Cotton - Cost of prod.

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THE ECONOMICS OF COTTON PRODUCTION

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INTRODUCTION***

Cotton, growing in 131 thousand hectares (89.8o/o irrigated and 10.2o/o unirrigated) and occuping the 3.7o/o of the total area cultivated,represents the 6o/o of the total gross output achieved from crop production. On the other hand, about 96 thousands of farm families are mainly or secondarily occupied with cotton growing.

After world war II, cotton growing is progressively and steadily expanded, except for some years between 1950-60. The main factors affecting area covered by cotton growing are the price achieved by farmers and the subsidy given by the State.

There is no doubt that cotton growing is one of the most productive and profitable farm enterprises of the agricultural sector, because it contributes to the increase on the one hand of the farm income of the family farms, and on the other of the total profit of the farm businesses. In addition, many industries are based on cotton production and this product makes up one of the main sources of importing money from other countries.

The prevailing, at present, price of cotton and the providing subsidy by the State are the basic factors for expanding of cotton growing, although it is noted a great increase mainly in labour wages and secondarily in land rent. However the possibilities of expanding cotton growing are limited, because of the continuous decrease of available labour in farming and because of lack, very often, of farm labour in some periods connected with certain operations of great economic importance. These difficulties are partly overcome by introducing improved farm machinery for cultivations and picking. This problem of cotton growing is expected to be overcome by introducing new farm techniques. The purpose of this study is to determine the profitability and competitiveness of cotton growing in various levels of yield, prices, wages and degree of mechanization under the existing of technical and economic conditions.

The methodology used and the technical and economic data analyzed from a large number of farms (586) show a good picture of the economics of cotton production.

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RESEARCH CONDITIONS

This research refers to the study, by using records and accounts, of a sample of 586 cotton farms, belonging to 188 villages in the plains of Thessaloniki, Larisa and Seres for the 6 year period 1965-70. Cotton is growing as an irrigated crop on 523 farms and as an unirrigated one on 63 farms.

The selection of the farms studied was not chosen on a random basis, as it was necessary to choose farmers who would be willing to provide continuously and for a long period detailed and accurate data for cotton growing. On the other hand, purpose of this research is not the presentation of general importance technical and economic data, but to show a real picture of the present economic position of cotton growing and its significance in the future.

The various technical and economic data and financial results are given according to yield, because it makes up the most characteristic criterion of comparing financial results and because the estimated results by this way are directly applicable.

The cost of certain farm operations (soil cultivations, seeding and interrow cultivations) was found to be independent of yield and for this reason the cost of these operations was considered to be the same in all classes of yield.

From all data collected during the 6year period 1965-70, price, wages and land rent have changed between that period and 1972, in which these data are analyzed. These changes were taken into account before analyzing these data by making the appropriate corrections.

In this paper the text is ommited and only tables and charts are given. This was done on 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 FACTORS

A! Land

Table 1

Number of farms according to yield and area cultivated

Classes of yield tons/hectare	Number of farms	Classes of land area hec./farm	Number of farms
Up to - 1.50	78	Up to - 0.50	60
1.51 - 2.00	124	0.51 - 1.00	135
2.01 - 2.50	138	1.01 - 2.00	158
2.51 - 3.00	113	2.01 - 4.00	125
3.01 - 3.50	49	4.01 - over	45
3.51 - over	21		
Total	523	Total	523

B! Labour

Table 2

Labour required in man equivalent hours according to yield and area cultivated

Classes of yield tons/hectare	Man hours per hectare	Classes of land area hec./farm	Man hours per hectare
Up to - 1.50	525	Up to - 0.50	774
1.51 - 2.00	622	0.51 - 1.00	706
2.01 - 2.50	677	1.01 - 2.00	708
2.51 - 3.00	751	2.01 - 4.00	667
3.01 - 3.50	791	4.01 - over	704
3.51 - over	894		

Table 3

Monthly labour fluctuations in man equivalent hours according to yield

Months	*Classes of yield in tons per hectare and corresponding labour requirements in man hours*					
	Up to 1.50	1.51-2.00	2.01-2.50	2.51-3.00	3.01-3.50	3.51-over
January-April	8.00	8.00	8.00	8.00	8.00	8.00
May	102.00	102.00	106.00	108.00	111.00	115.00
June	102.00	102.00	106.00	108.00	111.00	115.00
July	51.00	57.00	61.00	63.00	66.00	71.00
August	18.00	23.00	27.00	30.00	33.00	38.00
September	109.00	132.00	133.00	175.00	186.00	220.00
October	88.00	127.00	156.00	170.00	177.00	206.00
November	43.00	67.00	76.00	85.00	95.00	117.00
December	4.00	4.00	4.00	4.00	4.00	4.00
Year	525.00	622.00	677.00	751.00	791.00	894.00

T a b l e 4
Labour required per each kind of operation
in man equivalent hours according to yield

