A study of the factors influencing the kiwifruit production cost

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1. Introduction

One element characterising agricultural production in Greece is the fact that the rate at which the number of products offered increases is higher than the relative increase in the demand rate (Papanagiotou, 1990a). As a result, the overall number of encouraged crops is decreasing. The twenty-four products currently classified under this category occupy 1/4 of the cultivated land area, representing, in terms of value, 1/4 of the vegetable and fruit production. Kiwifruit is one such product, alongside asparagus, banana, avocado, decorative plants and animal-feed related plantations. The reason is that kiwifruit is judged to be a relatively new but dynamic product. Past experience has shown that, after an initial adjustment period, the demand rate for new dynamic agricultural products is higher than the supply rate.

The promotion of these plantations is potentially profitable, contributing both to the producers involved and to the national economy as well. Kiwifruits are very productive. While the cultivated land they occupy in Greece is less than 0.5%, their contribution to the gross value of the total vegetable and fruit production reaches 8% (Papanagiotou, 1990b). Kiwifruit farms, however, require a long-term investment. Three to four years have to elapse before the t-rees can be productive.

Abstract

The demand for kiwifruits is, at international level, increasing at a very high rate. The factors, however, influencing the production of the farms concerned, and thus the costs involved and the profitability of the enterprises, are not always easy to control. This paper presents a micro-economic study of the economic results of a farm situated in Northern Greece, covering a period of seven years, from the initial planting stage to full growth. By adhering to all currently established procedures with respect to the cultivation stages, attention was shifted to the following non-controllable qualitative and quantitative factors influencing the production cost and thus the revenue generated: climatic conditions (hail and frost), land rent, labour cost, fixed capital, fixed capital interest, variable capital and variable capital interest. The value of the results for the decade 1990-00 is interesting and indicative of micro-economic analysis

Résumé

Actuellement, la demande de kiwi s'accroît à un rythme considérable à l'échelon international. Pourtant, les facteurs qui influent sur la production des exploitations et par là même, sur les coûts et la rentabilité des entreprises, ne sont pas toujours faciles à contrôler. Ce travail présente une étude micro-économique des résultats obtenus dans une exploitation du nord de la Grèce, sur une période de sept ans, depuis la phase initiale de la plantation jusqu'à la pleine production. En appliquant tous les procédés acceptés couramment en ce qui concerne les diverses phases de la culture, l'attention a été focalisée sur les facteurs qualitatifs et quantitatifs non contrôlables, influençant les coûts de production et le rendement généré : les conditions climatiques (grêle et gel), le bail du terrain, le coût de la main d'œuvre, le capital fixe, l'intérêt du capital fixe, le capital variable et l'intérêt du capital variable. La valeur des résultats pour la décennie 1990-2000 est intéressante et indicative de l'analyse micro-économique.

Kiwifruit production was introduced in Greece in 1973. Since then it has known a rapid increase. It is estimated that the current production covers around 45,000 stremmata (4,500 hectares), with around 6,000 farmers being involved in the cultivation. The annual production in 1990 reached 22,000 tonnes (Papanagiotou, 1990b), while the figures for the years 1992/1993/1994 were 46,000/46,000/35,000, respectively (Kukurgiannis & Vasilakis, 1995). The results refer to the decade 1990-2000 because nothing changed in the following years and are indicative of the micro-economic analysis.

Most of the quantities produced (around 60%) are exported, with around 65% of the exports directed to other European Union countries (Kukurgiannis & Vasilakis, 1995). The share of the kiwifruit exports in the total exports of fruits and vegetables is around 7.8% (Matas, 1995). Germany and the Netherlands are the main importing countries of Greek kiwifruits. Germany imports 41% of the Greek production and the Netherlands around 19% (Eurostat, 1993).

The Mediterranean countries satisfy more than 60% of the demand for kiwifruits from the European Union countries. Though Italy is the member state that dominates in the market, Greece is one of the most dynamic and promising exporters since it caters for around 3.3% of the EU's demand (Eurostat, 1993). Many other countries, however, some of them already large kiwifruit exporters, are experiencing rapid growth rates as well (Mattas & Michaelidis, 1995). To be competitive, a producer has to pay attention not only to the quality of the fruits and to the way the pro-

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Table 1. *Technical and economic data (1987-1994) converted to a 1-hectare area = 10stremma, expressed in 1995 prices (1 ECU = 300 Drs).*

