Comparative analysis of Flue-cured tobacco production costs in Santander and Huila (Colombia)

Análisis comparativo de costos de producción de tabaco Virginia entre Santander y Huila (Colombia)

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ABSTRACT

Santander and Huila are the largest producers of Flue-cured tobacco in Colombia. They differ in their production systems and, consequently, in their production costs. Costs provide valuable information on the efficiency of resource use, a variable that determines the profitability of the crop. The purpose of this study was to determine and analyze the structure of production costs by department, as well as, their differences and possibilities for reduction. Data for the analysis was obtained from the records of Protabaco and surveys of 50 producers (farms) in the municipalities of Campoalegre and Garzon in Huila, and Capitanejo and Enciso in Santander. The results say the costs of the most important factors of production in both departments are: labor, inputs and services. Huila has higher total costs per hectare than Santander, but similar unit costs. Huila has a higher technological level of production, more capital and greater surface area per crop unit than Santander. Production costs can be reduced by increasing the availability of investment capital, and irrigation water, as well as, more efficient management of fertilization, cultural practices and mechanization of land preparation.

Key words: production factors, area and yields, capital investment, technological level.

RESUMEN

Los departamentos Santander y Huila son los mayores productores de tabaco Virginia en Colombia. Éstos presentan diferencias en sus sistemas de producción y, en consecuencia, en sus costos de producción. Los costos brindan información valiosa sobre la eficiencia del uso de recursos, variable que determina la rentabilidad del cultivo. El propósito del presente trabajo fue determinar y analizar la estructura de costos de producción por departamento, así como sus diferencias y sus posibilidades de reducción. La información para el análisis se obtuvo de los registros de Protabaco y de encuestas hechas a 50 productores (fincas) pertenecientes a los municipios Campoalegre y Garzón en Huila, y a Capitanejo y Enciso en Santander. Los resultados dicen que los costos de los factores de producción más importantes en ambos departamentos son: mano de obra, insumos y servicios. Huila tiene mayores costos totales por hectárea que Santander, pero similares costos unitarios. Huila tiene un mayor nivel tecnológico de producción, mayor capital y mayor superficie por unidad de cultivo que Santander. Los costos de producción se pueden reducir con una mayor disponibilidad de capital de inversión y agua para riego, así como con un manejo más eficiente de la fertilización, de labores culturales y de mecanización de la preparación del terreno.

Palabras clave: factores de producción, superficie y rendimientos, capital de inversión, nivel tecnológico.

Introduction

The production of tobacco is traditional in Colombia, dating from the late eighteenth century. It is labor intensive (240-280 wages/ha per cycle), generating about 15,000 direct jobs per year in production areas (BioGestión, 2008). Demand factors of production inputs, machinery, equipment, credit, etc., streamline other branches of the economy such as transport, cardboard processing, advertising, etc. The state also benefits from the industry, domestic trade of tobacco and income taxes (Observatorio de Agrocadenas Colombia, 2000). Tobacco production is done in Huila, Santander, Tolima and the coffee zone with blond tobacco (Flue-cured and Burley) and black tobacco. Production systems have some differences by area, so production costs are also somewhat different.

Agricultural production costs are determined by the type of company, the production unit, the quantity, quality and price of the production factors, the production technology, the obtained production, and the physical, social, economic and political environment (Ballestero, 1991; Barrientos, 2008; Bishop and Toussaint, 1991; Dondrup and Rollwage, 1998; Mankiw, 2004; Nicholson, 2004). Production costs

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allow one to view the structure, efficiency of resource use in the production process, product competitiveness in the market, the projection of the investment and, above all, the profitability of the business (Baye, 2006; BLV Verlagsgesellschaft mbH - Landwirtschaftsverlag GMBH, 2004; Frank, 2009; Heinhold, 2007; Méndez, 2007; Miller and Meiners, 1996; Mochón, 2005; USAID, 2008). Unit production costs, due to economies of scale (and scope), will decrease with the increasing size of the production unit. This fact as shown by CCI and MADR (2007) exposes the difference in production costs between a small Santander tobacco farm (less than 5 ha ($3.252/kg)) (all prices are in Colombian pesos) and a medium farm (5-10 ha ($2.964/kg)). The production cost structure depends on the criteria that divide and/or group it: in stages, factors, activities, involvement in the production and use of cash (Herrera, 1998). In Colombia, the cost structure of tobacco production (Tab. 1) is determined by the type of crop, the geographical location and the size of the production unit (CCI, 2001; CCI *et al.*, 2007 y 2009).