Kinds of operations	*Classes of yield in tons per hectare and corresponding labour requirements in man hours*					
	Up to-1.50	1.51-2.00	2.01-2.50	2.51-3.00	3.01-3.50	3.51-over
Soil cultivations	12.00	12.00	12.00	12.00	12.00	12.00
Fertilizing	4.00	4.00	4.00	4.00	4.00	4.00
Seeding	5.00	5.00	5.00	5.00	5.00	5.00
Inter-row cultivations	235.00	235.00	235.00	235.00	235.00	235.00
Spraying	8.00	8.00	8.00	8.00	8.00	8.00
Irrigation	46.00	51.00	67.00	76.00	88.00	106.00
Picking	215.00	307.00	346.00	411.00	439.00	524.00
T o t a l	525.00	622.00	677.00	751.00	791.00	894.00

C! C a p i t a l

T a b l e 5
Capital needed for cotton growing according to yield

Capital needed ($/hectare)	*Classes of yield in tons per hectare and corresponding capital needed in dollars*					
	Up to-1.50	1.51-2.00	2.01-2.50	2.51-3.00	3.01-3.50	3.51-over
Machinery services	47.70	60.00	69.00	76.30	79.00	99.30
Seed,fertilizers, pesticides etc.	37.30	40.70	44.30	45.70	47.00	55.70
Deprec.,interst etc. of capital	29.30	35.00	38.70	43.30	46.00	53.30
Taxes and miscella-neous	14.70	20.30	24.70	28.70	33.70	39.00
T o t a l	129.00	156.00	176.70	194.00	205.70	247.30

F I N A N C I A L R E S U L T S

A! G r o s s o u t p u t

T a b l e 6

Gross output according to yield

Classes of yield (tons/hectare)	*Gross output in $ per hectare*		
	Value of seed-cotton	Subsidy for farmers	T o t a l
Up to - 1.50 (average 1.21)	375.00	56.30	431.30
1.51 - 2.00 (" 1.82)	564.30	85.00	649.30
2.01 - 2.50 (" 2.28)	706.70	106.30	813.00
2.51 - 3.00 (" 2.73)	846.30	127.30	973.60
3.01 - 3.50 (" 3.25)	1007.30	151.70	1159.00
3.51 - over (" 3.83)	1187.30	178.70	1366.00

B! P r o d u c t i o n c o s t s

T a b l e 7

Production costs of seed - cotton according to yield

Classes of yield (tons/hectare)	*Costs of production*	
	$ per hectare	$ per ton
Up to - 1.50	408.00	337.19
1.51 - 2.00	484.00	265.93
2.01 - 2.50	541.70	237.59
2.51 - 3.00	604.30	221.36
3.01 - 3.50	649.00	199.69
3.51 - over	745.00	194.52

T a b l e 8

Participation of each production factor in the total costs according to yield

Classes of yield (tons/hectare)	*Production factors*						
			Capital (expences)				
	Land (rent) $/hect.	*Labour (expenses) $/hect.*	*Machinery services $/hect.*	*Seed,fertilizers,pesticides,etc. $/hect.*	*Depr.,interest,etc.of capital,tax. miscellaneous $/hect.*	*T o t a l $/hect.*	T o t a l $/hect.
Up to - 1.50	86.70	192.30	47.70	37.30	44.00	129.00	408.00
1.51 - 2.00	100.00	228.00	60.00	40.70	55.30	156.00	484.00
2.01 - 2.50	116.70	248.30	69.00	44.30	63.40	176.70	541.70
2.51 - 3.00	135.00	275.30	76.30	45.70	72.00	194.00	604.30
3.01 - 3.50	153.30	290.00	79.00	47.00	79.70	205.70	649.00
3.51 - over	170.00	327.70	99.30	55.70	92.30	247.30	745.00

T a b l e 9

Participation of each principal operation in the total costs of production according to yield

Operations of production	*Classes of yield in tons per hectare and corresponding operations in dollars*					
	Up to-1.50	1.51-2.00	2.01-2.50	2.51-3.00	3.01-3.50	3.51over
Soil cultivations	25.00	25.00	25.00	25.00	25.00	25.00
Fertilizing	18.00	21.00	25.70	26.70	28.30	38.70
Seeding	16.70	16.70	16.70	16.70	16.70	16.70
Inter-row cultivations	87.70	87.70	87.70	87.70	87.70	87.70
Spraying	16.70	16.70	16.70	16.70	16.70	16.70
Irrigation	38.00	46.00	61.00	67.00	74.30	99.70
Picking	78.60	119.00	132.20	161.00	170.70	201.60
Rent of land	86.70	100.00	116.70	135.00	153.30	170.00
Depr.,repairs ect.cf Capital	8.30	9.60	11.00	12.20	13.00	15.00
Interest of capital	21.00	25.30	27.70	31.00	33.00	38.30
Taxes miscellaneous	11.30	17.00	21.30	25.30	30.30	35.60
T o t a l	408.00	484.00	541.70	604.30	649.00	745.00