	1987	1988	1989	1990	1991	1992	1993	1994
Land / Number of trees	10/500	10/500	10/500	10/500	10/500	10/500	10/500	10/500
Labour (hours)	424	442	400	362	676	698	712	752
Variable capital ('000s)	22.3	496.1	104.2	363.5	344.7	456.9	307.2	303.5
Fixed capital ('000s)	2,632.3	1,212	370.5	1,507.7	248.5	173.0	34.0	1.6
Production (tonnes)	-	-	-	-	6.2	17.8	22.0	25.0
Gross revenue ('000s)								
1. Production value	-	-	-	-	1,335.6	1,477.2	1,774.6	2,131.8
2. Insurance compensation	-	-	-	-	-	859.4	774.2	640.4
Total	-	-	-	-	1,335.6	2,336.6	2,548.8	2,772.2
Production cost ('000s)								
1. Land rent	66.8	72.4	77.2	80.2	77.6	75.5	73.7	77.5
2. Labour	1,229.3	591.7	799.0	812.5	677.1	584.9	523.5	522.9
3. Consumable[1]	22.3	496..1	104.2	363.5	344.7	456.9	307.2	303.5
4. Consuming cap. int.	2.0	52.5	8.3	32.4	26.4	42.8	25.3	24.6
5. Fixed costs[2]	384.9	124.7	53.6	216.3	35.8	25.0	4.7	0.3
6. Fixed capital interest	421.3	193.6	54.3	218.2	47.2	37.9	6.9	0.7
7. Other costs	-	87.3	10.0	15.6	65.2	82.4	86.0	88.6
Total	2,125.5	1,628.3	1,096.6	1,738.7	1,274.0	1,305.4	1,027.3	1,018.1
Fixed costs ('000s)								
1. Amortisation (12)	219.2	101.0	30.8	125.6	20.7	14.4	2.8	0.12
2. Maintenance (3,3%)	86.8	40.0	12.2	49.7	8.0	5.5	1.1	0.09
3. Insurance (3%)	78.9	36.3	11.1	45.2	7.4	5.2	1.0	0.09
Total	384.9	177.3	54.1	220.5	35.8	25.0	4.7	0.30
Retail price / Kgr	222.7	206.9	193.0	178.0	155.3	137.3	122.9	110.8

Note:
1. fertilisers, chemicals, fuels-oils specific equipment, rights, harvest
2. Land improvements, manufactures, plantation of trees,wires, tubes, machines, tools, irrigation, well, dwelling ,store, tensing
3. Index of 1oo = 1995,...1 ECU = 300 drachmas...1 Hectare = 10 Stremmata

duct is marketed and promoted, but to the economic results of his farm as well.

The consequences of ending up with a low quality product are several, including a decline in market performance and wasted resources. Efforts to improve quality must go, however, beyond setting quality/grade standards and monitoring production practices. A broader quality management approach is needed, encompassing both the processes employed and the needs of the customers (Lawes, 1995). A quality system is concerned with skills and attitudes, personal responsibility and quality costs. All aspects of the business have to be considered, including its internal and external relationships.

Control of the production costs incurred, however, is not easily exercised (Ceroni, 1988). This is mainly because the exact contribution of each cost unit (e.g. labour requirements, consumable costs, fixed capital interest, land rent, etc.) to the total cost, in the majority of the cases, is not known. This fact, in conjunction with the widespread practice of the farmers in Greece not to include in the production cost the land rent and the auxiliary facilities owned by them, as well as the cost of their own labour, and that of their family members, accentuates the problem.

2. Materials and methods

A micro-economic analysis was carried out with the aim of examining the influence exercised by a series of factors, both qualitative and quantitative, on the production cost of a kiwifruit farm and then of ascertaining their effect on the economic results. The data used derive from the records kept by one of the authors (K. Haralabidis) covering the period 1987-1994, and refer to a farm situated in the area of Livadia, in Northern Greece, at a distance of 110 km from Thessaloniki.

Kiwifruit trees are very sensitive to climatic and soil conditions, requiring high humidity, neutral pH soil and free of Ca (Ministry of Agriculture, 1986; Paloukis, 1989; Buwalda et al., 1991). Very often, frost, either early or late, damages the fruits. This factor is important in deciding the type of cultivars to use, too, since, on one hand, early cultivars are needed in order to secure high market prices, while, on the other, late cultivars are needed to avoid late

frost. Strong winds and hail have adverse effect, too, on both the quality of the product and the total farm production.

