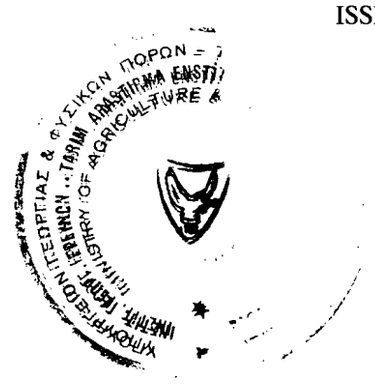
AGRICULTURAL ECONOMICS REPORT 17 ISSN 0379 - 0827



THE ECONOMICS OF GROUNDNUT PRODUCTION IN CYPRUS

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NICOSIA CYPRUS

JUNE 1987

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SUMMARY

This study was conducted in 1985 and covered 30 groundnut farms in 6 villages of the Paphos coastal plain. The mean operated land was 4.3 ha/farm of which 1.4 ha was under groundnuts. The majority of growers used mechanical sowing and harvesting, and chemical weed control. The labour requirements (500 h/ha) were covered by family labour (63%) and hired labour (37%). The most labour-intensive operations were hand weeding, accounting for 38% of the total labour, harvesting and pod cleaning with 38%, and irrigation with 19%. The average variable and total costs per ton of groundnuts were C£388 and C£576, respectively, and were inversely related to yield/ha. Gross revenue per ha averaged C£1689 and ranged between C£1128 and C£2386 among the different yield groups. Gross profit averaged C£776 and ranged between C£244 and C£1453/ha. Net profit, which was negative in the lower yield group, averaged C£131/ha. The break-even point occurred at 2495 kg/ha, and nearly two thirds of the growers were operating above it. The lowest cost point (point of intersection of the average total and marginal cost curves) was achieved at the level of 4400 kg/ha but only 10-15% of the growers were operating at that level. The level of profit maximization (point of intersection of marginal revenue and marginal cost curves) was 4760 kg/ha but none of the growers in the sample reached it. Productivity analysis based on the Cobb-Douglas production function indicated that the economic results could be improved if more capital could be substituted for labour (mainly chemical weedicides) and more land per farm could be under groundnuts. Due to the highly elastic demand further expansion is possible but overall production of groundnuts should not exceed demand because it will depress farmer's price and income. Proper development of the recently opened markets for selected, large-kernel roasted-and-salted groundnuts could provide a good outlet for quantities of up to 500 tons of pods.

ΠΕΡΙΛΗΨΗ

Η έκθεση αυτή βασίζεται σε μελέτη που έγινε το 1985 και κάλυψε 30 εκμεταλλεύσεις με φυστίκια σε 6 χωριά της επαρχίας Πάφου. Η μέση ολική έκταση των εκμεταλλεύσεων ήταν 4.3 εκτάρια (32 σκάλες) και η μέση έκταση με φυστίκια 1.4 εκτάρια (10.5 σκάλες). Η παραγωγή φυστικιών είναι σήμερα σε μεγάλο βαθμό εκμηχανισμένη με την πλειονότητα των παραγωγών να χρησιμοποιεί μηχανική σπορά (73%), μηχανική συγκομιδή και παλάρισμα σανού (90%), και χημική ζιζανιοκτονία (87%). Η απαιτούμενη εργασία, που κατά μέσον όρον ανέρχεται σε 500 ώρες το εκτάριο, καλύπτεται κατά 63% από οικογενειακή και 37% από μισθωτή εργασία. Οι καλλιεργητικές φροντίδες με τις μεγαλύτερες απαιτήσεις εργασίας είναι το ξεχόρτισμα (38%), συγκομιδή (38%) και άρδευση (19%). Η μέση ακαθάριστη πρόσοδος κατά εκτάριο ήταν K£1689 και κυμαινόταν από K£900 ως K£2620. Το μέσο ακαθάριστο κέρδος ήταν K£776 και κυμαινόταν από K£241 ως K£1706 το εκτάριο. Το μέσο καθαρό κέρδος, που στα κατώτερα επίπεδα παραγωγής ήταν αρνητικό, έφτασε στις K£131 το εκτάριο. Το μέσο μεταβλητό κόστος κατά τόννο φυστικιών ήταν K£338 ή 34 σ το κιλό, και το μέσο ολικό κόστος K£576 το τόννο ή 58 σ το κιλό. Το επίπεδο παραγωγής για πλήρη κάλυψη των δαπανών (μεταβλητών και σταθερών) αντιστοιχούσε με 2495 κιλά το εκτάριο και είχε επιτευχθεί από τα δύο τρίτα περίπου των παραγωγών. Το επίπεδο παραγωγής που παρουσίασε το χαμηλότερο κόστος κατά κιλό ήταν 4400 κιλά το εκτάριο και είχε επιτευχθεί από το 10-15% των παραγωγών. Το επίπεδο παραγωγής για μεγιστοποίηση του κέρδους αντιστοιχούσε με 4760 κιλά το εκτάριο αλλά κανένας παραγωγός στο δείγμα δεν πέτυχε την παραγωγή αυτή. Ανάλυση της παραγωγικότητας των συντελεστών παραγωγής έδειξε ότι τα οικονομικά αποτελέσματα μπορούν να βελτιωθούν αν υποκατασταθεί περισσότερη εργασία με κεφάλαιο (χημική ζιζανιοκτονία κ.λ.π.) και αν αυξηθεί η γη κατά εκμετάλλευση όχι όμως και η ολική έκταση που φυτεύεται με φυστίκια. Η ολική παραγωγή φυστικιών δεν πρέπει να ξεπερνά την ντόπια ζήτηση, η οποία φαίνεται να πλησιάζει το σημείο κορεσμού, διαφορετικά θα παρουσιαστούν προβλήματα διάθεσης και τόσο η τιμή παραγωγού όσο και το γεωργικό εισόδημα θα μειωθούν.

