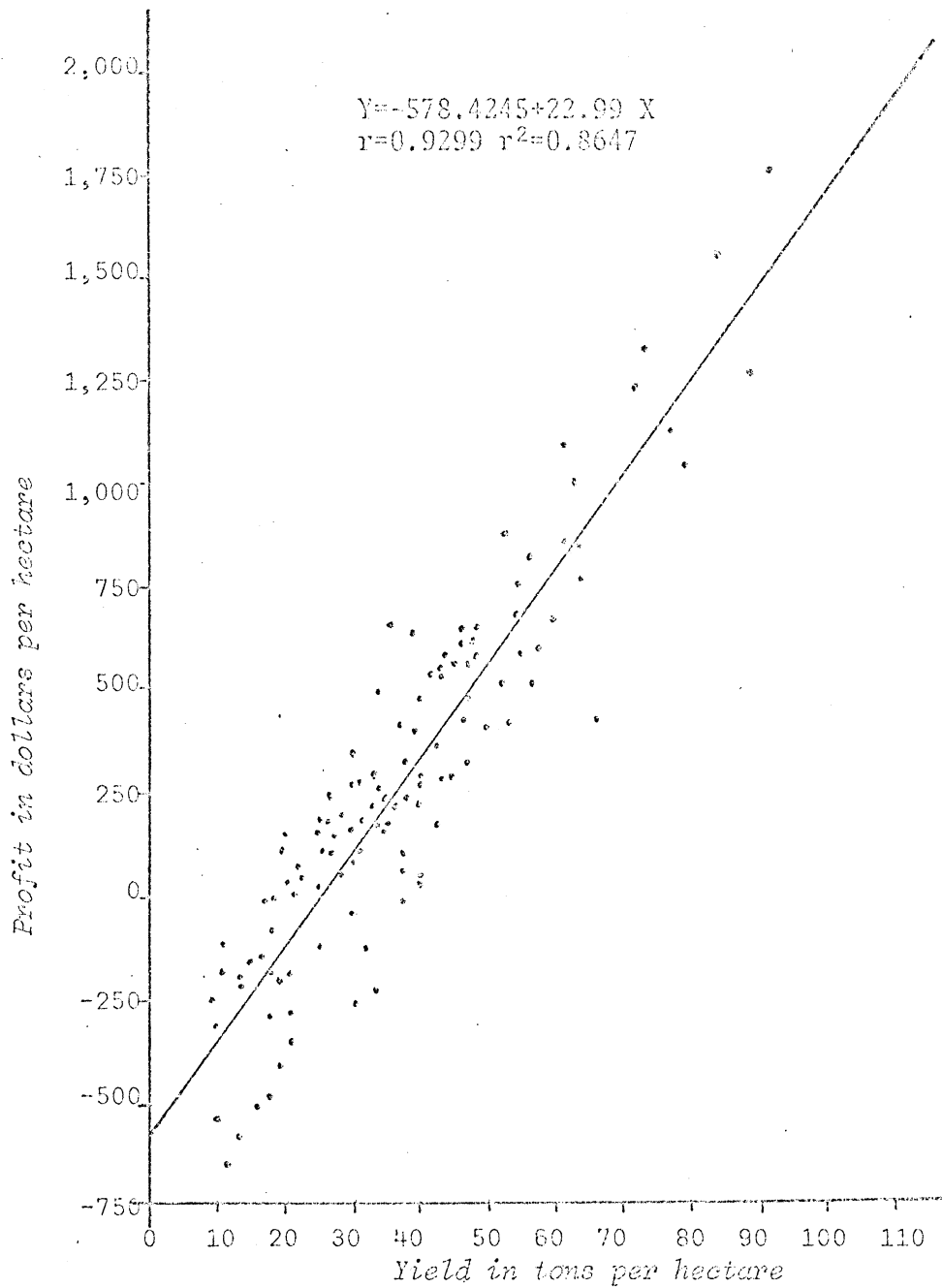


Chart 4. Regression and Correlation analysis between yield and profit or loss in Region of Drama

