Economics of Cotton Pickers in Greece

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Abstract

This paper illustrates the economics of cotton pickers according to their productive life with and without capital borrowing and with and without subsidies. The necessary physical and economic data used in this investigation came from the accounting books of cotton producer groups operating 62 cotton pickers for the period 1983 - 2002. The comparative analysis of these data showed that the acquisition and the operation of a cotton picker without subsidies is unprofitable, irrespective of its productive life. When 50% of the capital needed for acquisition of this machine comes from subsidies and the rest is borrowed, its profitability is improved and the most profitable productive life is 15 years. In contrast, when the initial value of the machine is covered 50% by subsidies and 50% by the group owners, the most profitable productive life falls to 10 years. These results prove that the E.U. was right when it passed Regulation 389/82 to allow cotton pickers' subsidies up to 50% of their initial value. They also show that their profitable productive life fluctuates between 10 and 15 years under Greek conditions. The above mentioned results can prove to be useful both for the cotton picker owners and for the policy makers of cotton growing and manufacturing, one of the most significant production sectors of the country's economy.

Résumé

Dans ce travail, on passe en revue les aspects économiques relatifs aux cueilleuses de coton, compte tenu de leur vie productive, avec et sans emprunt de capital et avec et sans subventions. Les données physiques et économiques utilisées dans cette recherché ont été tirées des livres comptables des groupes de producteurs de coton qui ont employé des cueilleuses entre 1983 et 2002. L'analyse comparative de ces données a mis en évidence que l'acquisition et l'utilisation d'une cueilleuse de coton sans subventions ne sont pas rentables, indépendamment de sa vie productive. Lorsque 50% du capital nécessaire pour l'acquisition de cette machine dérive des subventions et le reste est emprunté, sa rentabilité s'accroît et la vie productive la plus rentable est de 15 ans. Par contre, si la valeur initiale de la machine est couverte à 50% par les subventions et à 50% par les groupes de propriétaires, la vie productive la plus rentable descend à 10 ans. Ces résultats montrent le bien-fondé du Règlement européen 389/82 qui établit la possibilité de recevoir des subventions pour les cueilleuses de coton jusqu'à 50% de leur valeur initiale. En plus, ils indiquent que la vie productive rentable varie de 10 à 15 ans dans les conditions grecques. Ces même résultats peuvent s'avérer d'une très grande utilité aussi bien pour les propriétaires des cueilleuses que pour les décideurs qui oeuvrent dans le cadre de la culture et de la transformation du coton, l'un des secteurs les plus significatifs dans la production et l'économie du pays.

1. Introduction

There is no doubt that the introduction of cotton pickers in Greece not only stabilized the existing cotton area, but also had a significant effect upon its expansion. Indeed cotton pickers have substantially contributed to the increase in the country's cotton growing area from 130,000 hectares in the 60's to 450,000 hectares in the 90's and the cotton production from 410,000 tons to 1,355,500 tons respectively, especially when cotton prices were higher compared with those of other agricultural products (Mygdakos, 1982; Hellenic Cotton Board, 1999). The first cotton pickers which were imported into Greece in 1963 were purchased by large farm producers, who had the financial ability and the sufficient area to employ a cotton harvesting machine to its full capacity and to benefit from a cost reduction.

On the contrary, small farm producers were hesitant about purchasing cotton pickers, because of their high initial value, their inability to use them economically and their impression that the machines caused vast cotton losses in the process of harvesting, eliminating even more their anyway limited yield. In order to overcome the problem of small holdings and the high value of the machines, the Hellenic Cotton Board introduced, on the one hand, the institution of the informal cotton groups and, on the other, a financial support program to help cotton groups buying their machines.

The shortage of farm labor and the increase in labor wages during the '60s and '70s resulted in a vast increase in cotton pickers from 52, in 1971, to 982 in 1981 mainly through the institution of the informal cotton groups. This institution laid the bases upon which EU Regulation 389/82 on "Cotton Producer Groups and their Unions" was later built and upon which the two special Sectional Cotton Programs concerning cotton growing in Greece were established (Mygdakos and Kouloulas, 1982; Sitras and Avgoula, 1986). According to this Regulation, cotton pickers bought by producer groups were subsidized up to 50% of their initial value. Based on the above Regulation and the two Programs, the number of machines purchased reached up to 2,000 by 1995, while today it exceeds 3,100 machines, contributing substantially to the increase in the mechanical cotton harvesting area up to 98%.

