

FEASIBILITY STUDY FOR IMPLEMENTATION OF RUBBER PLANTATION IN A PROPERTY IN THE STATE OF TOCANTINS

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ABSTRACT: This study aims to evaluate forestry activity implementation feasibility, through a commercial rubber plantation in property located in the city of Ponte Alta do Tocantins, State of Tocantins, at Leonel Farm (FL). The article was developed through literature review, material already prepared for the commercial plantation implantation techniques in other regions already established as producers. The feasibility and applicability of the project have been demonstrated through research and consultation with public and private entities, and by studying soil and climatic conditions of the region where the project target property is located, as well as considering the regional economic and social conditions. So it was identified what conditions are necessary for cultivation in FL and Tocantins. The assessment viability tools were applied, determining the internal rate of return (IRR) of 10%, with payback recovery between twelve and fifteen, net present value (NPV) positive after 12 years, profitability index (PI) 1.7, and benefit / cost ratio (B / C) of 1.63. The project is aimed at the production of latex, which is the raw material of natural rubber, a product widely used by industry worldwide. The market shows clear signs of increasing demand, and natural rubber is irreplaceable in some cases by synthetic origin rubber. Once the necessary minimum conditions for implementation are found on the property and also considering the very nature of the project, in the case of forestry with recovery of degraded areas, promoting carbon sequestration, it has been concluded that it is economically feasible, environmentally friendly and socially fair, to promote one more work opportunity to local population with good remuneration policy.

Keywords: Forestry. Natural rubber. Sustainable.

1 INTRODUCTION

Rubber tree (*Hevea brasiliensis*) is a species of the botanical genre belonging to the Euphorbiaceae family. The production of the rubber tree is latex, raw material of natural rubber (GONÇALVES, 2002).

History records the period comprised between 1870 and 1912 as being the climax of latex production (natural rubber) in Brazil, by means of the extractivism process, once the rubber tree is a native plant of the amazon forest. After this period, a short extended life period, during the Second World War (1939 to 1945) deserves to be highlighted, followed by the decline caused by the advent of commercial rubber plantation production planted by the British, with seed taken from here to Malaysia, Ceylon and Africa. Being commercial plantations, and having a good adaptation, they became much more productive than the native Brazilian rubber trees. In the 20th Century, around 1917, the introduction of this culture was started in the State of São Paulo, by Colonel José Procópio de Araújo Ferraz, in the city of Gavião Peixoto. As of then, with ups and downs recorded in history, it is observed that currently the State of São Paulo produces 60% of all the natural rubber produced in the country. Highlight should be given to the Agronomic Institute of Campinas, national reference in research and spreader of technologies intended for the cultivation and exploitation of rubber trees (GONÇALVES, 2002).

A stimulating fact for implementation of the project in the mentioned property, is that the State of Tocantins is receiving a large incentive from its government, upon implementation of productive zones and attracting manufacturing industries of the product, including incentive to finance the cost and investments, as well as facilitation of implementation of forestry projects from the legal point of view, for example Law No. 2634/2012, which dismisses the environmental permit for the cultivation of these trees in areas already consolidated, degraded or underused in agriculture-cattle raising. This action from the state government of Tocantins is perfectly aligned with the purposes of the federal government's program called Low Carbon Emission Agriculture (ABC – *in the Portuguese abbreviation*), with financial resources especially intended for such. Created in 2011, with the Coordination of Agro Energy of the State Secretariat of Agriculture and Cattle Raising (Seagro), the Eco Seringueira Program aims to develop the State's potential for forestry, by means of meetings and field days, besides support for the preparation of the technical project for the rural properties. The perspective is to reach three hundred thousand hectares of forests planted in the State of Tocantins until 2020. In 2011, the rubber tree cultivation

area in the State was 1,840 hectares, while in 2013, preliminary studies pointed to an area of 6,825 hectares, which represents a growth of 270%.

According to a publication of São Paulo's Association of Rubber Producers and Processors (APABOR, 2013) the natural rubber market presents balanced prices until the year 2008, which registered a strong fall as consequence of the grave world economic crisis. In 2009/2010 a robust recovery of prices paid the producer and the industry occurs, when the activity shows consolidation, with slight upward trend, both for the coagulum as well as the rubber, in a twelve-year period.