B. Profits

Table 10
Profits according to period of transplanting or seeding and yield

Profits	Periods of transplanting or seeding							
	Period A			Period B			Period C	Period D
	A ₁	A ₂	A ₃	B ₁	B ₂	B ₃	C	D
I. Region of Serrai								
1. \$/hectare	-165.96	499.43	1,163.51	-210.01	393.73	931.52	130.53	-68.54
2. \$/ton	-4.94	8.41	13.87	-7.89	7.83	12.49	3.56	-2.89
3. % of total costs	-11.88	29.77	60.81	-17.68	27.16	51.68	10.77	-6.74
II. Region of Drama								
1. \$/hectare	-88.83	361.03	778.54	-115.99	315.16	881.11	-45.59	-71.13
2. \$/ton	-4.05	9.01	12.76	-5.75	8.47	14.60	-1.92	-3.61
3. % of total costs	-9.95	32.57	53.39	-13.55	30.03	66.12	-4.98	-8.29

C. Returns and incomes

Table 11
Returns and incomes according to period of transplanting or seeding and yield

Returns-Incomes	Periods of transplanting or seeding							
	Period A			Period B			Period C	Period D
	A ₁	A ₂	A ₃	B ₁	B ₂	B ₃	C	D
I. Region of Serrai								
1. Return to Land (\$/hect.)	57.71	735.43	1,418.18	-3.01	629.73	1,197.52	327.86	71.13
2. Return to Labour								
a) \$/hectare	429.04	1,306.43	2,157.18	373.32	1,111.73	1,871.85	672.20	471.13
b) \$/P.M.W.V.	3.06	6.85	9.10	2.78	6.62	8.49	5.25	3.80
3. Return to capital								
a) \$/hectare	90.71	777.10	1,473.51	26.99	668.73	1,244.52	362.19	94.46
b) \$ 100 (%)	2.1	16.8	28.9	0.7	14.6	23.8	9.4	3.5
4. Farm income (\$/hect.)	685.71	1,584.10	2,462.18	610.32	1,386.73	2,184.85	903.86	634.13
II. Region of Drama								
1. Return to Land (\$/hect.)	35.50	506.70	957.87	-7.66	439.49	1,048.44	104.41	88.87
2. Return to Labour								
a) \$/hectare	306.17	891.70	1,473.54	274.34	802.49	1,537.11	371.41	332.20
b) \$/P.M.W.V.	3.32	7.11	8.91	3.00	7.00	9.87	3.78	3.61
3. Return to capital								
a) \$/hectare	58.17	537.03	995.87	15.67	468.16	1,085.11	126.74	111.20
b) \$ 100 (%)	2.4	18.3	27.4	0.7	18.3	31.8	4.4	3.7
4. Farm income (\$/hect.)	453.17	1,067.70	1,690.87	406.00	955.49	1,741.11	543.74	514.53

D. Comparative analysis of tomato growing between seeding directly the seed in the field and transplanting young plant

Table 12
Comparison of labour required by tomato growing between seeding directly the seed in the field and transplanting young plants (seedlings)

Farm operations	Periods of seeding or transplanting and corresponding labour required					
	Region of Serral				Region of Brana	
	Period B		Period C		Period B	
	Seeding	Trans-planting	Seeding	Trans-planting	Seeding	Trans-planting
Seedbeds	-	93	-	66	-	83
Soil cultivations	23	19	29	28	19	14
Fertilizing	16	9	16	13	13	10
Seeding or Transplanting	303	211	206	120	153	140
Inter-row cultivations	388	313	315	271	232	184
Irrigation	78	66	67	52	43	43
Spraying	23	34	16	27	20	25
Picking	947	783	591	525	910	545
Transportation	87	65	48	43	103	59
Total	1866	1595	1289	1145	1498	1103