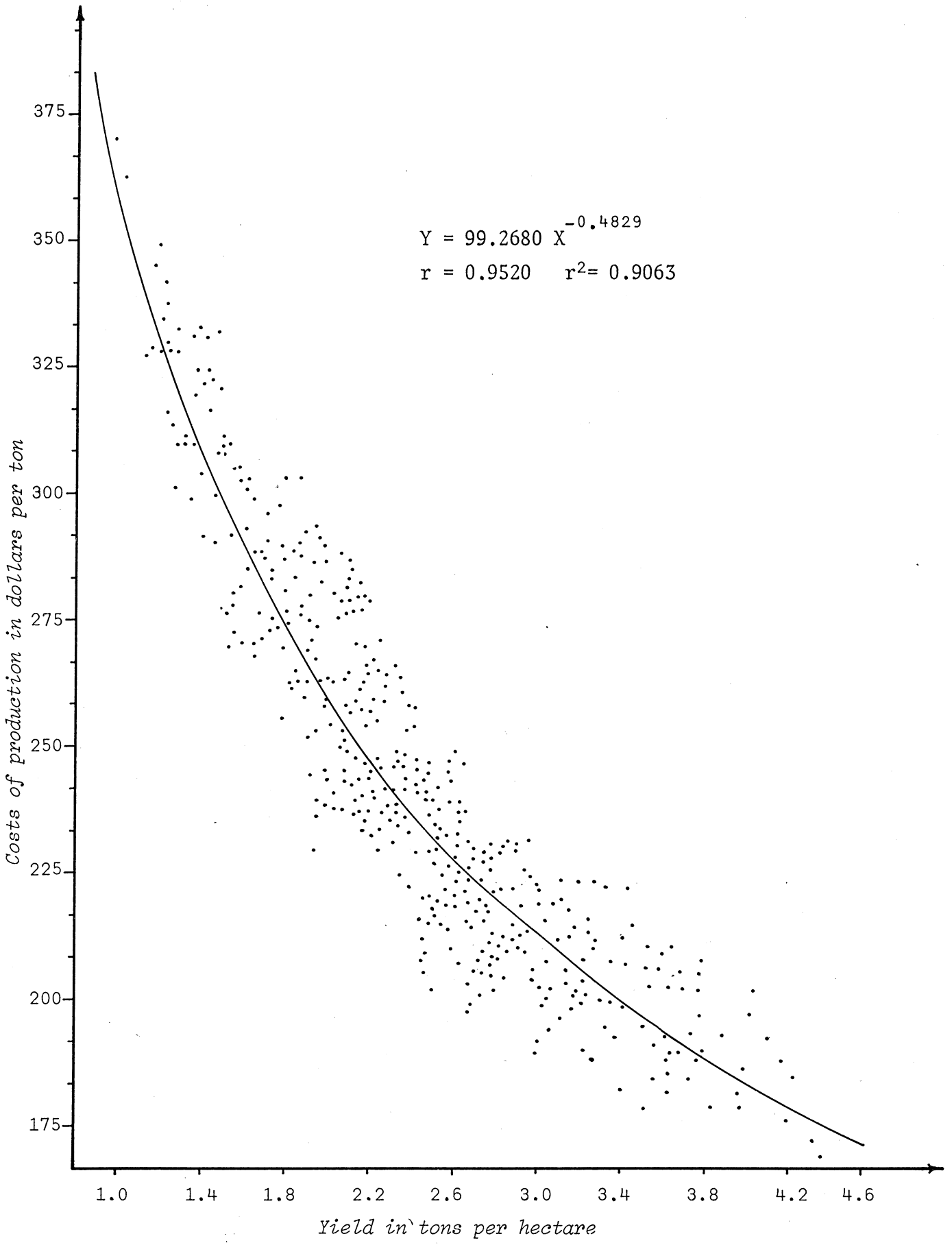

Chart 1. Regression and Correlation analysis between yield and production costs

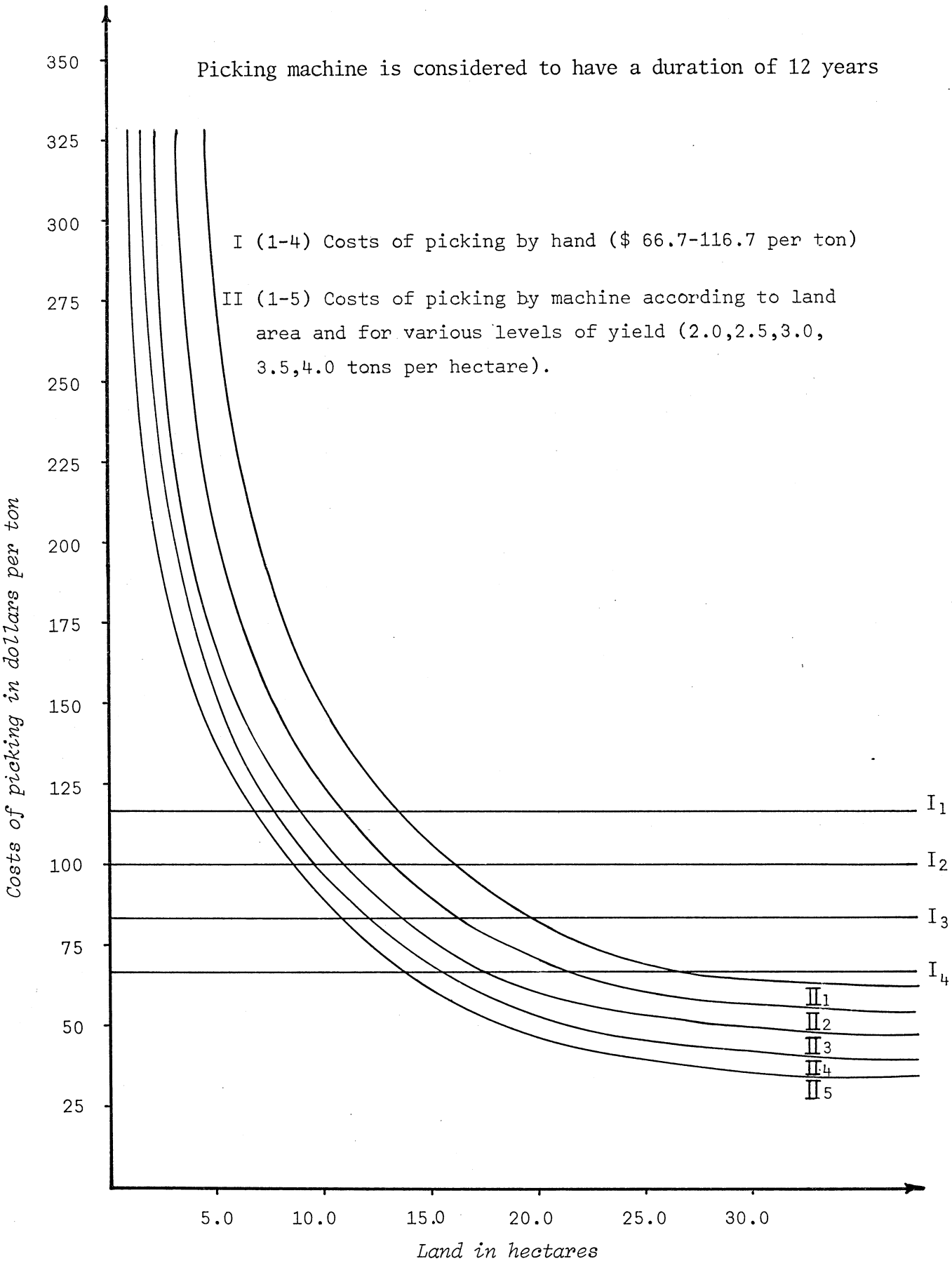

Chart 2. Economic comparison among various methods of seed cotton picking according to yield and area cultivated

T a b l e 10
Reduction of production costs in various levels of yield by decreasing costs of certain operations*

Operations of production	*Classes of yield in tons per hectare and corresponding costs of operations in $/hect.*					
	Up to-1.50	1.51-2.00	2.01-2.50	2.51-3.00	3.01-3.50	3.51-over
Soil cultivations	21.00	21.00	21.00	21.00	21.00	21.00
Fertilizing	18.00	21.00	25.70	26.70	28.30	38.70
Seeding	13.30	13.30	13.30	13.30	13.30	13.30
Inter-row cultivations	65.00	65.00	65.00	65.00	65.00	65.00
Spraying	15.00	15.00	15.00	15.00	15.00	15.00
Irrigation	38.00	46.00	61.00	67.00	74.30	99.70
Picking	78.60	119.00	131.00	134.00	137.70	142.00
Rent of land	86.70	100.00	116.70	135.00	153.30	170.00
Depr.,repairs,etc of capital	8.30	9.60	11.00	12.20	13.00	15.00
Interest of capital	21.00	25.30	27.70	31.00	33.00	38.30
Taxes,miscellaneous	11.30	17.00	21.30	25.30	30.30	35.60
T o t a l	376.20	452.20	508.70	545.50	584.20	653.60