INTRODUCTION

Groundnuts have been traditionally grown on about 100 ha in the south coastal plain of Paphos. After 1974 the area under groundnuts increased to about 300 ha, but due to the large demand for labour, especially for weeding and harvesting, it did not increase further. In fact there was a contraction of the area under groundnuts in the period 1978-1980.

With the introduction of mechanical harvesting and chemical weedicides in the early 1980's the area under groundnuts started increasing again and by 1985 it reached about 900 ha. Production increased from 560 tons in 1976 to 2400 tons in 1985 and the value of production at current prices increased from about C£150,000 in 1976 to almost C£1.5 million in 1985 (Table 1).

THE DATA

The technical and economic data were obtained during 1985 from a sample of 30 groundnut farms from 6 villages (Kouklia, Akhelia, Ayia Varvara,

Timi, Yeroskipos and Peyia) of the Paphos coastal plain. The mean area of land grown with groundnuts per farm studied was 1.4 ha while the total area in the sample accounted for 4.7% of the total area under groundnuts, which is considered satisfactory for the purpose of this study. The analysis was carried out by yield group and for the whole sample and the results are presented in Tables 2 to 8. The yield groups used were: up to 2000, 2000-3000 and over 3000 kg/ha.

State of Technology

Groundnuts are grown under irrigation, using improved irrigation systems (80% of the growers in the sample used sprinkler irrigation and 20% mini-sprinkler systems). On the average 5430 m^3 of water per ha was applied (range 4750-10000 m^3/ha). About 73% of the growers in the sample used mechanical sowing and 90% used mechanical harvesting including hay baling. Both these operations are carried out on a contract basis. Harvesting losses due to mechanization were estimated at about 6% of the yield.

About 87% of the producers used pesticides, mainly acaricides and fungicides, with two applications on the average, and 22 growers or 73% of those sampled, used chemical weedicides. In addition to pre-emergence and post-emergence weedicides hand weeding was also employed. Hand weeding represented the most important labour operation taking up 192 h/ha or about 38% of the total labour requirements.

Application of fertilizers amounted to 117 kg of N, 53 kg of P, and 20 kg of K per ha. Only one grower reported the use of iron chelate although there are indications that under certain conditions its use significantly increases yields (ARI, 1987; Papastylianou, personal communication).

Farm Household Characteristics

Only one third of the operators were full-time farmers. The age of the farm household head averaged 40.5 years and ranged from 25 to 56 years. The operators of all farms studied had received full primary education (6 years), 7 completed secondary education (6 years) and 2 attended university classes. The average was 8.3 years of formal education. The family size of the farm households studied ranged between 1 and 8 persons with a mean of 3.6 persons. The mean values of the household characteristics by yield group and for the whole sample are shown in Table 2.

Factors of Production

Land. The operated land of the mean farm studied was 4.3 ha of which 1.4 ha (33%) was own land and 2.9 ha or 67% was rented-in land. The mean area of land under groundnuts was 1.4 ha and ranged from 1.0-1.7 ha per farm among the different yield groups.

Labour. The labour requirements for groundnut production were around 500 h/ha. About 63% of the labour needed was supplied by the farm family. The relatively high percentage of hired labour used was due to supplementary hand weeding in all the farms. Also, some of the work associated with harvesting was performed by experienced workers accompanying the harvesting machine which was used

Table 1. Area, production, imports and consumption of Groundnuts (1976-1985).