Table 13
Comparison of financial results achieved by tomato growing between seeding directly the seed in the field and transplanting young plants (seedlings)

Financial Results	Periods of seeding or transplanting and corresponding					
	Region of Serral				Region of Brana	
	Period B		Period C		Period B	
	Seeding	Trans-planting	Seeding	Trans-planting	Seeding	Trans-planting
I. Gross output						
Yield (tons/hect.)	57.25	42.89	39.05	24.60	63.19	34.98
Price (\$/ton)	36.67	36.67	36.67	36.67	36.67	36.67
Total (\$/hect.)	2,099.36	1,572.78	1,431.96	902.08	2,317.18	1,282.72
II. Costs of Production						
1. Land rent (\$/hect.)	237.67	237.67	197.33	197.33	127.67	127.67
2. Labour expenses "	794.33	671.67	559.00	487.67	637.33	465.00
3. Machinery services "	302.33	279.67	309.00	246.67	245.67	240.67
4. Seeds "	6.33	3.67	6.67	4.00	5.67	3.67
5. Fertilizers, pect. "	84.67	62.33	98.33	51.33	85.67	81.67
6. Materials of the seedbeds (\$/hect.)	-	18.33	-	16.67	-	10.67
7. Deprec., interest, taxes, etc. (\$/hect.)	135.67	100.00	109.67	70.00	117.67	78.67
Total costs "	1,561.00	1,373.34	1,280.00	1,073.67	1,219.68	1,008.02
III. Profits "	538.36	199.44	151.96	-171.59	1,097.50	274.70
IV. Profits % of total costs	34.49	14.52	11.87	-15.98	89.98	27.25
V. Costs (\$/ton)	27.27	32.02	32.78	43.65	19.30	28.82
VI. Return to Land (\$/hect.)	776.03	437.11	349.29	25.70	1,225.17	402.37
VII. Return to Labour (\$/P.M.W.V.)	7.14	5.46	5.52	2.76	11.58	6.71
VIII. Return to Capital (%)	17.4	10.4	9.8	1.3	46.8	18.6
IX. Farm income (\$/hect.)	1,614.36	1,142.11	950.62	536.41	1,895.83	895.37

B. Comparison of tomato growing for processing with other crops

Table 14
Comparative analysis of tomato, sugar beet and lucerne growing in the region of
Serrai, based on data of the year 1973

Financial Results		Tomato	Sugar beet	Lucerne
I. Gross output				
a) Yield	(tons/hect.)	47.29	38.50	14.00
b) Price	(\$/ton)	36.67	23.33	76.67
	Total	1,734.12	898.21	1,073.38
II. Costs of Production				
a) Land rent	"	233.33	233.33	233.33
b) Labour	"	665.00	176.00	111.33
c) Machinery services	"	337.00	492.33	125.00
d) Seeds, fertilizers, pesticides	"	96.67	134.00	23.33
e) Deprec., interest etc.	"	37.00	74.67	55.67
f) Taxes, insurance etc.	"	73.00	53.33	50.00
	Total	1,442.00	1,153.66	598.66
III. Profits	"	292.12	-265.45	474.72
IV. Costs of production	(\$/ton)	30.49	30.22	42.76
V. Labour requirements	(hours/hect.)	1751	440	223
VI. Return to labour	(\$/P.M.W.V.)	5.47	-2.03	26.28
VII. Return to capital	(%)	13.0	0.4	16.5
VIII. Farm income	(\$/hect.)	1,225.45	193.55	955.38

Table 15
Comparative analysis of tomato and maize growing in a special area of the region
of Drama