Santander (50.30%) and Huila (31.04%) are, according to Agronet (2009), the biggest producers of blond tobacco in Colombia (14,516 t in 2008). Due to their unique geographical (Agro-environmental resources), socio-cultural (human resources), economic (capital and financial resources) and technological factors, these departments have differences in production systems, volume and quality of supply, and production costs of blond tobacco. This last economic variable provides valuable information on the use and efficiency of production, which is of interest to producers of raw material for the industry. However, information about this economic indicator is highly variable and incomplete in some cases; it is not a reliable decision-making tool. This gives rise to the present research, whose guiding questions are: What is the structure of production costs in each department? Is there a difference in cost between the departments? What is the difference? Why is there a difference? Can it be reduced?

The overall objective of this paper is a comparative analysis of the production costs in Flue-cured tobacco in Santander and Huila. To achieve the overall objective, one sets the following specific objectives: 1) to analyze the cost structure of production in each municipality and department, 2) identify and analyze the difference in costs between municipalities and departments, 3) identify and analyze the factors responsible for the difference in production costs and 4) explore the possibility of reducing costs.

Materials and methods

Study area

For this study, representative municipalities for tobacco production from each department were used: in Huila, Garzón and Campoalegre, and in Santander, Capitanejo and Enciso. Tab. 2 shows some differentiation factors in the production of tobacco between the departments and municipalities under the present study.

TABLE 1. Cost structure of production in Colombia of blond tobacco according to authors and years ($/ha).

Production factors	Blond tobacco (2003) – average Santander and Huila [1]	Blond tobacco (2003) - Santander [2]	Blond tobacco Virginia (2006) – Huila [3]	Blond tobacco (2007) – Santander [4]	Blond tobacco (2009) – Tolima [5]	Blond tobacco burley (2009) – Santander [6]
Land	409,474		750,000	280,000	774,500	2,014,000
Labor	1,610,237	4,970,543	2,889,000	2,715,060	2,773,794	2,980,000
Inputs	956,900	150,870	3,102,000	1,744,040	3,251,214	1,912,000
Materials	51,606	150,870	1,027,500			169,633
Machinery, equipment, tools	83,986	150,870				83,500
Services	131,207	897,000	2,232,000	284,050	2,546,848	1,060,000
Capital (interest)			385,000			294,554
Tobacco fund tax			215,000			201,400
Withholding tax						40,280
Administration	129,521		322,500	140,524	243,803	15,438
Insurance						120,000
*Contingencies				234,207	406,338	
**Indirect costs		1,861,519				
Cost per hectare	3,372,931	8,181,672	10,923,000	5,397,881	9,996,497	8,890,805

* Item in projected costs **Sum of indirect costs of factors (land, administration, etc.).

[1] Observatorio Agrocadenas Colombia – Ministerio de Agricultura y Desarrollo Rural, 2004.
[2] Ministerio de Agricultura y Desarrollo Rural - Observatorio Agrocadenas Colombia, 2005.
[3] Gobernación del Huila - Secretaria de Agricultura y Minería - Cadena Productiva de Tabaco, 2007.
[4] Corporación Colombia Internacional (CCI) - Ministerio de Agricultura y Desarrollo Rural (MADR) – Sistema de Información Agropecuaria (SIA), 2007.
[5] Corporación Colombia Internacional (CCI) - Ministerio de Agricultura y Desarrollo Rural (MADR) – Sistema de Información Agropecuaria (SIA), 2009.
[6] Protabaco – Bages Fernando, 2009.

TABLE 2. Comparison Factors for Flue-cured tobacco production: Huila and Santander.

Comparison Factors	Huila		Santander	
	Campoalegre	Garzón	Capitanejo	Enciso
Altitude (m a.s.l.)	525	828	1,090	1,554
Temperature (°C)	27	24	21	19
Precipitation (mm/year)	1,254	1,210	950	950
Average cultivated area (ha)	7.38	7.59	1.49	1.53
Average yield (kg ha^{-1})	2,746	2,904	2,328	2,823
Type of land use right (in order of importance)	Renter, owner		Owner, sharecropping, renter	
Availability of labor	Permanent and temporary workers		Family, wage workers and permanent and temporary workers	

Source: Historical data from Protabaco, 2005-2008.

