



**Alan Mario Zuffo**  
**(Organizador)**

**A produção  
do Conhecimento  
nas Ciências  
Agrárias e Ambientais 3**

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**Alan Mario Zuffo**  
(Organizador)

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## APRESENTAÇÃO

A obra “A produção do Conhecimento nas Ciências Agrárias e Ambientais” aborda uma série de livros de publicação da Atena Editora, em seu III volume, apresenta, em seus 28 capítulos, com conhecimentos científicos nas áreas agrárias e ambientais.

Os conhecimentos nas ciências estão em constante avanços. E, as áreas das ciências agrárias e ambientais são importantes para garantir a produtividade das culturas de forma sustentável. O desenvolvimento econômico sustentável é conseguido por meio de novos conhecimentos tecnológicos. Esses campos de conhecimento são importantes no âmbito das pesquisas científicas atuais, gerando uma crescente demanda por profissionais atuantes nessas áreas.

Para alimentar as futuras gerações são necessários que aumente à quantidade da produção de alimentos, bem como a intensificação sustentável da produção de acordo como o uso mais eficiente dos recursos existentes na biodiversidade.

Este volume dedicado às áreas de conhecimento nas ciências agrárias e ambientais. As transformações tecnológicas dessas áreas são possíveis devido o aprimoramento constante, com base na produção de novos conhecimentos científicos.

Aos autores dos diversos capítulos, pela dedicação e esforços sem limites, que viabilizaram esta obra que retrata os recentes avanços científicos e tecnológicos, os agradecimentos do Organizador e da Atena Editora.

Por fim, esperamos que este livro possa colaborar e instigar mais estudantes, pesquisadores e entusiastas na constante busca de novas tecnologias para as ciências agrárias e ambientais, assim, garantir perspectivas de solução para a produção de alimentos para as futuras gerações de forma sustentável.

Alan Mario Zuffo

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## ECONOMIC VIABILITY OF A CITRUS PRODUCTION UNIT IN THE CITY OF LIBERATO SALZANO IN RIO GRANDE DO SUL STATE, BRAZIL

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**ABSTRACT:** A production cost survey for the 2015/16 crop season was carried out on a 24.5 ha farm within Liberato Salzano city, where dual-purpose oranges are produced. The operation also produces varieties oranges and tangerines for the fresh market. Data was obtained by communicating with the producer directly and with the help of local extension organization, Emater. Price received for the fresh market fruit was R\$ 0.90 per kg, which is double the price received for the fruit sold for the juice processing industry (R\$ 0.47 per kg). Orange for processing was sold at a local association of citrus growers with certified FAIR TRADE to market juice concentrate to European countries with a price higher than the international market of juices. Operating estimated cost per hectare was R\$ 1,200. 56 (US\$ 4,119.12) and the gross margin was R\$ 5,433.40 / ha (US\$

18,641.99/ ha). For every R\$ 1.00 invested in citrus the return was R\$ 4.50. This analysis also considered the Pro-labore expenses of the three people working on the property and the opportunity cost for the 24.5 hectares cultivated with citrus. This operation yielded an annual income of R\$ 78,024.91 and an income of R\$ 3,184.69 per hectare per year. The study of this property, which is characterized as a family production unit, showed that citrus cultivation was profitable, even when considering the cost of the family's own labor and also the opportunity cost of the land.

**KEYWORDS:** citrus, varieties, market, cost, price.

### 1 | INTRODUCTION

The state of Rio Grande do Sul has a planted area of more than 16 thousand hectares of orange and more than 10 thousand hectares of mandarins. Orange production reached 280 thousand tons among 8.8 thousand producers, 35.00% of which is destined for the fresh fruit market and 65.00% is sold within the juice industry (Becker, 2015). There are 5.3 thousand producers of tangerines and production reaches about 150 thousand tons. 10.00% of the tangerine production is traded for the juice

industry (Becker, 2015).

The majority of the orange production is destined to supply the juice industry with predominance of Valencia or Baía orange varieties (Becker, 2015; Oliveira et al., 2010). In the case of tangerines, the most produced cultivars are Ponkan and Caí, Pareci and Montenegrina mandarins (Becker, 2015; Oliveira et al., 2010). Even so, Rio Grande do Sul imports 100 thousand tons of citrus fruits a year, evidencing an internal market that has not yet been fully exploited (Becker, 2015).

