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COST AND INCOME ANALYSIS OF AGRICULTURAL LABORS: THE ROLE OF PROVIDERS OF AGRICULTURAL MACHINERY SERVICES IN ARGENTINA

LUCIANA MOLTONI¹; GERARDO MASIÁ¹; ANDRÉS MOLTONI¹

¹ Instituto de Ingeniería Rural, INTA. Casilla de Correo 25, Castelar (1712), Buenos Aires, Argentina.
lmoltoni@cni.inta.gov.ar

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ABSTRACT: Transformations occurred in agriculture caused changes in Argentine agricultural structure along with and the raise of new economic and social agents. However, the development of agricultural providers of machinery services refers to a previous time but it was not until the 90's that they consolidate their role in Argentine agriculture. Nowadays, more than 30% of agricultural producers demand these services. Furthermore, this percentage is greater if it is only considered the pampas plain (47%). The aim of this study was to determine the cost of this new economic activity. A compared economic analysis between sowing, harvest and spraying labors was made in order to establish the profit rate for each case. With the purpose of calculating operating costs involve in each agricultural labor, the classical machinery operating cost analysis was used. The profits obtain in different labors by these new agents were calculated by using mean cost. Agricultural machinery services yield were different depending on agricultural labor but for most cases these activities were highly profitable. Of all labors spraying was the less lucrative task and also showed negative NPR and IRR results for one of the cases of study. This is even worst if probability of pesticide contamination of workers involved in the task is considered. If this cost were internalized the activity would be even less profitable.

KEYWORDS: machinery services, economic analysis,

INTRODUCTION: Transformations occurred in agriculture, which are most related to globalization process and expansion of agribusiness, caused changes in Argentine agricultural structure and the raise of new economic and social agents. However, the development of agricultural providers of machinery services refers to a previous time but it was not until the 90's that they consolidate their role in Argentine agriculture. Between the 40's and the 60's different laws were settled with the aim of protecting land leaser (LODOLA, 2003). This process caused the emergence of large agricultural capitalists which in spite of having land, they were owners of capital and agricultural machinery. These actors were responsible for most of technology innovations (PUCCIARELLI, 1997). During the well known "agricultural modernization period", which took place in Argentina in the 70's, the agricultural providers of machinery services had a center role. Credit policies based on low interest rates allowed some of small and medium agricultural producers to purchase more machinery than needed. Because of this, they started offering their machinery services to others producers and charging a fee per hectare worked (BAUMEISTER, E. 1980). This new practice enhanced the agricultural production and drove the technological innovation process related to Argentine machinery industry (PIÑEIRO et al, 2005). These technological changes were also improved by different public policy in the early 90's. This new scenario needed specialized and informed agents and providers of agricultural machinery services were capable of dealing with these new challenges. It was also important in those years the role played by the agricultural corporative pools which were great demanders of these services. Nowadays, more than 30% of agricultural producers demand these



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services. Furthermore, this percentage is greater if it is only considered the pampas plain (47%) (CNA, 2002).

The aim of this study was to determine the cost of this new economic activity. A compared economic analysis between sowing, harvest and spraying labors was made with the purpose of establishing the profit rate for each case.

METHODOLOGY: In order to calculate the operating costs involved in each agricultural labor, the classical machinery operating cost analysis was used. The profits obtain for different labors by these new agents were calculated by using mean cost.

$$MeC = f(ha) = \frac{FC}{ha} + VC$$

Where: *MeC* Mean Cost
ha Hectares
FC Fixed Cost
VC Variable Cost

Mean cost was estimated setting two equipment scenarios: brand new and second-hand. For each labor specific machinery equipment was employed (TABLE 1) using average market prices for machinery and estimating the remaining value of the equipment as 40% of its price. The yearly interest rate was set in 4%.