Financial Results		Tomato			Maize		
I. Gross output							
a) Yield	(tons/hect)	50.00	60.00	70.00	6.00	8.00	10.00
b) Price	(\$/ton)	36.67	36.67	36.67	133.33	133.33	133.33
	Total	1,833.50	2,200.20	2,566.90	799.98	1,066.64	1,333.30
II. Costs of Production							
a) Land rent	"	250.00	250.00	250.00	250.00	250.00	250.00
b) Labour	"	578.00	661.33	744.67	161.67	188.67	207.67
c) Machinery services	"	256.67	273.33	290.00	83.67	97.33	109.33
d) Seed, fert., pest.	"	119.00	124.67	132.33	38.00	55.67	62.33
e) Deprec., interest etc.	"	103.67	113.67	123.67	22.33	27.33	30.33
	Total	1,307.34	1,423.00	1,540.67	555.67	619.00	659.66
III. Profits	"	526.16	777.20	1,026.23	244.31	447.64	673.64
IV. Profits % of total costs		40.25	54.62	66.61	43.97	72.32	102.12
V. Costs of production	(\$/ton)	26.15	23.72	22.01	92.61	77.38	65.97
VI. Return to land	(\$/hect)	776.16	1,027.20	1,276.23	434.31	697.64	923.64
VII. Return to labour	"	1,104.16	1,438.53	1,770.90	405.98	630.31	881.31
VIII. Labour requirements	(h/hect)	1355	1550	1745	379	442	487
IX. Return to labour	(\$/P.M.W.V)	8.15	9.28	10.15	10.71	14.40	18.10
X. Return to capital	(\$/hect)	811.49	1,065.53	1,317.56	510.31	716.64	945.64
XI. Return to capital	(%)	17.0	22.0	27.1	11.5	15.0	20.8
XII. Farm income	(\$/hect)	1,389.49	1,726.89	2,062.23	671.98	905.31	1,153.31

F. Price needed and area required for achieved the same profit by all periods of transplanting or seeding

Table 16

Price of tomatoes needed and area required for achieving the same total or per ton profit by the various periods of transplanting or seeding of tomato growing

Physical and Economic data	<i>Periods of transplanting or seeding and corresponding data and financial results</i>							
	Region of Serrai				Region of Drama			
	Period A	Period B	Period C	Period D	Period A	Period B	Period C	Period D
1. Average yield (tons/hect.)	47.51	44.92	36.62	23.72	37.89	33.28	23.70	19.68
2. Area required (hectares)	1.00	1.06	1.30	2.00	1.00	1.14	1.60	1.93
3. Total yield (tons)	47.51	47.51	47.51	47.51	37.89	37.89	37.89	37.89
4. Price needed (\$/ton)	36.67	36.78	38.66	48.31	36.67	37.51	44.72	50.16
5. Total gross output (\$)	1,742.19	1,747.53	1,836.68	2,295.35	1,389.43	1,421.10	1,694.43	1,900.43
6. Total costs of production (\$)	1,481.33	1,486.67	1,576.00	2,034.67	1,157.33	1,189.00	1,462.33	1,668.33
7. Total profits (\$)	260.86	260.86	260.86	260.86	232.10	232.10	232.10	232.10
8. Profits (\$/ton)	5.49	5.49	5.49	5.49	6.13	6.13	6.13	6.13
9. Total farm income (\$)	1,233.00	1,276.67	1,266.00	1,666.00	965.33	972.67	1,175.00	1,362.00

PRODUCTION FUNCTIONS AND RESOURCE PRODUCTIVITY

A. Equations, Production Elasticities and Marginal value products

I. Region of Serrai

$$\text{A. Period } Y = 2.6561 X_1^{0.2384} X_2^{0.5143} X_3^{0.0724} X_4^{0.2446}$$

$$\text{B. Period } Y = 2.6090 X_1^{0.2611} X_2^{0.3678} X_3^{0.1563} X_4^{0.3123}$$

$$\text{(C+D) Period } Y = 1.7132 X_1^{0.1100} X_2^{0.4552} X_3^{0.2548} X_4^{0.2793}$$