Year	Area (ha)	Production of pods (tons)	Producer's price (C£/ton)	Imports (tons)*	c.i.f. price (C£/ton)	Consumption(pods)	
						tons	kg/capita
1976	330	559	217	1340	167	1899	4.0
1977	300	508	295	1252	189	1760	3.7
1978	187	356	354	957	210	1313	2.7
1979	154	305	354	1673	209	1978	4.0
1980	147	305	394	1308	208	1613	3.2
1981	427	965	512	952	360	1917	3.7
1982	467	1219	512	877	314	2095	4.0
1983	507	1270	586	362	328	1632	3.0
1984	600	1665	654	425	424	2090	3.8
1985	887	2400	590	323	373	2723	4.9

* In pod equivalent, converted from groundnut kernels using the factor 0.6.

Source: Department of Statistics and Research, 1976-1980; 1981-1986; 1976-1986.

on 24 out of 30 groundnut farms. Family labour, hired labour and total labour requirements by operation are shown in Table 3.

Capital. The most important capital costs included the irrigation water, seed, fertilizers and chemicals. The material inputs used are shown in Table 4. Types and quantities of fertilizers and chemicals and frequency of use are shown in Tables 5 and 6, respectively. Another significant capital cost, i.e. machinery cost, is presented under custom work. This item includes also the reward of the operator and is a joint input of both capital and labour. Own machinery and custom work requirements by operation are presented in Table 7.

The main fixed capital item owned by all producers was the irrigation system, which was valued at C£1400/ha (80% sprinkler systems at C£1500/ha and 20% mini-sprinkler systems at C£1000/ha).

RESULTS AND DISCUSSION

Gross revenue. The gross revenue from groundnuts of the mean farm in the first yield group was C£1128 compared to C£1599 in the second and C£2386 per ha in the third group. The overall mean gross revenue was C£1689/ha of which 95% came from the pods and 5% from the plant tops made into hay. Mean pod yield for the three groups was 1816, 2586 and 3719 kg/ha, respectively, while the corresponding hay production was 100, 140 and 150 bales/ha. The overall mean yield was 2700 kg of pods and 140 bales of hay per ha.

Table 2. Family structure and farm size of groundnut producers by yield group.

	Yield group (kg of pods/ha)			
	up to 2000	2000-3000	over 3000	Average
Number of observations	7	15	8	30
Age of operator (years)	38.7	41.6	39.9	40.5
Education of operator (years)	9.0	7.2	9.6	8.3
Family size (number of persons)	2.7	4.3	3.3	3.6
Size of holding (ha)	5.3	4.5	3.2	4.3
Area under groundnuts (ha)	1.0	1.7	1.1	1.4
Labour requirements (h/ha)	455	508	512	500

Table 3. Labour requirements for groundnut production by operation (h/ha).

Operation	Number of observations	Times performed	Family labour M	Family labour F	Hired labour M	Hired labour F	Total labour M	Total labour F
Land cultivation	30	2-4	3	—	—	—	3	—
Seeding	30	1	3	2	—	5	3	7
Fertilizing	30	1-2	1	1	—	1	1	2
Pesticide application	26	1-2	2	—	—	—	2	—
Weedicide application	22	1-2						
Hand weeding	30	1-3	37	49	—	106	37	155
Irrigating	30	5-8	54	36	—	3	54	39
Harvesting	30	1	16	21	1	22	17	43
Cleaning	30	—	41	43	2	42	43	85
Other	30	—	3	3	—	3	3	6
Total labour			160	155	3	182	163	337

Table 4. Material inputs for groundnut production by yield group.

	Yield group			
	up to 2000	2000-3000	over 3000	Average
Number of observations	7	15	8	30
Area under groundnuts (ha)	1.0	1.7	1.1	1.4
Seed (kg/ha)	77	69	75	72
Water (m^3/ha)	4950	5710	4990	5430
N (kg/ha)	140	96	145	117
P (kg/ha)	55	43	72	53
K (kg/ha)	20	18	23	20
Weedicides (C£/ha)	33	34	56	39
Pesticides (C£/ha)	22	15	21	18

Table 5. Types and quantities of fertilizers used in groundnut production.

Type of fertilizer	Number of users	Quantity	N	P	K
		----------	kg/ha		----------
26-0-0	13	95	25	—	—
46-0-0	8	38	17	—	—
21-0-0	7	50	11	—	—
0-48-0	7	70	—	15	—
0-0-52	2	15	—	—	7
16-20-0	16	245	39	21	—
14-22-9	9	176	25	17	13
Total	30		117	53	20

Table 6. Types and quantities of chemicals used in groundnut production.

	Number of users	Number of applications	Quantity of chemicals: Actual dose	Quantity of chemicals: Statistical mean
			--------L or kg/ha--------	
Weedicides				
Linuron (Afalon)	5	1-2	2.3	0.8
Alachlor (Lasso)	6	1	5.3	0.8
Dinoseb + Naptalam (Dyanap)	6	1	12.8	2.3
Fluaziprop-butyl (Fusilade)	3	1	4.5	0.3
Pendimethalin (Stomp)	1	1	4.5	0.1
Bentazon (Basagran)	2	1-2	3.0	0.1
Pesticides				
Dicofol (dust) (Akarol)	10	2	41.3	21.0
Dicofol (w.p.) (Acarin)	6	2	3.8	0.8
Pirimicarb (Pirimor)	3	1-2	0.6	0.3
Parathion	2	1-2	2.3	0.2
Cypermethrin (Cymbush)	2	1	1.5	0.1
Amitraz (Mitac)	2	1	6.0	0.3
Other	6	1	—	—

Table 7. Own machinery and custom work requirements for groundnut production by operation.