Required information and its acquisition

Production costs of Flue-cured tobacco in the four municipalities in the present study came from a sample of randomly selected tobacco producers (Tab. 3), who worked with the company Protabaco in semester I-2008. They completed a structured questionnaire with open and closed questions, called "tobacco production systems in Colombia" in the second half of 2008, for which production costs only constituted a part. Regional cost tables of the company were also used, as well as, the production records of its creditors to supplement the information gathered in the surveys. From this information, which is newer than the survey, inflation was subtracted for 2009 and part of 2008 to make the calculations.

TABLE 3. Tobacco producer sample for the survey.

Municipality / department	Population	Sample
Campoalegre	15	10
Garzón	17	11
Huila	32	21
Capitanejo	18	11
Enciso	49	18
Santander	67	29
Total	99	50

Systematization and analysis of information

Initially, a matrix of production factors was built for the costs and the stages with Excel. Then, an adjustment was made between the survey information from the producers and the company information to obtain partial costs for the stages and factors and the total cost per hectare per municipality and per department. Subsequently, the percentage of participation for each factor and stage in the total cost per hectare was calculated, which constituted the basis of the analysis of part of the study. The other benchmark is the unit cost analysis, which is obtained by dividing the total costs by total production. This data was used to analyze the efficiency of resource use (production technology and management) and its relation to the size of the crop area. As a benchmark for profitability comparison of the crop, the average sale price of $5,500/kg was used. For the analysis of the potential cost reduction, the characteristics of farms with lower unit costs were used as a base.

Results and discussion

Structure of production costs

Costs by stages

According to Tab. 4, the culturing step, on average, accounted for approximately 59% of the production costs, followed by the post-harvest stage with approximately 32% and the nursery stage with about 9%. In general, Huila spent 8%

TABLE 4. Structured summary of Flue-cured tobacco production costs by stage and factor in two municipalities of Huila and two municipalities of Santander.

Production costs	Municipalities								Departments			
	Campoalegre		Garzón		Capitanejo		Enciso		Huila		Santander	
	$/ha	(%)	$/ha	(%)	$/ha	(%)	$/ha	(%)	$/ha	(%)	$/ha	(%)
Stage												
Nursery	1,167,298	9.52	1,193,587	9.72	958,982	8.23	911,482	8.27	1,180,443	9.62	935,233	8.26
Culturing	7,115,007	58.03	6,971,793	56.73	7,115,658	61.16	6,503,297	59.01	7,043,402	57.38	6,809,479	60.08
Post-harvest	3,977,986	32.45	4,124,159	33.56	3,560,493	30.61	3,605,109	32.72	4,051,073	33.01	3,582,801	31.67
Factors												
1. Land	931,432	7.6	990,909	8.06	537,413	4.62	503,704	4.57	961,171	7.83	520,559	4.59
2. Labor	4,421,588	36.06	4,501,949	36.63	4,717,281	40.54	4,292,416	38.95	4,461,769	36.35	4,504,849	39.75
3. Inputs	3,580,330	29.2	3,359,851	27.34	3,064,653	26.34	2,662,478	24.16	3,470,091	28.27	2,863,566	25.25
4. Services	1,895,879	15.46	1,976,595	16.08	2,113,852	18.17	2,319,255	21.05	1,936,237	15.77	2,216,554	19.61
5. Equipment-tools-materials	441,106	3.6	441,106	3.59	296,046	2.54	296,046	2.69	441,106	3.59	296,046	2.62
6. Administration-Insurance-Taxes	989,956	8.07	1,019,129	8.29	905,888	7.79	945,989	8.58	1,004,543	8.18	925,939	8.19
Total production costs	12,260,291	100	12,289,539	100	11,635,133	100	11,019,888	100	12,274,915	100	11,327,511	100

more than Santander. This difference is apparently not very relevant, but nevertheless, becomes more noticeable at the nursery (26%) and post-harvest (12%) stages.