The predominant aspect of citriculture is the use of family labor in small farms and the enormous potential to be exploited due to the favorable climatic conditions favoring the production of citrus fruits of different quality (Bombardelli et al., 2014; Petry et al., 2012). The differences between diurnal and nocturnal temperatures above 10 °C provide the production of fruits with accentuated coloring and sugar-acidity balance, providing quality to conquer the most demanding markets (Koller, 2006; Wrege et al., 2004).

The predominant climate in Rio Grande do Sul, along with the characteristics of currently utilized rootstocks (resistance to cold and induction of fruits of better organoleptic quality) are crucial factors in the production of citrus fruits for in natura consumption. In the hottest regions, maturation is anticipated, while in the colder ones it is delayed, and there may be a significant difference in maturation time (Koller, 2006).

Cost of production is a factor that varies as a result of the management practices, the edaphoclimatic characteristics and the sanitary requirements of each operation. The producer must be aware of the costs of production as well as the management practices of the orchard. Production costs surveys assist in the planning and the control of the activities developed by the producer, it can be an effective instrument in the analysis of activities and decision-making, besides meeting the accounting and fiscal requirements (Bombardelli Et al., 2014; Cruz et al., 2011).

It is essential that the citrus grower details all the costs, separating them into fixed and variable, which allows the study to show correlations between the level of activities, the volume produced, costs and revenues obtained in a given period, and also gives the manager (Tondato et al., 2010) the economic situation of the activity (Bombardelli et al., 2014; Cruz et al., 2011; Tondato et al., 2010).

In this sense, the optimization of the workforce through the cultivation of different citrus cultivars can help in the production of better quality fruits. Provide a longer harvesting period, requiring less hiring labor to harvest (Hillesheim & Pelegrini 2015).

Another production aspect that indicates potential for income improvement is the possibility of harvesting citrus fruits at different times of the year, including the harvesting of mandarins and oranges outside of the general harvest season, thus allowing the grower to receive a higher price for the product.

In order to determine the fixed and variable costs involved in the citrus activity of a small rural property, an economic survey of this operation was carried out in the municipality of Liberato Salzano in the state of Rio Grande do Sul. The objective is to

assist producers in the detailed management of their properties, by creating a tool for future investments or reduction of costs, according to the real needs of the producer.

## 2 | MATERIALS AND METHODS

The cost of production survey was carried out in a rural property in the municipality of Liberato Salzano, RS with a citrus cultivated area of 24.5 hectares, in the year 2015. The climate of the region averaged monthly rainfall of 146 mm and average annual precipitation of 1752 mm, the climate is subtropical and with excellent luminosity throughout the year.

In the surveyed acreage, dual-purpose oranges are grown [*Citrus sinensis* (L.) Osbeck] such as Valencia, Folha Murcha, Do Céu, and Iapar. There are also varieties grown for the fresh market, such as Baía, Monteparnazo, and Lanelate. Tangerines Caí and Montenegrina (*Citrus deliciosa* Ten.) are also cultivated, as well as Murcot hybrids (*C. sinensis* (L.) Osbeck X *C. reticulata* Blanco) and Nova [*C. paradisi* Macfad. X *C. clementina* hort. Ex Tanaka]. The data was obtained through direct communication with the producer and with the help of the local Emater /RS-Ascar, the Company of Technical Assistance and Rural Extension of state of Rio Grande do Sul.

The variable costs are the activities carried out in the orchard, such as temporary labor, machinery and equipment operations, fuel, application of fertilizers, herbicides, insecticides, fungicides and other expenses that were considered to obtain the Total Variable Cost. Variable costs are all costs that are directly related to the change in the level of production units. Thus, these costs vary according to the occurrence of increases or decreases in production and sales levels (Bowersox, 2006; Beulke & Berto, 1982).

Maintenance costs are those that do not vary with production activity. These costs do not change with the activity volume and remain constant in the short term (Passarelli & Bomfim, 2004). Depreciation is the book value added to the cost of production to compensate for the use or wear of machinery and facilities. The life of each equipment can be estimated based on the supplier's information and the experience of the project technologists (Passarelli & Bomfim, 2004). The formula used for the calculation of depreciation costs was:  $\text{Depreciation} = \text{New Value} / \text{Useful Life}$ . The total costs of the crop were formed by facilities, machinery and equipment, composed by the cost of depreciation, opportunity cost and pro-labore.