II. Region of Drama

$$\text{A. Period } Y = 3.0758 X_1^{0.1541} X_2^{0.4739} X_3^{0.1805} X_4^{0.2517}$$

$$\text{B. Period } Y = 1.91 X_1^{0.3679} X_2^{0.4158} X_3^{0.1040} X_4^{0.2429}$$

$$\text{(C+D) Period } Y = 2.1560 X_1^{0.1653} X_2^{0.4345} X_3^{0.1576} X_4^{0.3189}$$

Table 17
Marginal productivity analysis of tomato growing for 4 independent variables according to period of transplanting or seeding

Elasticities of production Marginal value products	Periods of transplanting or seeding					
	Region of Serrai			Region of Drama		
	Period A	Period B	PeriodC+D	Period A	Period B	PeriodC+D
I.Number of farms	57	50	30	58	41	20
II.Elasticities of production						
a)Land	0.2384 ^c	0.2611 ^d	0.1100 ^f	0.1541 ^f	0.3679 ^b	0.1653 ^f
b)Labour	0.5143 ^a	0.3678 ^b	0.4551 ^f	0.4739 ^a	0.4158 ^f	0.4345 ^c
c)Variable or short-term capital	0.0724 ^f	0.1563 ^f	0.2548 ^f	0.1805 ^e	0.1040 ^f	0.1576 ^f
d)Machinery services	0.2446 ^c	0.3123 ^b	0.2793 ^f	0.2517 ^b	0.2429 ^f	0.3189 ^f
Sum of elasticities	1.0697	1.0975	1.0992	1.0602	1.1306	1.0763
III.R ² (Coef.of Mult.determination)	0.9583	0.9672	0.7859	0.9809	0.9594	0.9850
IV.R (Coef.of Mult.correlation)	0.9789	0.9834	0.8865	0.9904	0.9795	0.9924
V.Marginal value products						
a)Land (\$/hect.)	543.33	487.33	114.67	241.33	503.00	141.00
b)Labour (\$/P.M.W.V.)	50.53	39.33	40.33	57.00	48.73	38.70
c)Variable capital (\$/\$)	1.53	3.30	3.48	2.77	1.44	1.35
d)Machinery services (\$/\$)	1.48	1.99	1.12	1.48	1.35	1.75
VI.Opportunity costs						
a)Land (\$/hect.)	236.67	237.67	178.33	150.67	127.67	160.00
b)Labour (\$/P.M.W.V.)	34.60	42.37	42.87	42.37	42.33	43.90
c)Variable capital (\$/\$)	1.10	1.10	1.10	1.10	1.10	1.10
d)Machinery services (\$/\$)	1.08	1.08	1.08	1.08	1.08	1.08
VII.Marginal return to opportunity costs ratios						
a)Land	2.30	2.05	0.64	1.60	3.94	0.88
b)Labour	1.46	0.93	0.94	1.35	1.15	0.88
c)Variable capital	1.39	3.00	3.16	2.52	1.31	1.23
d)Machinery services	1.37	1.84	1.04	1.37	1.25	1.62
VIII.Marginal rate of substitution of labour by machinery	1.01	2.15	1.19	1.10	1.18	1.98

Table 18
Area covered and certain physical data needed of various varieties for preparing a programme of organizing of tomato production