Costs by factors

The cost structure is made up of six groups of production factors, which have a share percentage of the total direct costs. From Tab. 4, the major factors in costs are: labor (36 - 40%), materials (25- 28%) and services (16 - 20%). Huila spends 85% more on land, 21% more on inputs (23% more on solid fertilizers, 1800% more on herbicides, 33% more on coal) and 49% more on equipment, materials, tools than Santander, meanwhile Santander spends 10% more on labor (with a 56% increase in land preparation, 44% in irrigation and drainage and 30% in weeding and hoeing) and 15% more on services (100% more in preparation of the land with oxen and 66% in transport) than Huila.

Production cost difference between municipalities and departments

Costs per hectare ($/ha)

There are differences in production costs between departments and between municipalities, but they are only about 10% (Tab. 5). The production of one hectare of blond tobacco in Huila costs 8% more than in Santander. In Campoalegre, the municipality with the highest costs, the production of blond tobacco by cost per hectare is 11% more than in Capitanejo, the municipality with the lowest costs in the studied areas. Differences between municipalities and departments became more noticeable in the cost ranges. Campoalegre was the municipality with the smallest cost range (max - min = $1,682,897/ha) and Garzón had the largest (max - min = $3,926,322/ha). The average range in Huila for cost is approximately $3.5 million/ha, 11% above the average and 19% below, and Santander has an average

range of around $3.2 million/ha, 13% above the average and 18 % below. Ranges from 3.2 to 3.5 million pesos per hectare indicate marked differences between production units. These differences are due to two main aspects: agri-supply (soil and climate) and management of the production unit (technology and resource management). There is no exact knowledge about the proportionality of each factor's effect.

Unit costs ($/kg)

The unit cost differences both between the municipalities and between the departments have characteristics somewhat different from the costs per hectare (Tab. 5). Producing one kilogram of tobacco in Huila is, on average, 2% more expensive than in Santander. But between Capitanejo, the municipality with the highest unit costs, and Enciso, the municipality with the lowest unit costs, this difference increases to about 35%. The most striking differences are in the range (max - min). At the departmental level, Santander has a range of $9,688/kg, 176% above the average and 40% below, while Huila shows a slightly lower range, $4,796/ha, 76% above the average and 29% below. Among the municipalities, the highest range ($8,835/kg) is in Capitanejo, and the lowest ($3,267/ha) is in Campoalegre. This range is somewhat "exaggerated" in Santander due to farms that have low yields, as in the case of Capitanejo with 844 kg/ha and in Garzón with 1,618 kg/ha (Tab. 5) . This shows that one can find this kind of yield in both Santander and Huila. The factors determining the magnitude of the ranges are, as noted above, crop management, which includes production technology, and the influence of geography, including climate. On the other hand, unit costs above the sale price have been found in all studied municipalities, which in this case is $5,500/kg, mainly due to low yields. This means that the probability of risk in Huila is 19% (4 of 21 cases) and 10% in Santander (3 of 29 cases).

TABLE 5. Production costs, yields and growing area of Flue-cured tobacco in two municipalities of Huila and two municipalities of Santander.

Economic factors		Municipalities				Departments	
		Campoalegre	Garzón	Capitanejo	Enciso	Huila	Santander
Cultivation area (ha)	Average	7.38	7.59	1.49	1.53	7.49	1.51
	Maximum	20.00	15.00	2.00	4.00	20.00	4.00
	Minimum	3.30	3.00	0.60	0.50	3.00	0.50
Yield (kg ha⁻¹)	Average	2,746	2,904	2,328	2,823	2,829	2,635
	Maximum	3,647	4,067	3,510	4,140	4,067	4,140
	Minimum	2,000	1,618	844	1553	1.618	844
Cost per hectare ($/ha)	Average	12,260,291	12,289,539	11,635,133	11,019,888	12,274,915	11,327,511
	Maximum	13,273,435	14,168,686	12,984,200	12,634,382	13,721,061	12,809,291
	Minimum	11,590,538	10,242,364	10,331,714	8,851,565	10,242,364	9,591,640
Unit cost ($/kg)	Average	4,651	4,524	5,361	3,962	4,585	4,493
	Maximum	6,564	8,050	12,404	6,401	8,050	12,404
	Minimum	3,297	3,254	3,569	2,716	3,254	2,716

Determining factors of production costs

Using the type of labor and land

Santander uses 27% family labor and 27% wage earners, and 55% is grown on the owner's land and 19% by share-cropping, while in Huila over 95% of the production units use contracted labor and rented land (Tab. 6). In Huila, 85% more is paid for land and 5% more for labor than in Santander, while the latter spent 6% more in wages than Huila (Tab. 7). The availability of family labor, wage earners, and land use by owners and sharecropping allow producers to reduce their explicit costs. However, since money is not required to pay for these resources, their use may not be efficient, thereby actually raising costs, as may be the case in Santander.