In addition, the quality of the fruits at harvest time plays an important role in their storage performance (Velemis et al., 1995), as does the post-harvest handling of the fruits (Lallu, 1995), influencing ultimately the selling price and thus the economic results of the farms.

Quality of the product can be controlled and attained, in most cases at least partially, through adherence to the currently prevailing procedures with respect to fertilisation, irrigation, trimming, pruning, thinning out of the fruits, storing conditions etc. (Blanchet, 1987; Shien, 1987).

Hayward cultivars were planted in the spring of 1988. During the period previous to this, that is between October 1987 and the end of 1987, all the necessary preparatory work was completed with respect to soil examination and preparation, selection, fencing, purchase of materials, dwelling, etc..

The soil analysis was performed at the Soil Science Institute of NA-GREF, in Thessaloniki. The results were: pH = 7.4-7.5, CaCO3 traces, organic substance 1.26, soil texture SL and SCL. For fertilisation purposes, P and K were applied. In total 5 stremmata (0.5 hectares) were used. Fifty trees per stremma (0.1 hectare) were planted in a 5x5 formation. The ratio of male to female plants used was 1:8. The 250 female plants were cultivar Hayward while the male ones were of the Tomouri variety (Koukourgiannis, 1994).

Mixed fertilisers 14-7-14 + 5% MgO (2 kg/tree) were used at a later stage. For the watering of the plants a privately drilled well at a depth of 30 metres was used, employing a sprayer system. Grass-cutting machines were used and local interventions with pesticides was carried out whenever necessary.

Because of the lack of suitable infrastructure in the area, the fruits were transported to the agricultural co-operative Meliki Imathia, at a distance of 150 km, jointly with other local producers, who shared the transportation expenses. There, the fruits were classified, according to their size (23-46), into nine categories, and bought by the co-operative.

The farm was situated in a well protected valley at a distance of about 500 metres from the lake Kerkini, giving the area high humidity. The wind did not pose any serious problems. The grower was covered by the Organisation of Agricultural Insurance (G.A.I.) against damages caused by early or late frost, as well as hail.

The value of the field used, 5 stemmata in total (0.5 hectare), was estimated to be equal to 280,000 Drachmas (1 ECU = 300 Drs), rent 7.500 drachmas/st per stemma.

3. Results and discussion

Table 1 presents the data pertaining to the 1987-1994 period, expressed in 1995 prices. To facilitate comparisons, the figures refer to a 10 stremmata (i.e. 1 hectare) area. The expenses of installation etc. were spread over the entire expected exploitation period (Hypothesis) of twenty productive years(Laiopoulou, 1994; Martika et al, 1987).

The yield per tree ranged from 12.4 to 50 kg. In 1992 and 1993 production was influenced by late frost and in 1994 by hail. In 1992 too, weather conditions were rather adverse. Over the last three years, the selling price was around 100 Drs/kg.

Table 2 reports the production cost and the economic results of the period 1991-1994. Average figures for this period, as well as for the "fully productive" period 1992-94, upon which the comments on the results are based, are also included.

With respect to the variable capital needed, the average figure for the 1992-1994 period was 35,590 Drs/stremma (355,900 Drs/hectare), while the corresponding figure for the fixed capital was 41,200 Drs/stremma (412,000 Drs/hectare).

The average total production cost reached 174,370 Drs/stremma. Labour cost (corresponding to around 72,10 hours/stremma) account for 33%, fixed capital interest for 21%, consumable costs for 16%, other (transportation) for 5%, and rent for 5% (Figure 1).

The total average production for the 1992-94 period reached 2.16 tons/stemma while the total average production cost per kg was equal to 80.73 Drs.

The total average gross revenue for the same period was equal to 255,240 Drs/stemma. The economic results, therefore, showed, on average, a profit of around 80,870 Drs/stremma (around 37.4 Drs/kg or around 1,617.4 Drs/tree).