Costs $ per ton	*310.90*	*248.50*	*223.10*	*199.80*	*179.70*	*170.60*

*Table 10 shows that reduction of total costs may be mailly achieved in actual practice by increasing machinery used.

C! P r o f i t s

T a b l e 11
Profits by increasing and decreasing costs of certain operations

Classes of yield (tons/hect.)	*P r o f i t s b y*					
	*Increasing costs of certain operations**			*Increasing and decreasing costs of certain operation***		
	$/hect.	$/ton	% of total costs	$/hect.	$/ton	% of total costs
Up to - 1.50	23.30	19.30	5.70	54.30	44.90	14.40
1.51 - 2.00	165.50	90.90	34.20	197.00	108.20	43.60
2.01 - 2.50	271.30	119.00	50.10	304.30	133.50	59.80
2.51 - 3.00	369.30	135.30	61.10	428.00	156.80	78.40
3.01 - 3.50	510.00	156.90	78.60	574.70	176.80	98.40
3.51 - over	621.00	162.10	83.40	712.30	186.00	109.00

*Increasing costs refer to those operations (fertilizers, irrigation, better quality land) which affect yield favourably.

**Increasing costs refer to those operations (fertilizers, irrigation, better quality land) which affect yield favourably,while decreasing costs refer to those operations which are affect (picking) or unaffected by yield (soil cultiva - tions, seeding, inter-row cultivations and spraying).