Agro-environmental offering of the growing areas

In Santander, there is less availability of water than in Huila, many of the soils are shallow, stony, and located in hilly country with medium fertility (Observatorio de Agrocadenas Colombia, 2000). These conditions make certain tasks such as land preparation, cultivation, hoeing, transport and irrigation (Tab. 2) a bit more expensive than in Huila. Meanwhile, Huila has deep, flat, soil with good fertility and irrigation availability. Under these conditions, the yields in Huila are, on average, about 12% higher than in Santander (Tab. 5). It should be noted that yield does not only depend on the geographical conditions of the production area.

Production technology and crop area

Better technology, under the same conditions, will result in lower unit costs, higher yields and/or better quality product. The curve relating unit costs with acreage gives an idea of the level of technology of a production system. Each curve is "technology" or "technical degree", which reflects the efficiency of the use of production factors. According to Fig. 1, tobacco producing areas of the present study have developed specific technologies in response to the availability of resources: mainly land, labor (including management thereof) and financial capital. According to the graphs in Fig. 1, the technology gap between Santander and Huila is notable. The production technology of tobacco in Huila is based on the use of more land (Fig. 1), the mechanization of some tasks such as land preparation and hilling, the specialization of labor in weeding, harvesting and classification, the use of large amounts of fertilizer (Tab. 7), and the widespread use of irrigation. Technological curves (Fig. 1) allow us to see the point that denotes the optimal size of the production unit that corresponds with the lower unit costs of production. In Huila, it is between 11 and 15 ha (approx. $3,200 - $3,700/kg) and in Santander, it is between 2 and 3 ha (approx. $4,500 - $3,200/kg).

Prices and quantities of production factors

For all the production factors, Protabaco, which is active in both departments, offers producers inputs, materials and funding. Although the company maintains the same input prices for the two areas, the amounts and types of inputs that are delivered in each area are different, thereby changing costs. Meanwhile, producers provide/obtain the land, labor, equipment and tools, and most services. In each case, there are differences in prices and quantities. The most relevant production factors are: land, labor and fertilizer. In Huila, 85% more is paid for leased land than in Santander and 5% more for labor, but 6% less is used. Although Santander uses more and pays more for liquid fertilizers, Huila uses 24% more solid fertilizer than Santander, and pays 2% more for it (Tab. 7). A regression performed between yield and amount of solid fertilizer applied in Huila shows a negative relationship, indicating that increased fertilizer application may decrease yield. The same regression test for Santander shows a positive relationship between these variables. This result requires further analysis, taking into account the nutritional

TABLE 6. Use of labor and land use types (%).