From the above it is easily understood that cotton pickers solved the problem of cotton picking, but they raised the

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question whether they contributed to the increase in cotton growing profitability. Taking into account the above question, we carried out the present research for the purpose of estimating the cotton pickers profitability according to their productive life under various sources of capital needed to acquire these machines.

2. Material and Methods

The physical and economic data of this investigation come from a sample of 62 cotton pickers and especially from the accounting books of the cotton producer groups, which operate them and from the leaders of these groups through the use of a special questionnaire. These data refer to the period 1983-2002 and are: the annual operation of cotton pickers in working hours and in number of hectares harvested, the harvesting charge per hectare (including the wages of the machine operator), the annual expenses of fuels and lubricants, the insurance for the operator and the machine, the annuity or the annual depreciation, maintenance and interest of machine, and the annual expenses of machine sheltering.

The depreciation was estimated indirectly through the scrap value, year by year, of 45 cotton pickers sold at various ages and the following equation was derived from the statistical analysis of the aforementioned cotton pickers:

$$Y = e^{-0.506\,0.0686X} \quad (1)$$

where:

Y = percentage on the initial value of the machine and
X = age of machine in years.

Taking into account the fact that annual expenses of repair and maintenance of machines present an abnormal evolution according to their productive life, we analyzed statistically these expenses and determined the following equation:

$$Z = 161.46 + 319.36X - 33.71X^2 + 1.27X^3 \quad (2)$$

where:

Z = annual expenses of repair and maintenance of machines and
X = age of machines in years.

The physical and economic data of the 62 cotton pickers were analyzed according to their productive life (10, 15 and 20 years) and three different sources of capital for the machine acquisition (e.g. the total capital comes exclusively from borrowing, the total capital comes 50% from subsidies and 50% from borrowing, and the total capital comes 50% from subsidies and 50% from own capital).

The above comparative analysis is based on the following equations for estimating gross return, total costs, total profit or loss and cost per hectare and hour in standard prices:

$$GRi \rightarrow = \sum_{i=1}^{n} (XiYi) \quad (3)$$

where:

GR =gross return,
Xi = number of hectares harvested,
Yi = harvesting charge per hectare, and
n = productive life of a cotton picker in years.

$$TCi \rightarrow n = \sum_{i=1}^{n} (LWi + RMi + FLi + OTi) \quad (4)$$

where:

TC = total cost, LW = labour wages,
RM = repair, maintenance, insurance and interest,
FL = fuels and lubricants, and
OT = other expenses.

$$TCi \rightarrow n = \sum_{i=1}^{n} (LWi + RMi + FLi + OTi)$$

where:

PR = total profit or loss.

$$Ci = \frac{TCi}{Xi} \quad (6)$$

where:

Ci = average cost per hectare.

The necessary physical and economic data of cotton pickers for estimating various economic results according to their productive life are given in table1. In this table the total working hours of the machine for a period of 10 years are 3,340 or 334 per year, for a period of 15 years they are equal to 4,864 or 324 per year, and for 20 years they amount to 6,380 or 319 hours per year. The same is also observed for the total (1,043, 1,564 and 2,056 hectares respectively) and the annual (104.3, 104.2 and 102.8 hectares respectively) area harvested. This gradual decrease in the annual working hours and the annual hectares harvested according to the machine's productive life can be attributed to its age as well as to the increased number in the cotton pickers in the region year by year.

The average deflationary harvesting charge of the machine per hectare (39.5, 36.8, 34.4 €) is continually being decreased from 10 to 15 and 20 years of the machine's life. This means that the harvesting charge rate increased to a

Tab. 1. *Physical and economic data of cotton pickers according to their productive life*