T a b l e 12
Profits according to wages and yield

W a g e s in $/P.M.W.U.	*Yield in tons per hectare and corresponding profits or loss in dollars per hectare*					
	1.21	1.82	2.28	2.73	3.25	3.83
3.70	23.33	165.50	271.33	369.33	510.00	621.00
4.00	5.67	144.67	249.00	344.33	483.67	591.00
4.30	-12.00	123.67	226.33	319.33	457.33	561.33
4.70	-29.33	103.00	203.67	294.33	431.00	531.33
5.00	-47.00	91.33	181.00	269.00	404.33	501.67

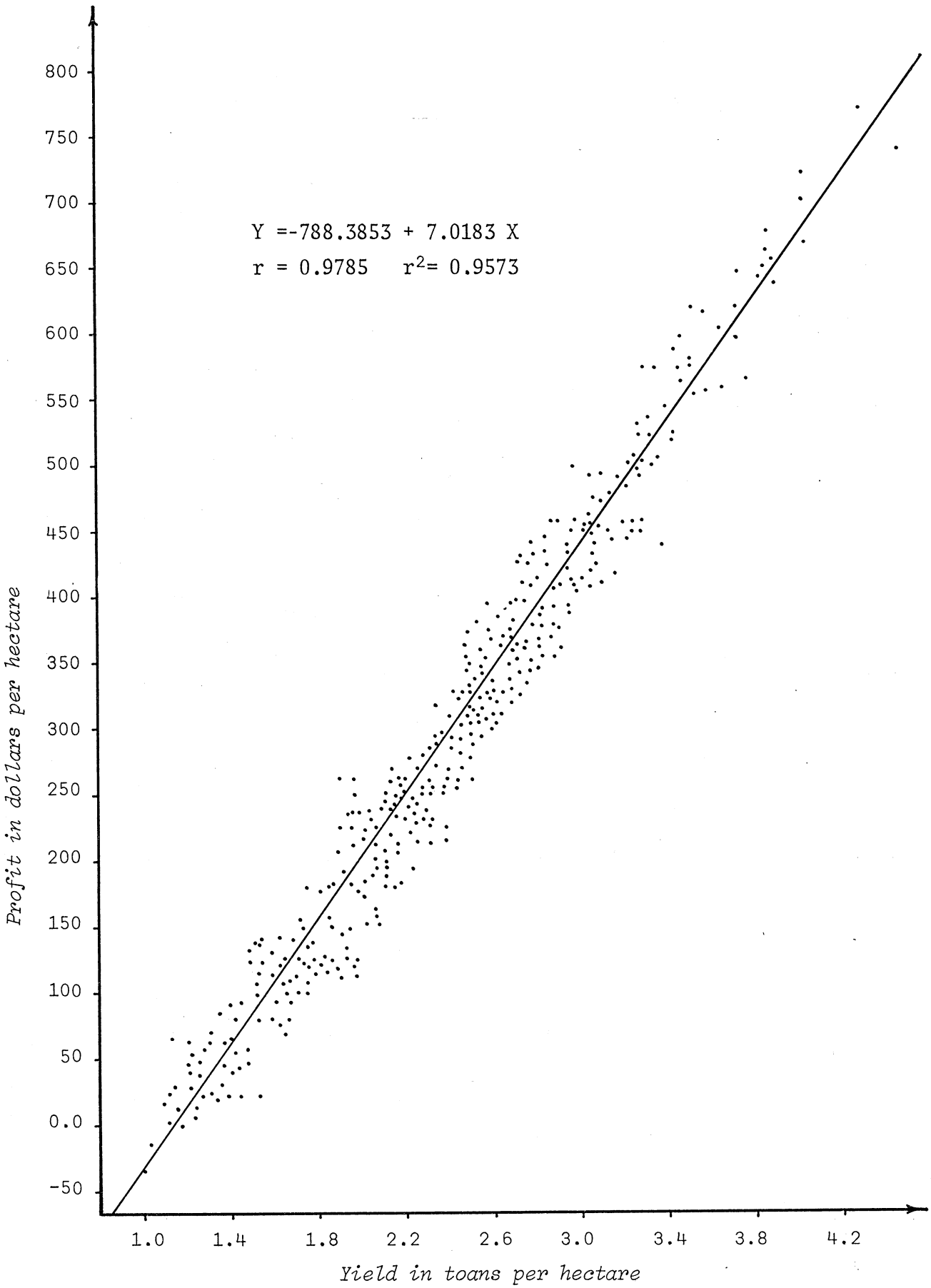

Chart 3. Regression and Correlation analysis between yield and profit or loss

D: Returns and incomes

Table 13

Returns and incomes of cotton growing accoding to yield

Returns - Incomes	*Classes of yield in tons per hectare and corresponding financial results in dollars*					
	Up to-1.50	1.51-2.00	2.01-2.50	2.51-3.00	3.01-3.50	3.51-over
Return to land($/hect)	110.0	265.3	388.0	504.3	633.3	791.0
Productive value of land ($/hect.)	1,863.7	4,641.7	6,480.0	8,423.3	11,076.7	13,210.0
Return to labour						
a.- $ per hectare	215.7	393.3	519.7	644.7	800.0	948.7
b.- " " P.M.W.U.	4.1	6.3	7.7	8.6	10.1	10.6
Return to capital						
a.- $ per hectare	131.0	290.7	415.7	535.3	696.3	829.3
b.- " " $ 100	7.29	13.89	17.25	19.31	22.38	23.84
Farm income($/hect.)	323.3	518.7	664.0	810.7	986.3	1,157.0