Operation	Times performed	Own machinery		Custom work	
		Number of observations	h/ha	Number of observations	C£/ha
Land cultivation	2-4	9	3	21	52
Sowing	1	8	1	22	22*
Fertilizing	1	2	1	10	3
Weedicide application	1-2	8	} 1	14	7
Chemical application	1-2	16		11	5
Harvesting	1	6	2	24	138**
Other	—	30	2	—	—
Total requirements/ha			10		227

* Mechanical sowing rate C£37/ha.

** Custom work for harvesting includes the following operations: Lifting C£30/ha, combining C£75/ha, baling C£20/ha and transport C£20/ha.

Variable costs. The variable costs for the three groups were C£884, C£914 and C£933 per ha. This indicates that expenses on production inputs are about the same in all the farms studied, and therefore the final yield level achieved is decided also by other factors such as microclimate and soil suitability. The main items contributing to total variable costs were: custom work (25%), irrigation (24%), hired labour (17%), seed (16%), and fertilizers and chemicals (14%). Variable costs per ton of pods was C£338 or 0.34 C£/kg with a range of 0.25-0.49 C£/kg among the different yield groups.

Fixed costs. Fixed costs of the average farm were C£645/ha with a range of C£630 - C£683 in the different yield groups. The family labour countribution was more than 50%. Another 35% of the fixed cost was taken up by interest and depreciation of the irrigation system, and the remaining 15% by imputed rent of land, and general costs.

Total costs. Total costs include both variable and fixed costs and amounted to C£1558/ha in the mean farm. The respective values for the three yield groups were C£1518, C£1544 and C£1616 per ha. Total cost per ton of pods was C£576 or 0.58 C£/kg and ranged between 0.43 and 0.84 C£/kg among the different yield groups.

Gross profit. Gross profit was in all groups positive and increased from C£244/ha in the first group to C£685 in the second and to C£1453 in the third group. Overall average gross profit was C£776/ha.

Net profit. Farmers in the lower-yield group suffered a loss of C£390/ha. However, as gross profit was positive, the sustained loss was in the form of underpayment of own productive resources mainly labour and land. Net profit in the other two groups was C£55 and C£770, respectively, and C£131 per ha for the average farm (Table 8).

Relation of Yield to Economic Results

Regression analysis was carried out for best fit relationship between yield, which was used as the independent variable, and the different economic parameters, used as dependent variables. Equations 1 to 5 show the relationship between gross revenue (GR), variable costs (VC), total costs (TC), gross margin (GM), and net profit (NP), on the one hand, and yield (Yd) on the other.

$$GR = 10.26 + 0.611\ Yd \quad R^2=0.974 \quad (1)$$

$$VC = 752.41 + 0.057\ Yd \quad R^2=0.005 \quad (2)$$

$$TC = 1342.49 + 0.077\ Yd \quad R^2=0.027 \quad (3)$$

$$GM = -742.15 + 0.554\ Yd \quad R^2=0.741 \quad (4)$$

$$NP = -1332.24 + 0.534\ Yd \quad R^2=0.666 \quad (5)$$

In the above equations the coefficients are highly significant (at the 99% level) except in equations 2 and 3 where the level of significance is 70% and 80%, respectively. The R^2_s indicate that yields are not significantly related to quantifiable inputs. This is quite common in agriculture where production conditions cannot be controlled to any great extent. The farmers usually apply the required inputs, but the actual yield depends in addition on soil characteristics, weather conditions during critical phases of the productive cycle, pest epidemics and other factors which are difficult to control.

The lines for variable cost, total cost and gross revenue per ha are shown in Figure 1. The point of intersection of the lines for gross revenue and total cost gives the break-even point. This point denotes the level of yield at which all factors employed re-

Table 8. Costs and returns per ha of groundnuts by yield group.