Adopting the methodology described by Lima et al. (2005), in the family production unit the Pro-labore for the family farmer considers a working day of eight hours per day for twenty five days per month, for a total of 300 days per year. The amount considered was a national minimum wage per month in the year 2015 for the three family members working on the property. Reference value equal to R\$ 788.00.

The opportunity cost of the land was based on the lease that considers 20 bags

of corn per hectare with a price in 2015 of R\$ 35.00 per bag of 60kg.

The data collected served as a basis to build the cost of production, which is the sum of the values of all productive services of the inputs used to produce any good.

### 3 | RESULTS AND DISCUSSION

The variable costs are described in Table 1 and the total was R\$ 29,413.76 or R\$ 1,200.56 per hectare. The labor force cost accounts for 17.34% of the variable cost. The fixed cost encompasses the cost of depreciation of machinery and equipment, and improvements and totaled R\$ 12,982.13 or R\$ 2,645.25 per hectare (Table 2). For each R\$ 1.00 invested in citriculture, the return was R\$ 4.50.

Bombardelli et al. (2014) determined the costs of an orange orchard in Aratiba, RS and obtained results showing that temporary labor contracted at harvest is the input that contributed the most to the variable cost, representing 36.20% of the total variable costs. In this same study, the authors estimated the average price paid for the orange delivered R\$ 0.15 per kg. Tondato et al. (2010) indicated that the cost for manual harvest reached 22.62% of the total cost. The economic viability portion of our study resulted in an annual total profit of R\$ 123,542.91, or R\$ 10,295.24 per month, or R\$ 5,042.56 per hectare per year (Table 3).

Adding to the cost of production the Pro-labore expenses of the three people working on the property and the opportunity cost of the land for the 24,5 hectares cultivated with citrus resulted on an annual income of R\$ 78.024,91 and an income of R\$ 3.184,69 per hectare per year and a monthly income of R\$ 6.502,08 (Table 3). The highest values considered in the cost of production were Pro-labore (family labor) and the opportunity cost, but citriculture showed positive results regarding its economic viability.

Producing food at a low cost has always been a challenge for the world economy, in the case of the primary sector it is fundamental to control costs in order to increase the sustainability of the activity. In citriculture it is not different, besides seeing the activity as a production system is necessary to think about the cost of the work of the family or businessman in the management of the activity, which we call Pro-labore, term used that comes from Latin “by Work “and that corresponds to the work of the owner of the business, partner or who is hired to manage the activity. We observed the great representativeness of this element of cost, when we compare with variable costs of production, but it is worth mentioning that Pro-labore is usually forgotten and the owner of the activity takes it as profit of the activity, when in fact it is the result of the process carried out in order to obtain production.

When a farmer chooses citriculture, he leaves aside the other possibilities, therefore he rejected other possibilities that could outweigh citrus, but he could also choose another activity that yields less, since we know that the agricultural market

oscillates in function of the law of supply and demand. In this study the authors opted for a more significant value of activity in the region, the corn crop, which is more frequent in the region and which usually provides an approximate opportunity value of 20% of maize production per hectare.

We observed that the lease of land that we considered as opportunity cost of land is an old practice in Brazil. But it is new in the region where the study was conducted. The region where the study was conducted was colonized by family farmers who own land as a mean of livelihood, family survival. Thus, leasing is a new activity in the region and usually the production costs of producers do not consider this element. We quote Rizzardo (2008) that rural lease occurs via contract, which passes to the lessee the responsibility of landlords, who hold the free administration of the rural property. As this practice is new in the region, there are no parameters in livestock activities, annual crops, permanent crops and much less in citriculture in the region, so we use what the landowners actually did that is the exploitation of the family soil.

The fruits were marketed to the fresh fruit market and to the juice industry. This diversification of fruit supply combined with the staggered harvesting were crucial to the success of the activity. The prices received for fresh fruits averaged R\$ 0.90 per kg, double the prices received by the fruits commercialized for juice industry which were R\$ 0.47 per kg (Table 3). The orange for industry was marketed in a local association of citrus growers, certified FAIR TRADE, or Fair Trade, to commercialize concentrated juice to European countries with a price above that practiced in the international juices market.

In this context, the fruit production period is an important characteristic to be considered by the fruit growers during the planning of the orchard, according to the target market, the climatic conditions of the region and the maximization of the means of production of the property in the case of planting more than one cultivar in the orchard (Tondato et al., 2010; Bombardelli et al., 2014). This is possible due to the fact that the different citrus cultivars have different stages of development during the year, thus maximizing the use of labor in the orchard (Tondato et al., 2010; Bombardelli et al., 2014).