E: Comparison between unirrigated and irrigated cotton growing

Table 14

Economic comparison between unirrigated and irrigated cotton growing

Financial results		*Unirrigated*		*Irrigated*	
		tons per hectare			
		0.83	1.31	1.21	1.82
1.Output	$/hect.	296.00	467.30	431.30	649.30
2.Input					
a. Land rent	"	66.70	86.70	86.70	100.00
b. Labour expenses	"	173.70	193.70	192.30	228.00
c. Machinery services	"	37.70	43.30	47.70	60.00
d. Seed,fertilizers,pestic.	"	12.00	12.00	37.30	40.70
e. Deprec.and interest of capital	"	22.00	25.70	29.30	35.00
f. Taxes, miscellaneous	"	9.00	14.00	14.70	20.30
Total (a-f)	"	321.10	375.40	408.00	484.00
3.Profits or loss	"	-25.10	91.90	23.30	165.30
4.Price including farmer's subsidy	$/ton	356.67	356.67	356.67	356.67
5.Costs of production	"	386.90	286.60	337.20	265.90
6.Return to land	$/hect.	41.60	178.60	110.00	265.30
7. " " labour	"	148.60	285.60	215.60	393.30
8. " " "	$/P.M.W.U	3.13	5.40	4.10	6.33
9. " " capital	$/hect.	57.30	195.70	131.00	290.70
10. " " "	$/$100	4.17	11.30	7.29	13.89
11.Farm income	$/hect.	231.00	389.30	290.00	518.70

PRODUCTION FUNCTIONS AND RESOURCE PRODUCTIVITY

A! Equations, Production Elasticities and Marginal value products

$$Y = 5.0807\ X_1^{0.4149}\ X_2^{0.4088}\ X_3^{0.1795}$$

$$Y = 5.7206\ X_1^{0.3969}\ X_2^{0.3974}\ X_3^{0.0229} X_4^{0.1851}$$

Table 15
Marginal productivity analysis of irrigated cotton growing for 3 and 4 independent variables

Elasticities of production-Marginal value products	*3 variables*	*4 variables*
1. Number of farms	515	515
2. Period in years (1965-70)	6	6
3. Elasticities of production		
a.Land	0.4129[a]	0.3969[a]
b.Labour	0.4088[a]	0.3974[a]
c.Capital(variable and mach.services)	0.1795[a]	—
d.Variable or short-term capital	—	0.0229[f]
e.Machinery services	—	0.1851[a]
Sum of elasticities	1.0012	1.0023
4.R^2 (Coef. of mult. determination)	0.9200	0.9227
5. Marginal value products		
a.Land ($/hectare)	351.67	338.33
b.Labour ("/P.M.W.U)	5.03	4.87
c.Capital ($/$)	1.30	-
d.Variable capital (" ")	-	0.44
e.Machinery services (" ")	-	2.17
6. Opportunity costs		
a.Land ($/hectare)	133.33	133.33
b.Labour ("/P.M.W.U)	3.67	3.67
c.Capital ($/$)	1.09	-
d.Variable capital (" ")	-	1.10
e.Machinery services (" ")	-	1.08
7. Marginal return to opportunity costs ratios		
a.Land	2.64	2.54
b.Labour	1.37	1.33
c.Capital	1.19	-
d.Variable capital	-	0.40
e.Machinery services	-	2.01
8. Marginal rate of substitution of labour by machinery	-	1.63

Probability level for t's

a) 0.001>P>0
b) 0.005>P>0.001
c) 0.01 >P>0.005
*e)*0.05>P>0.01
*d)*0.1 >P>0.05
f)... >P>0.1

Up to -2.00 tons/hect. $Y = 5.1854\ X_1^{0.3263}\ X_2^{0.4748}\ X_3^{0.1724}$

2.01 -3.00 " " $Y = 10.9699\ X_1^{0.3872}\ X_2^{0.3461}\ X_3^{0.1920}$

3.01 -over " " $Y = 6.9305\ X_1^{0.2704}\ X_2^{0.4851}\ X_3^{0.2257}$

T a b l e 16

Marginal productivity analysis of irrigated cotton growing for 3 independent variables according to yield