Physical and economic data	Productive life in years		
	10	15	20
Total harvesting hours	3,340	4,864	6,380
Harvesting hours per year	334	324	319
Total area harvested (ha)	1,043	1,564	2,056
Area harvested annually (ha)	104.3	104.2	102.8
Average harvesting charge (€/ha)	39.5	36.8	34.4
Repair & maintenance (€/year)	990	1,147	1,308
Fuels & lubricants (€/hectare)	6.46	6.79	7.32
Fuels & lubricants (€/hour)	2.02	2.18	2.36

lower rate than the inflation rate during the period 1983 - 2002 and it is mainly due to competition among cotton pickers. The annual repair and maintenance costs show a continuous increase from 10 to 15 and 20 years (990 €, 1,147 € and 1,308 € respectively). This is considered to be a normal consequence attributed to the machine age and usage and is consistent with the findings of other studies carried out in the United States of America and elsewhere (Bowers, 1970, Boyce et al., 1976, Mygdakos and Gemtos 1995, Bukhari et al., 1987, Morris, 1988, Hunt, 2001).

The fuel and lubricant expenses are given only in euro per hectare and per hour because there are not available data in quantities. Fuel and lubricant prices have shown considerable fluctuations during the period 1983 - 2002 and were very difficult to be manipulated. In particular, the fuel and lubricants expenses exhibit a continuing increase according to the age of the machine both per hectare (6.46, 6.79 and 7.32 € respectively) and per hour (2.02, 2.18 and 2.36 € respectively).

3. Results and Discussion

3.1 Returns, costs and profits of a cotton picker acquired completely by capital borrowing according to its productive life

Table 2 includes the returns, costs and profits of a cotton picker completely purchased by borrowing an amount of 19,000 € (1983 initial value) for a period of seven years at an interest rate of 15% and for a productive life of 10, 15 and 20 years. More specifically, the gross return from the harvesting charge amounts to 41,218 € for 10 years, 57,539 € for 15 years and 70,825 € for 20 years. By inspecting the total expenses, it is easy to understand that the most significant expenditure is the annuity, representing a proportion of 59, 50 and 44% for 10, 15 and 20 years of productive life, followed by repair and maintenance (15.9, 21,5 and 25.8% respectively), fuel and lubricants (10.8, 13.3 and 14.9% respectively) and the operator's wages (7.9, 8.4, 8.6% respectively). Indeed, the initial loan of 19,000 € turns into 36,756 € in 10 years, 40,037 € in 15 years and 44,268 € in 20 years. The total expenses of the machine (62,182, 80,016 and 101,215 € respectively) compared with the total hectares harvested (1,043, 1,564, and 2,056 respectively) and the total harvesting hours (3,340, 4,864 and 6,380) show that the cost per hectare is 59.62, 51.16 and 49.23 €, while the cost per hour is 18.62, 16.45 and 15.87 €, namely it decreases according to its productive life.

Tab. 2. *Returns, costs and profits of a cotton picker completely purchased by capital borrowing at 15 percent interest rate for 7 years according to its productive life*

Returns, costs and profits	Productive life in years		
	10	15	20
I Gross returns (€)	41,218	57,539	70,825
II. Production expenses			
Operator wages (€)	4,905	6,694	8,690
Operator insurance (€)	249	429	645
Machine insurance (€)	1,458	1,746	2,024
Fuels & lubricants (€)	6,734	10,618	15,044
Annuity (€)	36,756	40,037	44,268
Repair & maintenance (€)	9,900	17,212	26,153
Sheltering annual expenses(€)	2,054	3,081	4,109
Operating capital interest (€)	126	199	82
Total expenses(€)	62,182	80,016	101,215
III. Average cost (€/ha)	59.62	51.16	49.23
" " (€/ha)	18.62	16.45	15.87
IV. Total profit or loss (€)	-20,964	-22,477	-30,390
Average profit or loss (€/ha)	-20.1	-14.4	-14.8

Tab. 3. *Returns, costs and profits of a cotton picker acquired by borrowing capital (50 % at 15% interest rate for 7 years) and subsidies (50 %) according to its productive life*

Returns, costs and profits	Productive life in years		
	10	15	20
I. Gross returns (€)	41,218	57,539	70,825
II. Production expenses			
Operator wages (€)	4,905	6,694	8,690
Operator insurance (€)	249	429	645
Machine insurance (€)	1,458	1,746	2,024
Fuels & lubricants (€)	6,734	10,618	15,044
Annuity (€)	16,416	16,416	16,416
Repair & maintenance (€)	9,900	17,212	26,153
Sheltering annual expenses(€)	2,054	3,081	4,109
Operating capital interest (€)	126	199	282
Total expenses(€)	41,842	56,396	73,363
III. Average cost (€/ha)	40.1	36.1	35.7
« « (€/ha)	12.6	11.6	11.5
IV. Total profit or loss (€)	-624	1,143	-2,538
Average profit or loss (€/ha)	-0.60	0.70	-1.3