4. Conclusions

This paper presented the economic results of a kiwifruit farm, situated in Northern Greece, covering the period

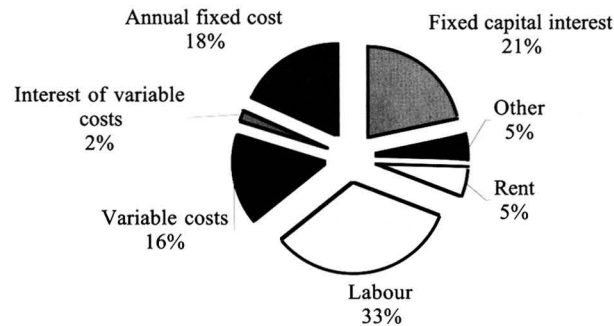Figure 1. *Contribution of the factors to the production cost*

Annual fixed cost 18%
Fixed capital interest 21%
Interest of variable costs 2%
Other 5%
Variable costs 16%
Rent 5%
Labour 33%

Table 2. *Economic results for the productive period (in 1995 values/ stremma)*

	1991	1992	1993	1994	1991-94 Average	1992-94 Average
I. Farm data						
1. Trees (number)	50,00	50,00	50,00	50,00	50,00	50,00
2. Labour (hours)	67.60	69.80	71.20	75.20	70.95	72.10
3. Variable capital ('000s)	34.47	45.69	30.72	30.35	35.30	35.59
4. Fixed capital ('000s)	58.89	51.34	37.44	34.80	4562	41.20
5. Production / tree (kg)	12.40	35.60	44.00	50.00	35.60	43.20
6. Production / stremma ......(tons)	0.62	1.78	2.20	2.50	1.78	2.16
7. Land value (000s)						280.00
II. Gross revenue ('000s)	133.56	233.66	254.88	277.22	224.80	255.24
III. Production costs ('000s)	EXPEN TO 20	SES PROD	TRAN UCTI	FORM VE YE	ED ARS	
1. Land rent	7.76	7.55	7.37	7.75	7.62	7.55
2. Labour	67.71	58.49	52.35	52.29	57.71	54.37
3. Consumable	34.47	45.69	30.72	30.35	35.30	35.59
4. Consuming capital ......interest	3.32	5.28	3.53	3.46	3.90	4.09
5. Annual fixed costs	10.87	18.88	27.93	41.16	24.71	29.32
6. Fixed capital interest	13.32	21.11	33.07	48.47	29.49	34.88
7. Other costs	6.52	8.24	8.60	8.86	8.05	8.57
Total	143.97	165.24	163.57	192.34	166.78	174.37
Economic results [1]						
IV. [1]Cost / Kgr	232.2	92.83	74.35	76.94	93.70	80.73
V. [2]Profit / stremma ....('000s)	-10.41	68.42	91.31	84.88	58.02	80.87
VI. [3]Net revenue ('000s)	13.99	102.36	135.28	144.56	99.03	127.39
VII. [4]Capital invested ('000s)	435.58	429.78	425.67	394.24	421.21	416.46
VIII. [5]Return of capital (%)	3.21	23.82	31.78	36.67	23.51	30.59
IX. [6]Farm income ('000s)	81.7	160.85	187.63	196.85	156.74	181.76

Note:
1.1 Total expenses/production per stremma
1.2 Gross revenue-Total production cost
1.3 Gross Income-Total Prod cost-Interest of capital(F + V)
1.4 Fixed + Variable capital + Land Value
1.5 (Net Revenue/Invested capital)x100
1.6 Profit + Rent + Labour + Inter of capital

their importance and the contribution of each one of these cost units to the total production cost.

The reason for undertaking this study was the need to examine closely the economic reality under which a grower has to operate and to establish the conditions influencing the profitability of a kiwifruit farm.

The current policy of encouraging the farmers to abandon other traditional crops in favour of kiwifruits has to be backed up by fully documented research, given the high degree of expectancy generated.

The exact evaluation of the production cost is something that was not, till now, attempted.

The tendency of the farmers in Greece not to include in the production cost the rent of the fields and the auxiliary facilities owned by them, as well as the cost of their own labour, accentuates the problem, blurring the results.

1987-1994. During the growth phases all established procedures with respect to soil fertilisation, pruning etc. of the trees were adhered to and followed.

As a result, uniformity with current practices was ensured, leading to a situation under which the factors influencing the quality of the fruit, and ultimately the selling price of the products, were, to a greater extent, controlled. This allowed us to concentrate on the aim of the study, which was the study of the uncontrollable factors, qualitative and quantitative, influencing the production cost of the farm.

The economic factors examined were: climatic conditions (hail, frost, winds), labour cost, fixed cost, fixed capital interest, consumable cost, consuming capital interest, land rent and other costs (transportation), so as to ascertain

According to the results of the analysis undertaken, the factors with the greater contribution to the total production cost are labour (33%) and fixed capital interest (21%). The fixed costs and consumable costs account for another 18% and 16% respectively. Transportation expenses to the co-operative unit, through which the products are sold, account for another 5%.