According to Virgens Filhos (2010), the implementation of a commercial rubber plantation requires medium to long term investments, with payback of around 15 years, with interest rates of 10.25% p.a and current price near R\$2,50 per Kg of natural rubber.

2 METHODOLOGY

This present work was prepared by means of a business plan in the first half of 2013. Bibliographic research and queries to public and private entities were made, such as Agronomic Institute of Campinas (IAC) and private companies that operate in the commercial forestry implementation segment. Budgets were used, like that of HeveaBrasil Group, to obtain information related to the article, such as the most indicated clone for the formation of the rubber tree plantation, spacing between trees, fertilizers used, formation period, start of production, bleeding methods, tools used, ant fighting period, number of trees/ha, spacing between lines and between individuals (trees), seedling price, i.e, the whole cultivation production process of the Rubber Trees. Through SWOT Analysis, the strong, weak points, opportunities and threats of the business were described, to analyze the Rubber Plantation scenario, and to identify and take advantage of the opportunities.

Feasibility and profitability studies for the business plan were made. This way, the net present value (NPV), internal rate of return (IRR), payback and profitability index (PI) were obtained, which are feasibility and profitability tools and payback period in years. The net present value (NPV) changes the future value into present value and shows if the business plan is feasible or unfeasible. As for the internal rate of return (IRR), it measures the profitability of the business plan in percentage, the payback measures the return period of the investment in years and the profitability index (PI) measures the percentage of profitability.

The owner already had the land, requiring finance for acquisition of equipment and for conducting the project, as well as for contracting a company specialized in the implementation, from the seedlings, to preparation of the soil, fertilization and planting. The

region where the property which is the aim of the project gathers minimum general conditions for the desired implementation and the latex production activity is considered promising, both on local, regional and global sphere.

3 RESULTS AND DISCUSSION

The Leonel Farm (FL) has as mission the profitable agroforest-pastoral production and thus participates in the local and regional development of the city of Ponte Alta do Tocantins, contributing to its own social and economic development and of the community.

FL intends to contribute with the social and economic development of the region through a clean, inexpensive and ecologically sustainable production, with employment of specific technologies in each area of actuation, aiming at productivity and profitability, and promoting human, social and cultural development of the workers.

The company's values are honesty and integrity, allied to management capacity and efficiency in operational activities, which are the pillars of FL in the construction of an environment of professionalism, competence, motivation and commitment with its workers.

The objectives are being successful and having efficiency in the implementation of a commercial rubber plantation; integrating this productive activity as an alternative of good long-term economic results in the already existing cattle breeding activity and obtaining guarantee of sustainability of the property.

The option for implementing a forestry project has its origin in the nature of the business, which allies good profitability and remuneration within the comparative parameters of production systems in the agribusiness sphere, promoting the recovery of areas degraded by cattle breeding exploitation, through a system considered economically viable, ecologically correct and socially fair, as it is another opportunity of work for the local population, with good remuneration capacity.

After SWOT analysis, Chart 1 below was prepared listing the strong and weak points of the farm, as well as the opportunities and threats to the business.

Chart 1 – SWOT Analysis

<p>STRONG POINTS</p> <p>Easy access by highway; Availability of area for production; Management capacity; Good water resources; Appropriate terrain.</p>	<p>WEAK POINTS</p> <p>Absence of specialized labor; Inexperience in forestry; Absence of machines and equipment; Absence of Infrastructure.</p>
<p>OPPORTUNITIES</p> <p>Government incentive, with technical assistance and ease of credit; Deficit of national latex production; Low cost of the land; Local market under expansion; Climate.</p>	<p>THREATS</p> <p>Climate; Diseases and plagues; Poor infrastructure in the city;</p>

Source: Prepared buy the author. 2013

FL has a total area of 968 ha, located in the southeastern region of the State of Tocantins, in the city of Ponte Alta do Tocantins, coordinates: Lat -10° 58' 21,2 Long 47° 25° 26,1°, its area is distributed according to Table 1.

Table 1 – Destination of the area of Leonel Farm.

Destination	Area
Legal Reserve	338, 800 ha
APP (permanent preservation area)	55, 458 ha
Pastures	300, 000 ha
Improved and not used area	273, 742 ha
Total	968, 000 ha

FL's soil texture classification is frankly sandy, with clay percentage varying between 13% and 25%, with soil profile between medium and deep, according to analysis made of the soil.