Elasticities of production marginal value products	*Classes of yield in tons/hect.*		
	Up to-2.00	2.01-3.00	3.01-over
1. Number of farms	194	251	70
2. Period in years (1965-70)	6	6	6
3. Elasticities of production			
a.Land	0.3263[a]	0.3872[a]	0.2704[a]
b.Labour	0.4748[a]	0.3461[a]	0.4851[a]
c.Capital	0.1724[a]	0.1920[a]	0.2257[a]
Sum of elasticities	0.9735	0.9253	0.9812
4.R^2 (Coef. of mult. determination)	0.9075	0.9215	0.9706
5. Marginal value products			
a.Land ($/hectare)	191.67	345.00	325.67
b.Labour ($/P.M.W.U)	4.73	4.33	7.17
c.Capital ($/$)	1.02	1.42	1.96
6. Opportunity costs			
a.Land ($/hectare)	96.00	132.00	157.33
b.Labour ($/P.M.W.U)	3.67	3.67	3.67
c.Capital ($/$)	1.09	1.09	1.09
7. Marginal return to opportunity costs ratios			
a.Land	2.00	2.67	2.07
b.Labour	1.29	1.18	1.95
c.Capital	0.94	1.30	1.80

Probability level for t's

a) 0.001> P> 0.0

b) 0.005> P> 0.001

c) 0.01 > P> 0.005

d) 0.05 > P> 0.01

e) 0.10 > P> 0.05

f) ... > P> 0.10

Up to - 2.00 tons/hect. $Y = 6.0925\ X_1^{0.3134}\ X_2^{0.4591}\ X_3^{0.0307}\ X_4^{0.1674}$

2.01 - 3.00 " " $Y = 11.7387\ X_1^{0.3863}\ X_2^{0.3460}\ X_3^{0.0263}\ X_4^{0.1717}$

3.01 - over " " $Y = 8.7950\ X_1^{0.2744}\ X_2^{0.5032}\ X_3^{0.1157}\ X_4^{0.0771}$

T a b l e 17

Marginal productivity analysis of irrigated cotton growing for 4 independent variables according to yield

Elasticities of production marginal value products	*Classes of yield in tons/hect.*		
	Up to-2.00	2.01-3.00	3.01-over
1. Number of farms	194	251	70
2. Period in years (1965-70)	6	6	6
3. Elasticities of production			
a.Land	0.3134[a]	0.3863[a]	0.2744[a]
b.Labour	0.4591[a]	0.3460[a]	0.5032[a]
c.Variable or short-term capital	0.0307[f]	0.0263[f]	0.1157[a]
d.Machinery services	0.1674[a]	0.1717[a]	0.0771[f]
Sum of elasticities	0.9706	0.9303	0.9704
4. R^2 (Coef. of mult. determination)	0.9094	0.9229	0.9723
5. Marginal value products			
a.Land ($/hectare)	184.00	344.33	330.67
b.Labour ($/P.M.W.U)	4.57	4.33	7.43
c.Variable capital ($/$)	0.45	0.52	2.66
d.Machinery services (" ")	1.64	2.02	1.08
6. Opportunity costs			
a.Land ($/hectare)	96.00	132.00	157.33
b.Labour ($/P.M.W.U)	3.67	3.67	3.67
c.Variable capital ($/$)	1.10	1.10	1.10
d.Machinery services (" ")	1.08	1.08	1.08
7. Marginal return to opportunity costs ratios			
a.Land	1.92	2.61	2.10
b.Labour	1.25	1.18	2.03
c.Variable capital	0.41	0.47	2.42
d.Machinery services	1.52	1.87	1.00
8. Marginal rate of substitution of labour by machinery	1.31	1.71	0.53

Probability level for t's

a) 0.001 > P > 0.00 *d)* 0.05 > P > 0.01

b) 0.005 > P > 0.001 *e)* 0.10 > P > 0.05

c) 0.01 > P > 0.005 *f)* ... > P > 0.10

T a b l e 18

Actual and optimum combination of production factors and output of irrigated cotton growing for 3 variables according to yield

Classes of yield (tons/hect.)	Output achieved and estimated Y $	*Combination of production factors*		
		Land X_1 hectares	Labour X_2 man hours	Capital X_3 $
1. Up to - 2.00				
actual combination	898.70	1.53	904.40	152.40
optimum "	928.00	2.20	836.80	111.40
2. 2.01 - 3.00				
actual combination	2,088.50	2.34	1671.70	283.00
optimum "	2,263.00	3.82	1227.50	249.70
3. 3.01 - over				
actual combination	2,696.30	2.24	1822.00	310.40
optimum "	2,718.80	2.33	1793.80	306.10

T a b l e 19

Actual and optimum combination of farm resourses and output of irrigated cotton growing for 4 variables according to yield

Classes of yield (tons/hect.)	Output achieved and estimated $ Y	*Combination of farm resources*			
		Land in hectares X_1	Labour in man hours X_2	Variable capital $ X_3	Machinery services $ X_4
1. Up to - 2.00					
actual combination	898.70	1.53	904.40	60.83	91.53
optimum "	928.00	2.20	836.80	17.27	94.10
2. 2.01 - 3.00					
actual combination	2,088.50	2.34	1671.70	105.93	177.07
optimum "	2,263.00	3.85	1227.50	33.17	216.50
3. 3.01 - over					
actual combination	2,696.30	2.24	1822.00	117.43	193.00
optimum "	2,718.80	2.33	1793.80	183.67	122.40