The average return of capital, though quite high (30.59%), was not as high as reported by other investigators conducting macro-economic surveys (Papanagiotou, 1990b).

As a general conclusion we can claim that, from a microeconomic point of view, the sector seems productive, showing normal economic results. These results can be further

improved if attention is paid, in addition to other factors not directly related to the ones this study was concerned with, to the fact that the product is very susceptible to climatic conditions and changes. Hail, as well frost, early and late, affect adversely both the quality, and thus selling price, and the quantity of the fruits produced.

This, in conjunction with the fact that early cultivars are needed in order to secure high prices in the market, leads one to the conclusion that construction of greenhouses could be a measure towards a solution to the problem. As an indication of the effect that favourable weather conditions can have on the production, it should be noted that during 1996 the production increased to 3 tonnes/stremma (30 tonnes/hectare). This is, therefore, where investment funds should be directed, alongside the initial installation phase during which the sector is very demanding in fixed capital.

The authors are currently collecting data, from the farm upon which this study was based, as well as from other farms, in order to re-examine, after a period of time, the economic results from both a micro and a macro economic point of view.

References

Blanchet, P., (1987). "*Management of irrigation, nutrition and crop protection as an adaptation to kiwifruit vine characteristics*", International Symposium on kiwi, 14-16 October, Abstracts, p.70, Padova, Italy

Buwalda, J.C., Smith, G.S., (1991). "*Influence of anions on the potassium status and productivity of kiwifruit vines*", Plant and Soil, Vol. 133, pp. 209-218

Cerpni, F.R., (1988). "*Costi di Produzione dell' Actinidia*", Frutticoltura, Vol. L, pp. 47-48, Bologna, Italy

EUROSTAT, (1993). Analytical Tables of International Trade, Vol. A

Koukourgiannis, V., (1994). "*The kiwifruit production in Greece*", Agriculture-Veterinary, Issue 5, pp. 38-42.

Koukourgiannis, V., Vasilakis, M., (1995). "*Kiwifruit production and research in Greece*", 3rd International Symposium on Kiwifruit, 19-22 September, Aristotle University of Thessaloniki, Greece

Laiopoulou, N., (1994). "*Qualitative and quantitative factors of processing cost of industrial tomato*", (Symposium) Sa-

vremena Poljoprivreda, vol. 42: 191-200, Novi-Sad.

Laiopoulou, N., (1995). "*Qualitative and Quantitative factors of Kiwifruit Cost Production*" (abstracts) 3rd International symposium on Kiwifruit, GSHS-ISHS-AUT. Thessaloniki.

Lallu, N., (1995). "*Physiological and economic analysis of precooling kiwifruit*", 3rd International Symposium on Kiwifruit, 19-22 September, Aristotle University of Thessaloniki, Greece

Lawes, G.S., (1995). "*Development of quality systems by horticulturists*", 3rd International Symposium on Kiwifruit, 19-22 September, Aristotle University of Thessaloniki, Greece

Mattas, K., Michaelidis, A., (1995). "*Export changes in kiwifruits: an E.U. perspective*", 3rd International Symposium on Kiwifruit, 19-22 September, Aristotle University of Thessaloniki, Greece

Ministry of Agriculture, (1986), P.D. 56/86, article 3, Gazette A 279-281

Martika, M., Mattas, K., Papanagiotou, E., Grafiadellis, M., 1987. "*Technical and economic comparison of various Heating systems applied in tomato Greenhouses*", Research Centre of Macedonia and Thrace, Greece.

Paloukis, S., Dinopoulos, O., (1989). "*Kiwifruits (phyto-cultivation, protection-trade)*", Thessaloniki, 1989.

Papanagiotou, E., (1990a). "*Dispersion possibilities of new production branches in Greek agriculture. The kiwi case*", Pan Hellenic Congress on Agricultural Economics, 23-24 November, Athens, Greece.

Papanagiotou, E., (1990b). "*Economical investigation of kiwi cultivation in Greece*", Magazine Geoponika, Vol.328, July-August 1990, pp. 116-121

Shien, Lee-Shu (Li Shuxuan), (1987). "*The resource and production of kiwi-fruit in China*", International Symposium on Kiwi, Padova, Italy, October 14-16, Abstracts, p.70

Velemis, D., Vasilakis, M., Manolakis, E., (1995). "*Effect of kiwifruit quality at harvest on storage performance*", 3rd International Symposium on Kiwifruit, 19-22 September, Aristotle University of Thessaloniki, Greece.