Comparing the total gross return of the machine with its total expenses for 10, 15 and 20 years' productive life, we can highlight a significant loss (20,964, 22,477 and 30,390 € respectively). The same is true comparing the gross return per hectare (39.5, 36.8 and 34.4 €) with the corresponding harvesting cost (59.6, 51.2 and 49.2 €), namely the loss is -20.1, -14.4 and -14.8 € respectively. These results mean that the acquisition and the operation of a cotton picker under conditions of capital borrowing is completely unprofitable irrespective of its productive life.

Under these circumstances the only way to improve the profitability of a cotton picker is to increase the harvesting charge per hectare up to 50.4, 39.1 and 42.8 % respectively according to its productive life. However, this increase can not be achieved under the existing economic conditions.

Tab. 4. *Returns, costs and profits of a cotton picker acquired by one's own capital (50%) and subsidies (50%) according to its productive life*

Returns, costs and profits	Productive life in years		
	10	15	20
I. Gross returns (€)	41,218	57,539	70,825
II. Production expenses			
Operator wages (€)	4,905	6,694	8,690
Operator insurance (€)	249	429	645
Machine insurance (€)	1,458	1,746	2,024
Fuels & lubricants (€)	6,734	10,618	15,044
Depreciation & Interest (€)	12,643	15,537	16,817
Repair & maintenance (€)	9,900	17,212	26,153
Sheltering annual expenses(€)	2,054	3,081	4,109
Operating capital interest (€)	126	199	282
Total expenses(€)	38,069	55,516	73,764
III. Average cost (€/ha)	36.5	35.5	35.9
" " (€/ha)	11.4	11.4	11.6
IV. Total profit or loss (€)	3,149	2,023	-2,939
Average profit or loss (€/ha)	3.0	1.3	-1.5

3.2 Returns, costs and profits of a cotton picker acquired by capital borrowing and subsidies according to its productive life

The profitability of a cotton picker acquired by capital borrowing (50%) and subsidies (50%) is significantly higher compared with the previous case. Indeed, as table 3 shows, in a 10 years' productive life the loss is reduced from 20,963 € in total and 2.01 € per hectare to 624 € in total and 0.60 € per hectare. In a 20 years' productive life, the 30,390 € loss in total and 14.8 € per hectare is reduced to 2,538 € in total and 1.3 € per hectare. On the other hand, in a 15 years' productive life, not only the total loss (22,477 €) is avoided, but also a profit (1,143 € in total and 0.70 € per hectare) is achieved.

Under these circumstances, the acquisition and performance of a cotton picker becomes profitable for a productive life of 15 years, as the gross return (57,539 €) is higher than the total expenses (56,396 €), leading to a profit of 1,143 €. In other words, when the cotton picker is acquired by capital borrowing (50%) and subsidies (50%), the machine becomes a profitable investment for a period of 15 years. Indeed, a ten-year period is too short to make the machine profitable, while 15 years seem enough to balance the consequences of capital borrowing. Similarly, a longer period (i.e. 20 years) leads to a loss, as repair and maintenance expenses increase substantially (from 30.5% in 15 years to 35.6% in 20 years of the total expenses), making machine performance unprofitable again.

3.3. Returns, costs and profits of a cotton picker acquired by one's own capital and subsidies according to its productive life

The profitability of a cotton picker improves even more if the capital needed to acquire this machine comes from one's own capital (50%) and from subsidies (50%). In this case the annuity is substituted by two items, namely the yearly depreciation and interest of investment. The yearly depreciation was estimated by using the straight line method, while the interest rate used was 15% (table 4). The profit in this case increases not only for the 15 years' period (2,023 € in total or 1.3 € per hectare) but also for the 10 years' period (3,149 € in total or 3.0 € per hectare). This remarkable increase in the picker's profitability, particularly for a 10 years' productive life, indicates that it is preferable to keep the machine for 10 than for 15 years. This is true as the cotton picker's gross return overcomes the charge from the depreciation and interest in a shorter period. On the contrary, the continuous operation of the machine for 20 years creates a great loss (2,939 € in total or 1.5 € per hectare), due on the one hand to the substantial increase in the machine's repair and maintenance costs and on the other to the depreciation and interest of capital.