	Yield group (kg/ha)			
	Up to 2000	2000-3000	over 3000	Average
Number of observations	7	15	8	30
Mean area (ha)	1.0	1.7	1.1	1.4
Yield 1. Nuts (kg/ha)	1816	2586	3719	2700
Price (C£/kg)	0.59	0.59	0.62	0.60
2. Hay (bales/ha)	100	140	150	140
Price (C£/bale)	0.57	0.52	0.53	0.55
A. GROSS REVENUE (C£)	1128	1599	2386	1689
Variable costs (C£)				
Seed	152	142	144	144
Fertilizers	86	52	98	68
Chemicals	55	50	77	57
Irrigation	198	229	199	217
Custom work	180	228	260	227
Machinery cost	6	3	4	4
Hired labour	171	171	112	158
Other	17	19	18	18
Interest on operating capital	19	20	21	20
B. TOTAL VARIABLE COSTS (C£)	884	914	933	913
C. GROSS PROFIT (C£)	244	685	1453	776
Fixed costs (C£)				
Rent ol land	108	90	82	91
Family labour	278	318	398	328
Interest and depreciation*	240	214	193	218
General costs	8	8	10	8
D. TOTAL FIXED COSTS (C£)	634	630	683	645
E. TOTAL COSTS (B+D) (C£)	1518	1544	1616	1558
F. NET PROFIT (C£)	-390	55	770	131
G. Variable cost per ton (C£)	487	353	251	338
H. Total cost per ton (C£)	836	597	434	576

* Interest and depreciation refers mainly to the irrigation system which costs £1400/ha (80% sprinkler system x £1500/ha and 20% mini-sprinkler system x £1000/ha) and will be depreciated in 10 years at 9% interest.

ceive full payment for their participation in the production process. The break-even point was 2495 kg/ha, and about two thirds of the growers were operating above this point.

The implications from this analysis are that in the long-run all growers must operate at or above the break-even point in order to continue producing. In the short-run, however, it is possible for a grower to continue producing even below the break-even point provided he is covering his variable costs. In this case all groundnut producers had positive gross profits (Table 8), i.e. they covered their variable costs.

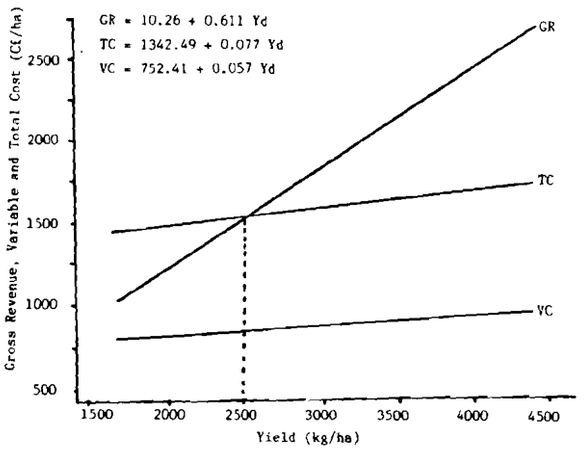


Figure 1. Relationship between Yield (Yd), Gross Revenue (GR), Variable Cost (VC) and Total Cost (TC) per ha.

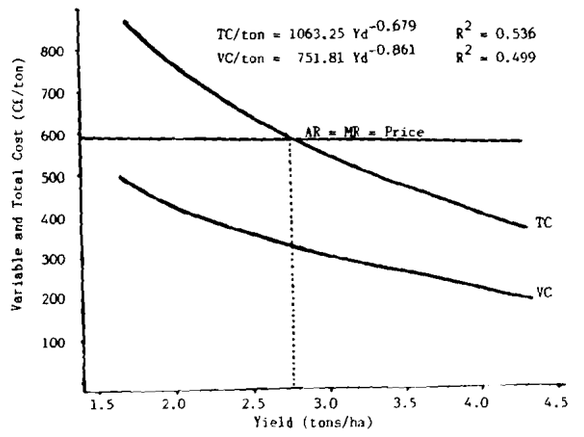


Figure 2. Relationship between Yield (Yd), Variable Cost (VC) and Total Cost (TC) per ton.

Justification for this behaviour lies in the expectation for better prices and/or higher yields in the future (Tomek and Robinson, 1972; Watson, 1972; Shepherd, 1963).

Variable cost and total cost per ton of groundnuts are given in Figure 2. The curves are exhibiting downward slopes, because the higher the yield the lower the cost per unit of output, with coefficients significant at the 99% level of probability.

The average total cost curve (ATC) per ton of pods together with the marginal cost curve (MC), which was derived from the total cost equation, are shown in Figure 3. The average revenue, which in perfect competition coincides with marginal revenue and price, is depicted by line AR=MR=Price. The point of intersection of the ATC and MC curves gives the level of production which incurs the lowest cost per unit of product. The lowest cost point is achieved at the level of 4.4 tons/ha. Presently only about 15% of the growers in the sample are operating at this point. According to the theory of production, the groundnut growers will maximize their profits if they equate their marginal cost with their marginal revenue which, in this case, coincides with the going price of pods. The level of production that maximizes profit (Ferguson and Gould, 1975; Panayiotou, 1980) is 4.76 tons/ha but none of the growers in the sample is presently operating at this level.