T a b l e 20

Marginal productivity and opportunity costs of farm resourses of irrigated cotton growing for 3 variable according to yield

Classes of yield (tons/hect.)	*Opportunity costs and marginal productivity*		
	Land ($/hect.)	Labour ($/10hours)	Capital ($/$)
I. Up to - 2.00			
1. Opportunity costs	96.00	3.67	1.10
2. Marginal productivity			
a)Actual combination	191.67	4.73	1.02
b)Optimum "	137.67	5.27	1.44
II. 2.01 - 3.00			
1. Opportunity costs	132.00	3.67	1.10
2. Marginal productivity			
a)Actual combination	345.00	4.33	1.42
b)Optimum "	229.67	6.37	1.74
III. 3.01 - over			
1. Opportunity costs	157.33	3.67	1.10
2. Marginal productivity			
a)Actual combination	325.67	7.17	1.96
b)Optimum "	315.67	7.37	2.00

$$Y = 2.9429\ X_1^{0.3337}\ X_2^{0.5170}\ X_3^{0.1507}$$

$$Y = 3.1555\ X_1^{0.3397}\ X_2^{0.5359}\ X_3^{0.0514}\ X_4^{0.0771}$$

T a b l e 21

Marginal productivity analysis of unirrigated cotton growing for 3 and 4 independent variables

Elasticities of production Marginal value products	*3 variables*	*4 variables*
1. Number of farms	63	63
2. Period in years (1965-70)	6	6
3. Elasticities of production		
a.Land	0.3337[d]	0.3397[e]
b.Labour	0.5170[a]	0.5359[a]
c.Capital(variable and mach. services)	0.1507[f]	-
d.Variable or short-term capital	-	0.0514[f]
e.Machinery services	-	0.0771[f]
Sum of elasticities	1.0014	1.0041
4. R^2 (Coef. of mult. determination)	0.8491	0.8482
5. Marginal value products		
a.Land ($/hectare)	131.00	133.33
b.Labour ($/P.M.W.U)	4.03	4.17
c.Capital ($/$)	1.12	-
d.Variable capital (" ")	-	1.68
e.Machinery services (" ")	-	0.74
6. Opportunity costs		
a.Land ($/hectare)	78.00	78.00
b.Labour ($/P.M.W.U)	3.67	3.67
c.Capital ($/$)	1.09	-
d.Variable capital (" ")	-	1.10
e.Machinery services (" ")	-	1.08
7. Marginal return to opportunity costs ratios		
a.Land	1.68	1.71
b.Labour	1.10	1.14
c.Capital	1.03	-
d.Variable capital	-	1.53
e.Machinery services	-	0.69

Probability level for t's

a) 0.001 > P > 0.00 *d)* 0.05 > P > 0.01

b) 0.005 > P > 0.001 *e)* 0.10 > P > 0.05

c) 0.01 > P > 0.005 *f)* .... > P > 0.10

CONCLUSIONS

This study refers to the technical and economic analysis of 586 (523 irrigated and 63 unirrigated) cotton growing farms, belonging to 188 villages of the plains Thessaloniki, Larisa and Seres for the 6year period 1965-70 by using records and accounts.

The various technical and economic data and financial results are expressed according to yield because it makes up the main factor affecting profitability of cotton growing.

In this study it was found that yield is affected by quality of land, irrigation and fertilizing, and consequently their increase up to the highest optimum level, from an economic point of view, leads to the increase of profits and of the other financial results (when yield increases 3 times,then profit increases 25 times and farm income 4 times). Also an increase of profits, returns and incomes was found to be achieved by decreasing costs of inter-row cultivations and picking about 8.8-12.3o/o by changing the method of performing of these operations. Thus, considering price achieved and protection provided by the State, the profitability and competitiveness of cotton growing is expected to be improved, on one hand by using better quality land connected with the appropriate irrigation, and on the other by applying complete mechanization on inter-row cultivations and picking.

By comparing cotton growing as an irrigated crop with that as an unirrigated one it is concluded that the first is more profitable than the second,when a yield of 1.5 tons per hectare and over is achieved. In actual practice,the yield of cotton growing as an irrigated crop is usually 2.0 tons per hectare and over, and for this reason cotton is usually cultivated as an irrigated crop.

Marginal productivity analysis of cotton growing shows that marginal value products of all production factors used, except variable capital, are considered to be high in relation to opportunity costs, justifying the transfer of production factors to this crop from other ones. Under the existing conditions the substitution of labour by machinery is considered profitable.

The low marginal productivity of variable capital is mainly due to the great diffirence of fertilizers used among various farms (e.g. in other farms fertilizers are not used at all, while in other ones are used great quantities).

From the above, it is concluded that cotton growing is one of the most productive farm enterprises of our Agriculture. Its productivity can be improved by achieving higher yields and by substituting labour by machinery,when these are utilized more and more economically. This can be done by increasing size of farms operating on a bussiness basis.

Taking into account that the consumption of cotton is continuously increased in world market and the possibilities of exporting Greek cotton are not li-

mited, it can be said that the future of cotton growing seems to be hopeful in Greece, if cost of production decreases and its quality is improved.