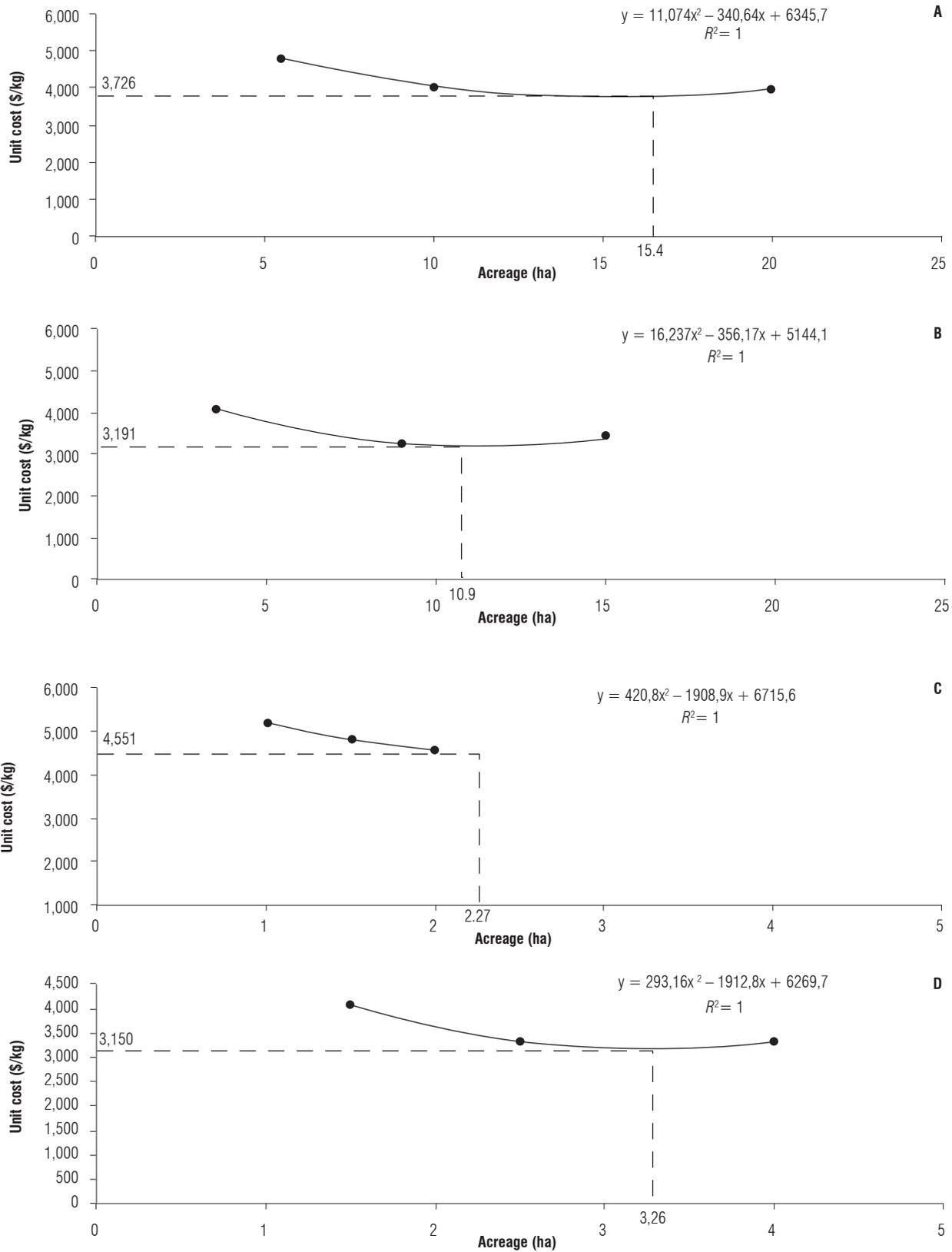| Factors		Municipalities				Departments	
		Campoalegre	Garzón	Capitanejo	Enciso	Huila	Santander
Labor	Family	0	0	34	23	0	27
	Permanent Workers	23	43	15	2	33	8
	Temporary Workers	76	55	32	37	65	35
	Wage earners	0	0	19	32	0	27
	Labor contract	1	2	0	6	2	3
	Total	100%	100%	100%	100%	100%	100%
Land	Owner	0	5	82	37	3	55
	Renter	100	95	6	39	97	26
	Sharecropping	0	0	12	24	0	19
	Total	100%	100%	100%	100%	100%	100%

FIGURE 1. Ratio of acreage (ha) and unit cost ($/kg) in municipalities of Huila (A, Campoalegre; B, Grazón) and Santander (C, Capitanejo; D, Enciso), showing the optimal size of the production unit. The points were obtained by averaging three clusters of unit costs for each municipality.

TABLE 7. Costs and amounts of wages, fertilizer and land for one hectare of tobacco.