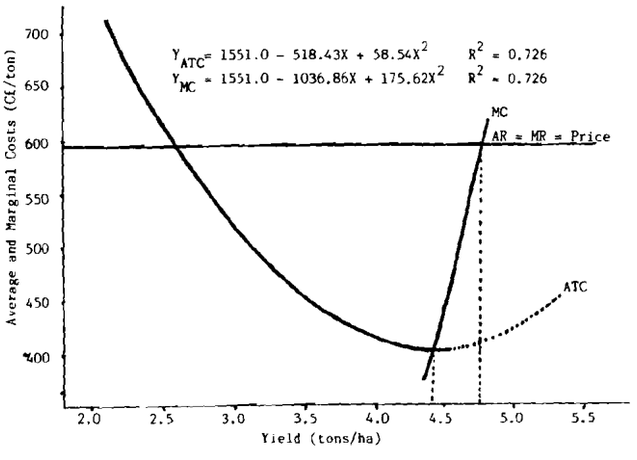


Figure 3. Relationship between Yield per hectare and production costs and revennes per ton of groundnuts.

Production Functions and Resource Productivity

The purpose of the marginal productivity analysis is to show: a) the contribution of each factor of production to the total product, b) the economic utilization of the factors available by taking into consideration the ratio between productivity and opportunity cost (factor prices), and c) the substitution of a production factor by another leading to cost reduction (Heady and Dillon, 1969).

The analysis was carried out using the Cobb-Douglas production function. Equation 6 (estimated by the least squares method) had the best fit and, therefore, it was used for the productivity analysis.

$$Y_{GR}=1.27\ X_1^{0.132}\ X_2^{0.253}\ X_3^{0.716} \qquad R^2=0.782 \quad (6)$$
$$(0.37)\quad (1.56)\quad (1.93)$$

Y_{GR} represents the gross revenue per annum in C£, and X_1, X_2, X_3 represent the annual cost of land (rent), labour and capital, respectively. The coefficient of each independent variable is the production elasticity and indicates the expected increase (or decrease) of output that would occur if the amount of the input resource was increased (or decreased) by one percent, other input levels being held constant. The elasticities of labour and capital are significant at the 90% level of probability but that of land is not significantly different from zero. The variation of output explained by the independent variables, as indicated by the R^2, is 78%. The Cobb-Douglas function is mainly used to estimate marginal value productivities for mean input of resources, which may then be used to indicate whether there is a disequilibrium in resource use. The marginal value product for each factor was calculated from equation 7, where V represents the value of output, $\bar{X}i$ the different inputs at mean level and bi the production elasticity (Heady and Dillon, 1969).

$$\frac{V}{X_i}=\frac{b_i}{\bar{X}_i}\ V \qquad (7)$$

The marginal value products for land, labour and capital, estimated at the geometric mean input level, together with the opportunity cost (going price), and the marginal return to opportunity cost ratio, are shown in Table 9. The marginal value product of an input decreases with increasing quantities used when quantities of other inputs are held constant. According to the economic theory of production, profit maximization is attained when all factors of production are used up to the point where their marginal value product equals their cost. The marginal value product of land was C£202/ha compared to a rent rate of C£131/ha, which means that the producers can increase their profits if they employ more land per farm in the production of groundnuts. The fact, however, that the coefficient for land is not statistically significant indicates that this suggestion should be taken with caution. The marginal value products of labour and capital were C£6.93/day and C£1.20/C£ respectively, compared to a wage rate of C£8/day and an interest rate of 9%. The marginal return to opportunity cost ratio for labour was less than unity, which means that too much labour was used while capital input could increase further. Although there has been rapid mechanization of groundnut production in the last few years, with the introduction of the harvesting machine in the early 1980's, it seems that further mechanization or capital intensification is needed to replace low productivity labour. Thus hand weeding, which takes up 38% of total labour used, could easily be substituted by weedicide application. The marginal rate of substitution of capital for labour shows the decrease in total costs by substituting a C£'s worth of capital for labour when output is held constant, and is given by equation 8 where b_1 and b_2 are the production elasticities of labour and capital, X_L and X_k are the quantities of labour and capital in C£, and W and r are the opportunity costs of labour/h and capital. The marginal rate of substitution of capital for labour in groundnut production is C£1.30/C£ which means that for every C£'s worth of capital substituted for labour there is a C£0.30 decrease in costs (Ferguson and Gould, 1975).

$$MRS_{k \text{ for } L}=\frac{b_2 X_L}{b_1 X_k}\cdot\frac{W}{r} \qquad (8)$$

Table 9. Elasticities of production, marginal value products and opportunity costs for inputs used in groundnut production.