The fertility levels vary from medium to low natural fertility, requiring pH correction and aluminum (Al) neutralization, as well as addition of chemical nutrients by fertilization.

According to Köppen Geiger climate classification, it's AW type, which means tropical with dry winter season. Two well-defined seasons, with the rainy occurring between October and April, and the dry period from May to September. Rainfall is around 1600 mm/year, with maximum average temperature in the warmest month of the year of 36 °C and average

minimum temperature in the coldest month of the year of 21 °C. The average relative humidity of the air is 76%, with approximately 1.800 to 2.200 h/year of insolation.

According to a study made by Empresa Brasileira de Pesquisa Agropecuária (CAMARGO; MARIN; CAMARGO, 2003) which established agricultural zoning for the commercial planting of the Rubber Tree, it is observed that there are areas called fit, restricted, marginal and unfit for this culture. This classification has as main foundation the climactic conditions, like average maximum temperature, average minimum temperature, occurrence of frost and problems related to water deficiency.

According to mentioned agriculture zoning, the region where Leonel Farm is located is identified as being, Range E, considered Marginal Area, which is fit with restrictions for the plantation of rubber tree, especially in relation to the water deficit, requiring the use of deep soils and avoiding low grounds thus preventing risks of lack of moisture in the soil and the feared leaf blight disease caused by the *Microcyclus ulei* fungus.

After queries made to the State Secretary of Agriculture and Cattle Breeding (Seagro) of Tocantins, broad bibliographical revision of material published by the Agronomic Institute of Campinas (IAC), as well as after queries to commercial companies that act in the implementation of rubber plantation, it was decided to use the secondary clone RRIM 600, developed by the Rubber Research Institute of Malaysia – (RRIM), whose parental are primary clones Tjir 1 and PB 86. Its trees are high, with vertical stem and quick growth when young. High production is its highlight. It is indicated by IAC for large scale planting. For the planting, seedlings of 10 to 18 months are recommended and the most productive clone in Brazil currently is the RRIM600, with highlights also for the clones: GT1, PR255, PB235 and PB217.

As technology to be employed in the implementation of the rubber plantation, in view of the researches made, it is observed the tendency for planting with density of 550 plants per ha, in 40 cm x 40 cm x 40 cm holes, and spacing of three meters between plants and six meters between lines.

The soil correction operation, in relation to pH and aluminum neutralization, will be made in the full area, according to specific recommendation after analysis of the soil by agronomic engineer from company HEVEABRASIL, with application of 1.5 ton/ha of dolomitic limestone with 85 of PRNT, seeking to elevate saturation of bases at 50, between the two heavy harrows, aiming at the best incorporation of limestone from 0 to 40 cm. It is considered that the number of two harrows in said process could be used without prejudice to the soil structure, without risks of erosion, seeing that the culture to be implemented is of perennial nature, and it will remain there for many years, without requiring new interventions of this nature to the soil.

According to soil analyses, the technical assistance recommends the application of nitrogen in the amount of 10 to 15 Kg/ha, phosphorous between 75 and 90 Kg/ha and potassium from 40 to 50 Kg/ha. Transferring the indices requested in the analysis to commercial formula, we have the need of applying three hundred kilos of fertilizer 5.25.15 + 5% Zinc.

The planting will be made in holes, as already mentioned above, opened in furrows that will delimit the lines, with crowning in each plant. Fertilization of the planting will be made in the holes, using recommendations from soil analyses, requiring incorporating in the hole 30g of P₂O₅, 30 g of K₂O; use 20 liters of matured pen manure, if available; apply nitrogen in coverage in three portions of 30g/plant during the first year.

The Leonel Farm (FL) intends to supply mainly the latex in form of coagulum. This product is obtained by bleeding the rubber trees' trunks, collecting it in recipients in the shape of buckets, duly fixed to the trunk. The latex, once solidified, gives origin to the coagulum, which duly processed in manufacturing plants, will be marketed in the form of natural rubber.

The useful life of a rubber plantation is approximately 30 years of production, starting between the 5th and 7th year after planting, depending on the planting technology and performance of the cultivation. A production between 4 kg/tree in the beginning of production, and 8 kg/tree/year to 9 kg/tree/year with the maturity of the plants is expected.