Municipality and Department		Wages per hectare	Wage unit cost ($)	Liquid fertilizer (L ha⁻¹)	Liquid fertilizer unit cost ($/L)	Solid fertilizer (kg ha⁻¹)	Solid fertilizer unit cost ($/kg)	Land unit cost ($/ha)
	Average	276	16,000	1.7	16,512	1,323	1,376	931,432
Campoalegre	Maximuum	294	16,000	4	45,846	1,627	1,576	1,001,818
	Minimum	260	16,000	0	12,892	884	1,227	712,500
	Average	265	17,000	0.9	10,791	1,166	1,430	990,909
Garzón	Maximum	297	17,000	3	13,578	1,811	1,653	1,000,000
	Minimum	232	17,000	0	0	260	1,289	900,000
	Average	286	16,500	1.3	13,030	1,070	1,463	537,413
Capitanejo	Maximum	321	16,500	8	20,475	1,251	1,986	1,200,000
	Minimum	266	16,500	0	0	828	1,166	300,000
	Average	286	15,000	2.3	16,038	931	1,333	503,704
Enciso	Maximum	311	15,000	14	95,813	1,513	1,448	1,000,000
	Minimum	267	15,000	0	0	301	1,128	320,000
	Average	270	16,500	1.3	13,515	1,241	1,404	961,171
Huila	Maximum	297	17,000	4	45,846	1,811	1,653	1,001,818
	Minimum	232	16,000	0	0	260	1,227	712,500
	Average	286	15,750	1.9	14,897	984	1,382	520,556
Santander	Maximum	321	16,500	14	95,813	1,513	1,986	1,200,000
	Minimum	266	15,000	0	0	301	1,128	300,000

requirements of the plant, when to apply fertilizers, sources used and soil characteristics.

Possibility of reducing unit costs

Production costs can be decreased as seen in the farms that yielded the lowest unit costs: $ 3,254/kg in Huila and $2,716/kg in Santander (Tab. 5). The characteristics of the farms with the lowest unit cost of each zone are: presence of postharvest room and oven, water for irrigation, investment capital (credit or cash), use of the results of soil analysis for fertilization, a density equal to or greater than 20,000 plants/ha, mechanized preparation of the ground where possible, use of about 1,000 kg of fertilizer per cycle and a surface close to the optimal cultivation area (Fig. 1). These features are related to lower production costs in each area. Additionally, certain tasks can be done more efficiently such as weeding, hoeing, harvesting and postharvest (less labor), or more efficient use of fertilizers in Huila is possible (less labor and fertilizer) and increased use of these in Santander (higher yield), and finally, a cheaper method of soil preparation could be developed in Santander (increased mechanization).

Conclusions and recommendations

Production costs indicate the investment amount of a production project, reflect agro-ecological conditions of production and resource use efficiency and the competitiveness of a company in the international market.

Cost production information in Colombia is varied, so taking into account various sources to have an average reference is recommended. The most reliable sources are tobacco companies.

The two areas in the present study differ in climate and soil conditions, availability of labor, crop area size of tobacco, type of land use, capital investment and technological level.

The structure of production costs of tobacco is similar in the two study areas. There are some differences in the use of production factors, such as site preparation, weed control, water management and type of land use. For the calculation of tobacco production costs, the "unexpected" should only be used for planning and/or investment purposes.

Production costs of tobacco differ by department and municipality, as well as by size of production unit. In Huila, costs are higher per hectare and per kilogram of product than in Santander. At the municipal level, Enciso has much lower costs per hectare per kilogram of product, while in Capitanejo costs are higher per kilogram.

In Huila, compared with Santander, more is paid on average for land, labor and some inputs such as fertilizers. In the latter department, more days are spent per hectare / cycle but using family labor and wages, so explicit costs are lower. We recommend scientific research on this last topic and the "apparent" overuse of fertilizers in Huila.

Based on unit costs, Santander has a greater range (diversity) of technological levels than Huila, where technology is more homogeneous (less yield difference between maximum and minimum), characterized by increased mechanization, increased use of irrigation, increased use of fertilizer and taking advantage of economies of scale. The latter is clearly reflected in the production of tobacco, showing optimal surfaces (with existing technology), 11-15 ha in Huila and between 2 and 3 ha in Santander. This does not mean, however, that the economy of scale is always the answer to lower production costs. Proof of this is seen in Enciso (Santander), where the lowest unit costs of the study areas have been achieved.

It is possible to reduce the unit costs of tobacco production. Options include the availability of investment capital and water for irrigation, efficient fertilization management, efficiency in cultural practices, mechanization of land preparation, optimal cultivation area and efficient use of land (sharecropping and leasing). Businesses and producers need to try to implement each option for cost reduction.

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