3.4. Comparison between the above alternative cases

Comparing Tables 2, 3 and 4 the following results are obtained: a) when the acquisition and the operation of a cotton picker is achieved by entirely capital borrowing at an interest rate of 15%, its profitability is completely negative, regardless of its productive life (10, 15, 20 years respectively). This is true as total machine expenses (62,182, 80,016, and 101,215 € respectively) exceed the corresponding gross return (41,219, 57,539, and 70,825 € respectively). This means that it is irrational for the cotton growers to acquire and operate a cotton picker without subsidies.

b) when 50% of the machine's initial value comes from capital borrowing at the same interest rate and the remaining 50% from subsidies, then the machine's profitability is improved. This improvement, however, is not enough to cover the loss for the periods of 10 and 20 years' productive life. On the contrary, it is more than enough to cover the picker's loss and to leave considerable profit (1,143 € in total and 0.7 € per hectare) for a 15 years' productive life. These positive results derive from the reduction in the machine's initial value (due to subsidies) and from the lower annuity share (16,416 €) compared with the previous case, where its share was much higher (40,037 €). This means that subsidies play a vital role not only for the machine's acquisition but also for the improvement of its profitability, justifying the policy applied by EU Regulation 389/82.

c) when the initial value of the machine comes from one's own capital (50%) and subsidies (50%), its profitability is further improved not only for the 15 years' life but also for 10 years. This is due to the lower depreciation and interest share in total expenses compared with the annuity share in the previous case. Only the period of 20 years shows negative results (2,939 €) due to repair and maintenance increase as the machine ages. In a 15 years' time the profit increases up to 2,023 € compared to 1,143 €, in the previous

case. As for the 10 years' period, it shows the highest profit (3,149 € in total), compared to a loss (624 € in total) in the previous case.

Regardless of the capital source to acquire a cotton picker, it is irrational and unprofitable to maintain and operate this machine beyond 10 or even 15 years.

3.5. Determining the year of the highest total profit from a cotton picker during its productive life

The above analysis illustrates that the years during which the highest total profit is achieved by a cotton picker are 10 or 15 cumulated respectively when its purchase depends on one's own capital (50%) and subsidies (50%) or on capital borrowing (50%) and subsidies (50%). The question is if the 10th or any other year (e.g. 9, 11, etc.) is the optimum in the first case. Analyzing the data year by year, in this case, we see that the total profit of the cumulated 9 years is 2,934 €, while the corresponding for the cumulated 10, 11, 12, 13 and 14 years is 3,149, 3,126, 2,941, 2,811 and 2,225 € respectively. On the contrary, analyzing the data year by year, in the second case, we see that the total profit for the cumulated 11 years is 240 €, while the corresponding for the cumulated 12, 13, 14 and 15 years is 854, 1,434, 1,469 and 1,143 € respectively. The above comparison shows that the year with the highest total profit is the 10th in the first case and the 14th in the second case. This indicates indirectly the optimum year to replace a cotton picker according to the different sources to acquire this machine in Greece.

4. Summary and Conclusions

In this paper an attempt is made to estimate the profitability of the cotton pickers according to their productive life under various sources of capital needed to acquire them. The necessary data for this investigation derive from a sample of 62 cotton pickers in Central Greece and particularly, from the accounting books of the corresponding cotton groups and the use of a special questionnaire. The comparative analysis showed that the acquisition and the operation of a cotton picker without subsidies is unprofitable, regardless of its productive life. If subsidies cover 50 % of the machine's initial value, the most profitable productive life is 10 years cumulated if the remaining 50% of its initial value is covered by one's own capital or 14 years cumulated if it is covered by capital borrowing. These results justify the EU Regulation 389/82 relating to subsidies through the institution of the cotton producer groups implemented by the two Special Sectional Cotton Programs. These results can prove to be useful both for the cotton pickers owners (cotton groups and cooperatives) and for those dealing with the policy of cotton growing, a traditional and very important branch of the agricultural sector and the country's economy.

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