Periods and varieties	Date of Seeding	Date of Transplanting	Date of expected starting of picking	Date of achieving the picking of 80% of the total production	Area in hectares	Expected production according to period of transplanting or seeding and variety	
						minimum in tons	maximum in tons
A. Period (Transplanting)							
a) Variety No 1	15-20/2	15-20/4	12-15/7	10/8	300	11000	12000
b) " No 2	"	"	14-17/7	12/8	200	7000	8000
c) " No 3	"	"	15-20/7	15/8	200	7000	9000
d) " No 4	"	"	17-20/7	20/8	100	3500	4000
e) " No 5	"	"	25-30/7	25/8	300	10500	13000
Total					1100	39000	46000
B. Period (Seeding)							
a) Variety No 5	25-30/4	-	20-25/8	20/9	300	11500	14500
b) " No 6	"	-	23-28/8	"	80	3000	3500
c) " No 7	"	-	23-28/8	"	70	2500	3500
d) " No 8	"	-	20-25/8	"	30	1000	1500
Total					480	18000	23000
C. Period (Seeding)							
a) Variety No 9	20-25/5	-	1-5/9	15/10	300	11000	13000
b) " No 7	"	-	2-7/9	"	50	1750	2000
c) " No 6	"	-	2-7/9	"	50	1750	2000
Total					400	14500	17000
D. Period (Transplanting)							
a) Variety No 2	25-30/5	20-30/6	15/9	5-10/10	120	3500	4000
Total					120	3500	4000
TOTAL					2100	75000	90000

Table 19
Expected production according to variety and period of picking

Periods and varieties	Area in hectares	Average total production in tons	July		August			September			October
			11-20	21-31	1-10	11-20	21-31	1-10	11-20	21-30	1-20
A. Period											
a) Variety No 1	300	11500	500	2000	6000	2500	500	-	-	-	-
b) " No 2	200	7500	300	1200	3500	2500	-	-	-	-	-
c) " No 3	200	8500	300	1300	4000	3000	900	-	-	-	-
d) " No 4	100	4000	200	500	1000	1500	800	-	-	-	-
e) " No 5	300	11500	-	1000	1500	5000	3000	1000	-	-	-
Total	1100	43000	1300	6000	16000	13500	5200	1000			
B. Period											
a) Variety No 5	300	13000	-	-	-	2500	6300	2500	1000	500	200
b) " No 6	80	3500	-	-	-	500	1800	700	300	200	-
c) " No 7	70	3300	-	-	-	500	1600	700	400	200	-
d) " No 8	30	1200	-	-	-	200	600	200	200	-	-
Total	480	21000	-	-	-	3700	10300	4000	1900	900	200
C. Period											
a) Variety No 9	300	12000	-	-	-	-	1600	9000	800	400	200
b) " No 7	50	1800	-	-	-	-	200	1200	200	100	100
c) " No 6	50	1700	-	-	-	-	200	1100	200	100	100
Total	400	15500	-	-	-	-	2000	11300	1200	600	400
D. Period											
a) Variety No 2	120	3700	-	-	-	-	-	-	2000	1200	500
Total	2100	83000	1300	6000	16000	17200	17500	16300	5100	2700	1100

Table 20
Production costs of tomato and tomato paste in 1974

Physical and Economic Data		Costs of Production	
		dollars	%
I. Production costs of tomato			
A. Production expenses			
1. Land rent	(\$/hectare)	266.67	12.9
2. Labour (expenses)	"	1,050.00	50.8
3. Capital (expenses)	"	751.67	36.3
3.1. Seeds, Fertilizers, Pesticides	"	145.00	7.0
3.2. Machinery services	"	483.33	23.4
3.3. Depreciations, Interest etc.	"	50.00	2.4
3.4. Taxes, Insurance etc.	"	73.34	3.5
Total	"	2,068.34	100.0
B. Average yield	(tons/hect.)	47.290	
C. Costs of production	(\$/ton)	43.74	
II. Production costs of tomato paste 28-30%			
A. Expenses for processing tomato			
1. Value of tomato (raw material)	(\$/5 kgr.)	1.23	44.4
2. Expenses of regular and casual labour	"	0.35	12.6
3. Fuel and electricity	"	0.15	5.4
4. Deprec., repairs, interest of factory (buildings, machinery etc.)	"	0.36	13.0
5. Expenses for tin and packing	"	0.44	15.9
6. Expenses for transportation and customs F.O.B.	"	0.06	2.2
7. General expenses	"	0.18	6.5
Total (costs of tomato paste)	"	2.77	100.0
B. Costs of tomato paste \$/ton (5 kgr. X 200 tins)		554.00	

SUMMARY AND CONCLUSIONS

The present study refers to the technical and economic analysis, by using records and accounts, of 2,607 tomato growing farms of the regions of Serrai and Drama for the four year period 1971-74.