The prices considered for each labor were set according to “Federación Argentina de Contratistas de Maquinaria Agrícola” (FACMA, 2008). The prices for harvest depend on the kind of crop and its yield. The average yield set was: soybean 3000 kg ha⁻¹ and corn 9000 kg ha⁻¹. Only these two crops were considered because they are the two most important crops in terms of implant area in Argentina. For the four scenarios set, it was considered that two people were involved in the working (processes) process and their wages depended on the task assign. All values are expressed in Argentine pesos (\$).

TABLE 1: Equipment involved in each agricultural labor

Harvest equipment	Spraying equipment	Sowing equipment
Harvester 180 hp	Self-propelled Sprayer (160 hp)	Tractor 140 hp
Soybean header 10x0.52		Sower 9x0,52
Corn header 8x0.52		
Tractor 100 hp	Tractor 75 hp	Tractor 75 hp
Grain Cart 14 tn	Water tank 5000 L	Self-unloading grain cart
Trailer	Trailer	Trailer
Fuel Tank	Fuel Tank	Fuel Tank

RESULTS AND DISCUSSION: The mean cost function for each labor was calculated for different amounts of hectares worked yearly. As this amount increases Mean cost tends to variable cost (FIGURE 1).

With the aim of analyzing the cost and yeild of this activity, it was first estimated the profit obtain per hectare worked for each labor (TABLE 2, TABLE 3). Secondly, net present value (NPV) was determined. The activity is profitable when NPV is equal or more than cero. The discount interest rate considered was 13% yearly. Finally, the internal rate of return (IRR) was calculated. By using this method the interest rate in which the cash flow is equal to cero was obtained. For both TIR and VAN, the duration of investment project was set to at 10 and 5 years for band new and second-hand equipment respectively. An average amount of hectares worked yearly were fixed in: harvest 1200, sowing 2000 and spraying 8000.



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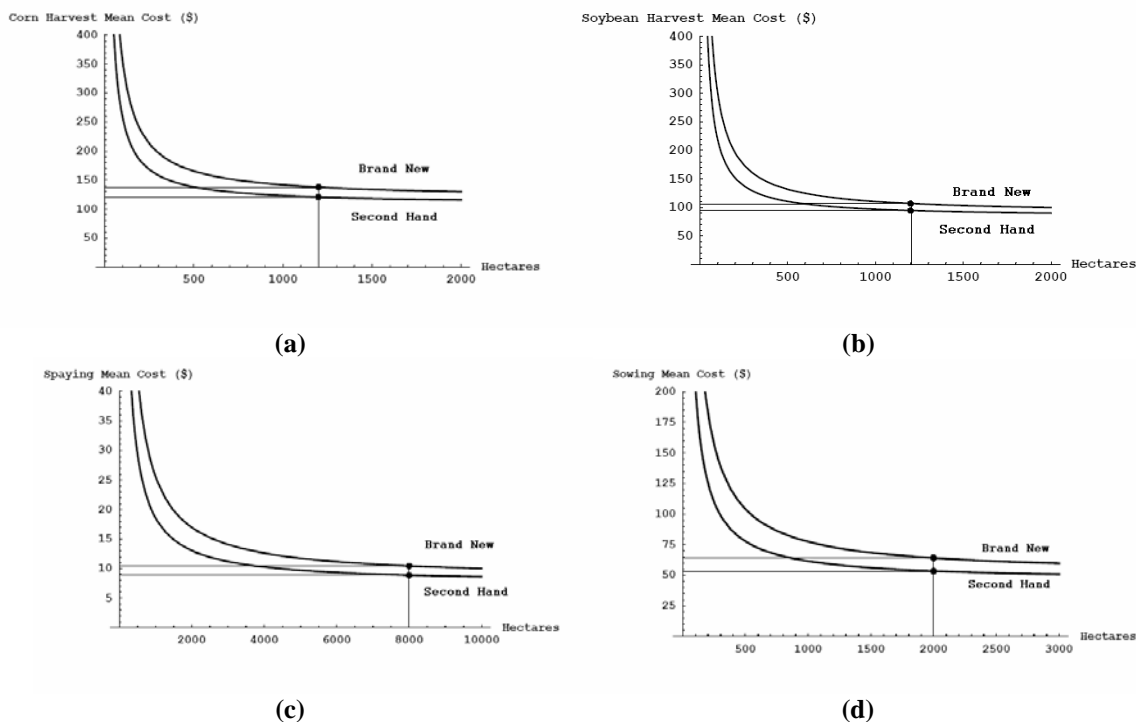