The optimization of the workforce through the cultivation of different citrus cultivars can help in the production of higher fruit quality. For instance, there is a longer period of time available to carry out the necessary management operations. We can also cite as an indication of the income improvement of the producer the possibility of harvesting citrus fruits at different times of the year, including the harvesting of mandarins and oranges outside of the general harvest season, thus providing a better price for the product.

The survey of production costs and economic viability allowed the clarification of how the different activities carried out in the orchard determined the production costs and as the citrus activity is profitable and can serve as a basis for the maintenance of families in rural areas.

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Item	Unit	Amount	Unit Price (R\$)	Total (R\$)
Copper Sulphate	Kg	25.0	7.50	187.50
Mineral Oil	L	60.0	12.50	750.00
Fertilizer Zinc	Kg	10.0	41.00	410.00
Fertilizer CaB	L	10.0	14.70	147.00
Fungicide Comet	L	0.4	119.00	47.60
Fungicide Cercobin	Kg	22.0	39.40	866.80
Fertilizer Fosfito	L	8.0	56.25	450.00
Acaricide Abamectina	L	5.0	23.32	116.60
Lime Sulfur	L	800.0	2.50	2,000.00
Insecticide Malathion	L	1.0	25.26	25.26
Herbicide Glyphosate	L	60.0	12.80	768.00
Fertilizer	Kg	6,200.0	1.70	10,540.00
Pig manure (5.000 L)	L	42.0	52.50	2,205.00
Freight	ton.	166.0	25.00	4,150.00
Hand Labor (harvest)	d/h	85.0	60.00	5,100.00
Diesel Oil	L	550.0	3.00	1,650.00
<b>Total Cost</b>				<b>R\$ 29,413.76</b>

**Table 1.** Cost of management operations and agricultural pesticides for production and maintenance of 24.5 hectares of citrus in 2015 in Liberato Salzano, RS.

Machines and Equipment	Value New (R\$)	Useful life (years)	Total	Depreciation/Activity	
			Depreciation (R\$)		(R\$)
			(%)		
Tractor	65,000.00	15	4,333.33	70%	3,033.33
Drag atomizer 1.500 l	28,000.00	10	2,800.00	100%	2,800.00
Wagon three tons	2,500.00	10	250.00	80%	200.00
Hydraulic bucket	2,500.00	10	250.00	90%	225.00
Mechanical Mowing	7,500.00	10	750.00	100%	750.00
Mowing manual	750.00	10	75.00	100%	75.00
Lancer	2,500.00	10	250.00	70%	175.00
<b>Improvements</b>					
Shed machines	10,000.00	15	666.66	50%	333.33
Dwelling house	100,000.00	35	2,857.14	50%	1,428.57
Silo	5,000.00	10	500.00	100%	500.00
Shed inputs	2,500.00	10	250.00	50%	125.00
<b>Total</b>			<b>12,982.13</b>		<b>9,645.23</b>

**Table 2.** Rate of maintenance of 24.5 hectares of citrus in 2015 in Liberato Salzano, RS.

Description	Activity	Unit	Amount	(R\$)	(R\$)
<b>Revenue</b>	Orange juice	Tons	245	469.50	115,027.50
	Tangerine	Box 25 kg	1.520	22.22	33,774.40
	Navel Orange	Box 25 kg	600	23.00	13,800.00
<b>Total Revenue</b>					<b>162,601.90</b>
<b>Costs variable</b>	Management operations and agricultural pesticides	Hectare	24.5	1,200.76	29,413.76
	Rate of maintenance (depreciation)	Hectare	24.5	393.68	9,645.23
	<b>Total Cost variable</b>				
<b>Profit</b>	Annual Profit (Total Revenue – Cost variable)				123,542.91
	Hectare Profit (Annual Profit / 24.5ha)				5,042.56
	Monthly Profit (Annual Profit / 12)				10,295.24
<b>Costs</b>	Pró-Labore				28,368.00
	Opportunity cost of 24.5ha				17,150.00
<b>Total Costs</b>					<b>84,576.99</b>
<b>Profit</b>	Annual Profit (Total Revenue – Total Costs)				78,024.91
	Hectare Profit (Annual Profit / 24,5ha)				3,184.69
	Monthly Profit (Annual Profit / 12)				6,502.08

**Table 3.** Economic viability of a property with 24.5 hectares of citrus in 2015 in Liberato Salzano, RS.

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