The tomato growing for processing is characterized as an intensive crop of our Agriculture, because it requires large quantities of labour (1,651 and 1,218 hours per hectare in the regions of Serrai and Drama respectively) and capital (\$ 433 and 347 per hectare per year in Serrai and Drama respectively), while they are known the needs of tomato growing in good quality and irrigated land.

The comparative analysis of tomato of various periods of transplanting or seeding in each region indicates that the economics (profit and return to capital) and productivity of the tomato growing of early periods of transplanting or seeding are high in relation to those of the late periods of transplanting or seeding. The picture does not change when this comparative analysis is based on the farm income achieved by this crop on family farms. For this reason, tomato is growing by both family farms and farm businesses as an early crop from the period of transplanting or seeding stand point. The difference in financial results of tomato growing between early and late periods of transplanting or seeding is due to the higher yield achieved in comparison to the production costs.

In order to be achieved the same profits by the four periods of transplanting or seeding of the tomato growing it is necessary to be changed on the one hand the price of tomatoes from \$ 12-28 per ton and on the other the area cultivated by tomato from 0.3-1.0 hectares per hectare according to period of transplanting or seeding of both regions.

The comparative analysis of tomato growing between seeding directly in the field and transplanting young plants (seedlings) shows that the tomato growing by the first method requires more total labour than by the second method. This increase in labour requirements is connected with an increase in yield achieved, so that the financial results achieved by the first method of tomato growing are higher than those obtained by the second method of tomato growing.

The competitiveness of tomato growing compared with the growing lucerne, sugar beet and maize depends on the yield achieved. For this reason tomato growing is considered as one of the most productive crops of the family farms.

The marginal value products of land and labour compared with their opportunity costs show the economic utilization of these production factors by the tomato growing of early periods of transplanting or seeding than that of late ones. On the contrary, the marginal value products of variable capital and machinery used by the tomato growing fluctuate according to periods of transplanting or seeding. These products are higher than their opportunity costs, which means that variable capital and machinery can be profitably increased.

The economics of production and marketing of tomato and tomato processed products will depend on the quality and the production costs of tomato, on the quality and the production costs of tomato processed products and on the better possible marketing of these products in the international market. The production costs of tomato, amounting at the present time (1974) about \$ 44 per ton and depending basically on the labour expenses (50.8%) and on the machinery services (23.4 %) will be depend in the future on the most economical degree of mechanization of tomato growing. Also, the production costs of tomato paste amounting at present (1974) about \$ 553 per ton (200 tins X 5 kgr. per tin) depends basically on the value of tomato (as raw material) (44.6%) and on the expenses of labour (regular and casual) and factories (buildings, machinery etc.) (26.2%).

Taking into account that the limits for reducing production costs of tomato are very small (small size of tomato growing per farm, progressive increase of labour wages and low degree of mechanization it can be said that the decrease of the production costs of tomato paste it is expected to be affected favourably by increasing the annual operation of the factory for the full utilization of the existing regular labour, buildings and machinery of the factory. This can be achieved by the best organization of tomato growing both by the industry and the growers. Additionally, it is necessary to be organized also and the marketing of the tomato paste in the international market because our country is now one of the most exported countries in the world.

Of the above mentioned it can be said that, in order to avoid unfavourable effects on our national economy, it is necessary to be investigated the possibilities of marketing of tomato processed products and to be adapted to these possibilities on the one hand the area cultivated by tomato, and on the other the size of the tomato factories. This investigation must depend on the general tendency of the demand of tomato paste and not on the demand of any one year only, because the area cultivated by tomato it is possible to be adapted from year to year, while the establishment of a tomato industry, required large amounts money, is characterized as a long-term investment.

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