FIGURE 1: Mean Cost (\$): (a) Corn Harvest, (b) Soybean Harvest, (c) Spraying, (d) sowing

TABLE 2: Mean Cost (\$) and Profit (%) for Spraying and Sowing

Spraying (ha)	Mean Cost (\$)		Profit (%)	
	Brand new	Second hand	Brand new	Second hand
5000	11,9	9,8	40,5	51,0
6000	11,3	9,4	43,4	52,8
7000	10,9	9,2	45,5	54,2
8000	10,6	9,0	47,0	55,2
9000	10,4	8,8	48,2	55,9
10000	10,2	8,7	49,2	56,6

Sowing (ha)	Mean Cost (\$)		Profit (%)	
	Brand new	Second hand	Brand new	Second hand
1400	69,8	56,9	36,5	48,3
1600	67,5	55,5	38,7	49,6
1800	65,6	54,4	40,3	50,6
2000	64,1	53,5	41,7	51,4
2400	61,9	52,1	43,7	52,6
2800	60,3	51,2	45,1	53,5

TABLE 3: Mean Cost (\$) and Profit (%) for Soybean and corn Harvest

Harvest (ha)	SOYBEAN				CORN			
	Mean Cost (\$)		Profit (%)		Mean Cost (\$)		Profit (%)	
	Brand new	Second hand	Brand new	Second hand	Brand new	Second hand	Brand new	Second hand
800	115,8	100,2	50,8	57,4	147,5	126,7	50,7	57,6
1000	110,4	96,8	53,1	58,9	141,6	123,0	52,7	58,9
1200	106,9	94,5	54,6	59,9	137,6	120,4	54,0	59,7
1600	102,4	91,7	56,5	61,1	132,7	117,3	55,6	60,8
2000	99,8	90,0	57,6	61,8	129,7	115,4	56,6	61,4
3000	96,2	87,7	59,1	62,8	125,7	112,9	57,9	62,2

TABLE 4:

NPV (\$)		IRR (\$)	
Brand new	Second hand	Brand new	Second hand



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Sowing	-\$ 6.956	\$ 71.928	12,3%	39,3%
Soybean harvest	\$ 121.502	\$ 114.356	22,2%	41,9%
Corn harvest	\$ 195.614	\$ 187.981	25,9%	57,9%
Spraying	-\$ 103.775	\$ 6.397	3,7%	15,1%

Both NPV and IRR show that when using brand new equipment sowing and spraying labor are not lucrative. If we pay special to spraying labor, we are able to conclude that this task is the one which has the lower NPV and IRR. This is caused by the high initial investment which needed preventing form getting a NPV higher than zero even when profit is positive (TABLE 1). It is also important to point out that this labor is excrementally dangerous for workers because of agrochemical manipulation involved in this job. This task is included into occupational chronic toxicology and, together with chemical manufacturers works, it is considered the most dangerous in terms of pesticide contamination (SRT, 2004; IPCS, 2005). For the reasons stated above this cost should be internalized making the activity even less profitable.

CONCLUSION: Agricultural machinery services yield were different depending on agricultural labor but for most cases these activities were highly profitable. Of all labors spraying was the less lucrative task and also showed negative NPR and IRR results for one of the cases of study. This is even worst if probability of pesticide contamination of workers involved in the task is considered. If this cost were internalized the activity would be even less profitable.

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