Inputs	Production elasticity	Marginal value product	Opportunity cost	Ratio of marginal return to opportunity cost
Land	0.132	C£202.4/ha	C£131.0/ha	1.54
Labour	0.253	C£6.93/day	C£8.0/day	0.87
Capital	0.716	C£1.20/C£	C£1.09/C£	1.10

Demand Analysis and Marketing Prospects

As mentioned earlier, the area under groundnut production increased from about 300 ha in 1976 to almost 900 ha in 1985 and the output of pods increased by more than four times. This was promoted by the introduction of mechanical harvesting in the early 1980's. The productivity analysis suggests further expansion of the groundnut area per farm and further capital intensification in the production process, e.g. by substituting chemical weed control for handweeding. However, the overall future expansion of groundnut production is limited by the small size of the local market which is rapidly approaching the point of saturation. The annual consumption of groundnuts in the last ten years has been fluctuating around 2000 tons with local production substituting increasing quantities of imports after 1980 (Table 1). In 1985, however, apparent consumption increased substantially but it is believed that most of the extra quantities went into stocks rather than direct consumption. This is further supported by the preliminary data for 1986 which show that no imports were made in that year even though local production was considerably lower than in 1985.

With the international prices of groundnut kernels at about the price of locally produced pods (about 60% lower than the locally produced equivalent) it appears that there is no possibility of exporting any appreciable quantities of goundnuts unless there is a major cut in production costs. For the same reason there is no possibility for substituting imports of groundnut oil with oil produced from locally grown nuts. In the foreseeable future, therefore, local production and consumption of groundnut pods is expected to stabilize at around 2500 tons annually.

Demand analysis based on prices, consumption and disposable income for the period 1970-1985 was carried out using the following set of linear equations:

$$P_r = b_0 + b_1 Q + b_2 Y \quad \text{(retail level)}$$
$$P_f = a_0 + a_1 Q + a_2 Y \quad \text{(farm level)} \qquad (9)$$

where P_r and P_f represent the expected retail and farm price, Q the per capita consumption of groundnuts and Y the per capita disposable income.

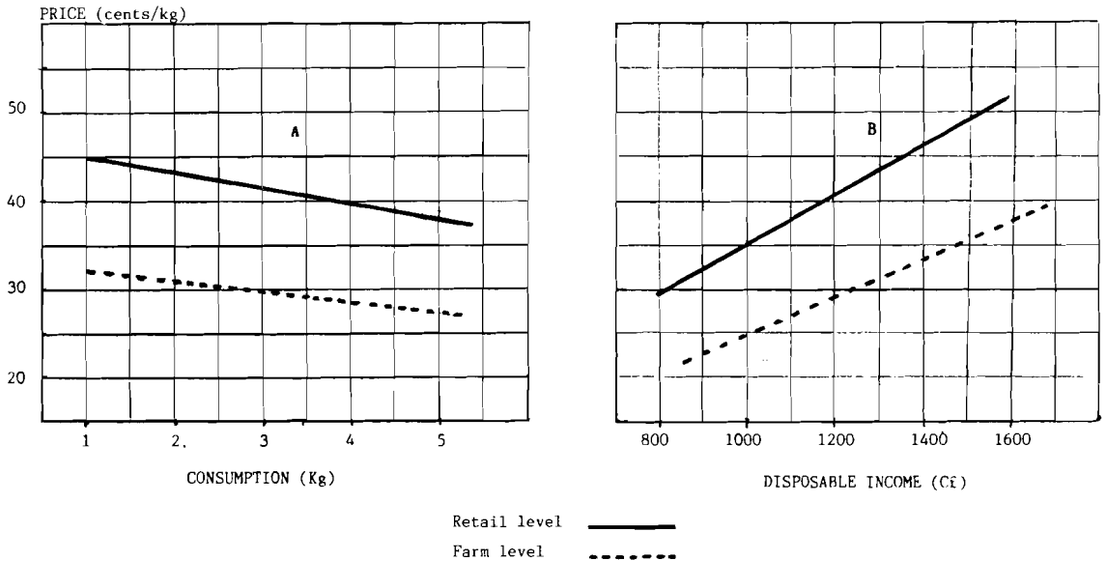
The elasticity of expected retail or farm gate price with respect to quantity, when income is held constant at the mean, is called price flexibility with respect to quantity ($F_{rq.y}$; $F_{fq.y}$) and is negative and much below unity (Figure 4). Since the reciprocal of price flexibility under certain conditions represents price elasticity of demand it is concluded that groundnuts in Cyprus are facing a very elastic market demand. This means that there is room for increased demand, and therefore production, if the price is reduced by only a small percentage.

The elasticity of expected price with respect to income, when quantity is held constant at the mean, is called price flexibility with respect to income ($F_{ry.q}$; $F_{fy.q}$) and is positive and below unity (Figure 4). The income elasticity of demand (reciprocal of flexibility) is positive and above unity meaning (Waugh, 1964; Panayiotou, 1983) that for every one per cent increase of the disposable income there will be a larger than one per cent increase in the demand for groundnuts at the going price.