As financial planning, according to the technology to be employed and according to average production indicative, the objective is to reach income between the 6th and 7th year, with start of productivity in the range of 4 Kg of latex per tree, and increasing this production to 8 to 9 Kg per tree in the 10th year.

According to price history surveyed with the São Paulo association of rubber manufacturers (APABOR) the price in January 2011 was around 2,70 BRL per kilo, with possibility of variations depending on the quality of the product and distance from the production site.

As of this information, a gross income is projected for the first three years of production in the range of 540.000,00 BRL per year, and 1.080.000,00 BRL as of the 10th year, according to table 2.

Table 2 – Summary of the project's cash flow

YEAR	Income	PV* Income	Outputs	PV* Outputs
YEAR 1	40.000,00	37.558,68	137.270,00	137.268,93
YEAR 2	32.218,40	28.405,65	137.270,00	121.025,36
YEAR3	23.814,27	19.714,62	137.270,00	113.638,84
YEAR 4	14.737,81	11.456,04	137.270,00	106.703,14

YEAR 5	4.935,23	3.602,12	137.270,00	100.190,74
YEAR 6	0	0,00	137.270,00	94.075,81
YEAR 7	540.000,00	347.493,35	319.270,00	205.452,22
YEAR 8	540.000,00	326.284,84	319.270,00	192.912,89
YEAR 9	540.000,00	306.370,74	319.270,00	181.138,86
YEAR 10	1.080.000,00	575.344,11	535.270,00	575.344,11
YEAR 11	1.080.000,00	540.229,21	521.770,00	260.995,74
YEAR 12	1.080.000,00	507.257,48	521.770,00	245.066,42
YEAR 13	1.080.000,00	476.298,10	521.770,00	230.109,93
YEAR 14	1.080.000,00	447.228,26	521.770,00	216.065,08
YEAR 15	1.080.000,00	419.932,64	521.770,00	202.878,01
YEAR 16	1.080.000,00	394.302,95	521.770,00	190.495,78
YEAR 17	1.080.000,00	370.237,51	521.770,00	178.869,28
YEAR 18	1.080.000,00	347.640,85	521.770,00	167.952,38
YEAR 19	1.080.000,00	326.423,34	521.770,00	157.701,76
YEAR 20	1.080.000,00	306.500,79	521.770,00	148.076,77
TOTAL	13.575.705,71	5.754.722,60	7.397.130,00	3.688.693,12

*PV = Present Value

The amount needed for implementation of a rubber plantation in a 100 ha area is in the order of 1.299.300,00 BRL, amount spent in the whole implementation process, as well as in the conduction during the first six years of the project. In this amount, it is already included resources for acquisition of an agricultural tractor with 75 CV power, a tanker with 4,000 liters capacity, a dry load truck with 4,000 Kg capacity, power brush-cutter and rotary cutter, air compressor and a welding machine, as well as buckets and several tools. It is also foreseen the construction of a 200 m² shed in the farm.

As of the cash flow estimated for a 20-year period, which is demonstrated in table 2, the net present value (NPV), internal rate of return (IRR), discounted payback and effective payback, the profitability index (PI), the benefit/cost ratio (B/C), with the following results:

The net present value (NPV) according to the twenty years net cash flow is 965.588,61 BRL, at a rate of 6.5 pa;

The internal rate of return (IRR) is 10%, which shows that the project is economically feasible, as said rate is greater than the investment cost rate, which is 6.5% pa.

The discounted payback and the effective payback show, respectively, return in 11.43 years and 14.71 years, which means that in said periods, depending on the method, it will have the initial investment paid and a net profit in net present value (NPV) of 965.588,61 BRL, i.e., between one third and half of the project's useful life, which is estimated in 30 years, but which could be longer according to the handling employed.

The profitability index (PI) for the present project is 1.7, which represents a relative return value for each Brazilian real invested according to table 2.

The calculation of the benefit/cost ratio (B/C) resulted in a ratio of 1.63. The calculation of the net income in 20 years indicated a value of around 965.588,00 BRL, after the payment of the investment.

4 FINAL CONSIDERATIONS

In view of the favorable results obtained in the financial evaluation methods mentioned above, it is concluded that the project is feasible, financially and economically, at a rate of 6.5% a year, showing an internal return rate (IRR) of 10% pa., a recovery of the value to be invested in a period comprised between 11 and 15 years, and a positive NPV.

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