The closeness of the price flexibilities at the retail and the farm level indicates that the farm-to-retail spread (marketing margin) is very near to a constant

percentage of the retail price. Since imported groundnut kernels are very close substitutes to local groundnut pods a separate analysis was carried out in order to decide how these imports and disposable income affect the price of locally produced nuts. As shown in equation 10, the expected price of local nuts (Pe) is inversely related to quantities of both local (Qe) and imported (Qi) nuts demanded and directly related to the disposable income (Y). More specifically, the corresponding elasticities (η) suggest that for every 1% increase in the demand for local or imported groundnuts there will be a decrease in price of only about 0.1% and for every 1% increase of the disposable income there will be an increase of 0.6% in the price of nuts. These results indicate a highly elastic demand for local groundnuts.

The regression coefficients, and therefore the elasticities, are statistically significant and the signs of the coefficients are consistent with the laws of supply and demand. The expected demand for locally grown nuts (Qe) is inversely related to the price of local (Pe) and quantities of imported (Qi) nuts and directly related to the price of imported nuts (Pi) and disposable income (Y) (equation 11). The corresponding elasticities (η) indicate that for every 1% increase/decrease in the price of local nuts there will be a 3.1% decrease/increase of the quantity demanded (own-price elasticity), and for every 1% change in the price of imported nuts and disposable income there will be a 2.6% and 2.3% change of the demand in the same direction (cross-price and income elasticity, respectively). Finally for every 1% increase/decrease of the quantity of imported nuts



Regression equations

$\hat{P}_r = 13.18 - 1.74Q + 0.0276Y$ (0.73) (5.14) $\quad R^2 = 0.721$

$\hat{P}_f = 7.76 - 1.24Q + 0.0211Y$ (0.66) (5.00) $\quad R^2 = 0.712$

$S = 5.42 - 0.50Q + 0.0065Y$

Price Flexibility with respect to

	Quantity	Income
$\hat{P}_r$	$F_{rq.y} = -0.132$	$F_{ry.q} = 0.813$
$\hat{P}_f$	$F_{fq.y} = -0.151$	$F_{fy.q} = 0.868$

Means: $\bar{P}_r = 41.38$ $\quad \bar{P}_f = 29.63$ $\quad \bar{S} = 11.75$ $\quad \bar{Q} = 3.14$ $\quad \bar{Y} = 1218.63$

Figure 4. Price related to consumption per capita (A) and disposable income per capita (B) at retail and farm level.

$$P_e = 28.04 - 3.99Q_e - 2.43Q_i + 0.026Y \qquad R^2 = 0.769$$
$$(1.78) \quad (1.61) \quad (5.17) \qquad (10)$$

$$\eta = \frac{\partial P_i}{\partial Q_j} \cdot \frac{Q_j}{P_i} : \quad -0.101 \quad -0.087 \quad 0.632$$

$$Q_e = -0.21 - 0.078P_e + 0.104P_i + 0.0024Y - 0.464Q_i$$
$$(3.45) \quad (3.42) \quad (5.02) \quad (4.89) \quad (11)$$
$$R^2 = 0.895$$

$$\eta = \frac{\partial Q_i}{\partial P_j} \cdot \frac{P_j}{Q_i} : \quad -3.078 \quad 2.602 \quad 2.285 \quad -0.656$$

there will be a 0.7% decrease/increase in the demand for local nuts. The magnitude of the elasticities indicates that local groundnuts are facing a highly elastic demand and that they are considered superior to imported groundnuts.

The regression coefficients, and therefore the elasticities, are statistically significant at the 99% level. The signs of the coefficients and the direction of change are consistent with economic theory. It is evident that there is room for small increases in the production of local groundnuts due mainly to the highly elastic demand which will allow some expansion without serious downward pressure on prices. If, however, production increases substantially without a parallel increase in demand it will depress price and reduce producer's income.

Recent developments appear to create some possibilities for increased demand for Cyprus groundnuts. In 1986 100 tons of pods were exported to Belgium and exports of roasted nuts and pods are under way to Arab countries. This shows that, despite the price differential against them, Cypriot groundnuts enjoy a certain amount of consumer's preference due to their high quality, their large kernels and their good taste. It seems that proper development of this market, by maintaining quality and organizing supply on a regular, long-term basis, can provide a good outlet for an additional quantity of up to 500 tons annually. From the production point of view efforts should be made to increase the proportion of large kernels by using suitable varieties and improved farming practices.

ACKNOWLEDGEMENTS

The author thanks Mr. S. Papachristodoulou for valuable help and constructive comments on the form and contents of this report, Mr. J. Loizou and Mr. K. Charalambous for collecting and processing the data, Mrs Elli Photiou for assistance with the computer analysis, and Miss Skevoulla Philippou for typing the report. He also wishes to thank all the producers in the sample for their cooperation.

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Issued by the Press and Information Office, Nicosia

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