v. 2, n. 1, 2022

Journal of
Agricultural
Sciences
Research

# GOOD PRACTICES IN HYVECULTURE: IMPLEMENTATION AND CONDUCTING OF THE RUBBER TREE PLANTATION

***Elaine Cristine Piffer Gonçalves***
APTA Polo Regional Alta Mogiana
Colina/SP
ORCID ID – 0000-0001-5797-6264

***Antônio Lúcio Mello Martins***
APTA Polo Regional Centro Norte
Pindorama/SP
http://Lattes.Cnpq.Br/1092498137289104

***Marli Dias Mascarenhas Oliveira***
APTA – Instituto De Economia Agrícola
São Paulo/SP
http://Lattes.Cnpq.Br/6205294317598755

***Ivana Marino Bárbaro-Torneli***
APTA Polo Regional Alta Mogiana
Colina/SP
ORCID ID - 0000-0002-2954-2693

***José Antonio Alberto da Silva***
APTA Polo Regional Alta Mogiana
Colina/SP
http://Lattes.Cnpq.Br/1398758607886303

***Anita Schmidek***
APTA Polo Regional Alta Mogiana
Colina/SP
http://Lattes.Cnpq.Br/3709782731891847

***Fernando Bergantini Miguel***
APTA Polo Regional Alta Mogiana
Colina/SP
ORCID ID – 0000-0002-4778-8961

***Marcelo Henrique de Faria***
APTA Polo Regional Alta Mogiana
Colina/SP
http://Lattes.Cnpq.Br/4131019883040512

***Regina Kitagawa Grizotto***
APTA Polo Regional Alta Mogiana
Colina/SP
http://Lattes.Cnpq.Br/2809175495850519

**Abstract:** Rubber cultivation is a long-term activity and some care needs to be taken when deciding to invest in a rubber project. In a perennial crop, we have to be very careful with the agricultural practices adopted because, once the planting is installed, there is no way to redo it. It is extremely important specialized technical follow-up, from the choice of area for project implementation, choices of seedlings and clones that will be used, all the management practices and conduction of the rubber plantation, as well as the nutritional program, control of pests, diseases, weeds. The success of the enterprise will depend on the choice of best practices in all phases of the culture. The present work was developed with the objective of making available to rubber growers a Guide to Good Practices for the cultivation of rubber trees: from the choice of the area to the beginning of production.
**Keywords:** rubber tree, good practices, implantation, rubber tapping.

## INTRODUCTION

Rubber cultivation is an important agricultural activity, which has great environmental, social and economic value. The use of its raw material, latex, occurs in multiple segments, with emphasis on pneumatic industries and pharmaceutical products. The rubber tree is originally from the Amazon region, belonging to the genus Hevea, family Euphorbiaceae. Among the 11 species of the genus, H. brasiliensis is the most important, as it is the largest source of natural rubber for Brazil and the world. (WILCKEN, et al., 2015).

Natural rubber is a strategic raw material, which combines the characteristics of resilience, elasticity, plasticity and wear resistance. (GONÇALVES et al., 2009), intended for the manufacture of various products (SOARES et al., 2008). The national production of rubber (coagulated latex) is

concentrated in the states of São Paulo, Bahia, Mato Grosso, Minas Gerais, Goiás, Espírito Santo and Mato Grosso do Sul.

The state of São Paulo stands out for being the largest national producer and has, according to the IBGE (Brazilian Institute of Geography and Statistics), 49.1% of all Brazilian harvesting area (75,179 hectares) and 68.2% of the produced volume (227,163 tons) of clotted latex (Oliveira & Gonçalves, 2020).

In a perennial crop, we have to be very careful with the agricultural practices adopted because, once installed, most of the time there is no way to redo them. The installation of a rubber tree plantation must follow validated technical guidelines, as the success of the enterprise will depend on this. The objective of the present work is to guide investors who intend to implement new rubber projects and subsidize rubber growers who have already implemented rubber plantations, on the good practices to be adopted for the rubber tree culture.

## MAIN CARE: FROM THE CHOICE OF SEEDLINGS TO THE START OF PRODUCTION.

The rubber tree crop has some peculiarities. As it is a perennial crop (producing for more than 40 years if well conducted) and takes an average of 7 to 8 years to start production, some care and guidelines must be followed in order to be successful. When deciding to invest in the rubber tree culture, we have to consider several factors, among which we can mention:

**- Choosing the area for installing the syringe:**

The first step to be considered in the implementation of a rubber project is to verify if the region is framed in an area favorable to its development, according to the Agroclimatic Zoning for the crop. (Gonçalves et al., 2010). For this, Agroclimatic Zoning Maps are available for culture in Brazil and specific to the state of São Paulo.

The maps and the location of the areas where the culture is intended to be planted should be carefully analyzed, as there are areas with disease restrictions (mainly leaf blight as illustrated in Photo 1), and others with water and temperature restrictions, subject to frosts and cold winds, etc.

**In addition to this framework, other care should be taken,** observing the characteristics of the place:

a) **Exposure to cold or prevailing winds:** as far as possible, avoid areas exposed to such factors. Otherwise, special care must be taken to mitigate the harmful effects, such as windbreaks, which can be from large annual crops, or even legumes with a size that meet these requirements..
b) **Depth of the ground:** for the perfect development of the root system of the rubber tree, a minimum depth of approximately 4 meters is required, free from any impediment, or waterlogging.
c) **Accumulation of cold air:** In the first years of formation, the rubber tree is susceptible to the effect of low temperatures, which is why slopes with accumulation and poor drainage of cold air should be avoided..
d) **Isolation of the area:** consider aspects related to fire risks such as pasture areas, sugarcane fields, capoeiras, etc., keeping the area closed.
e) **Topography:** avoid very steep areas in order to facilitate mechanization, cultural practices and exploitation.
f) **Presence of wild animals:** avoid planting in areas where the concentration of wild animals is high and it is not possible to remove them. In some states, plantations were carried out in areas where there were many problems, mainly in the first years of implantation due to the attacks of tapirs, wild boars and capybaras, which cause serious damage to the plants..

Photo 1: Area in Bahia: clone susceptible to leaf blight – Bahia (Photograph: Elaine Gonçalves).

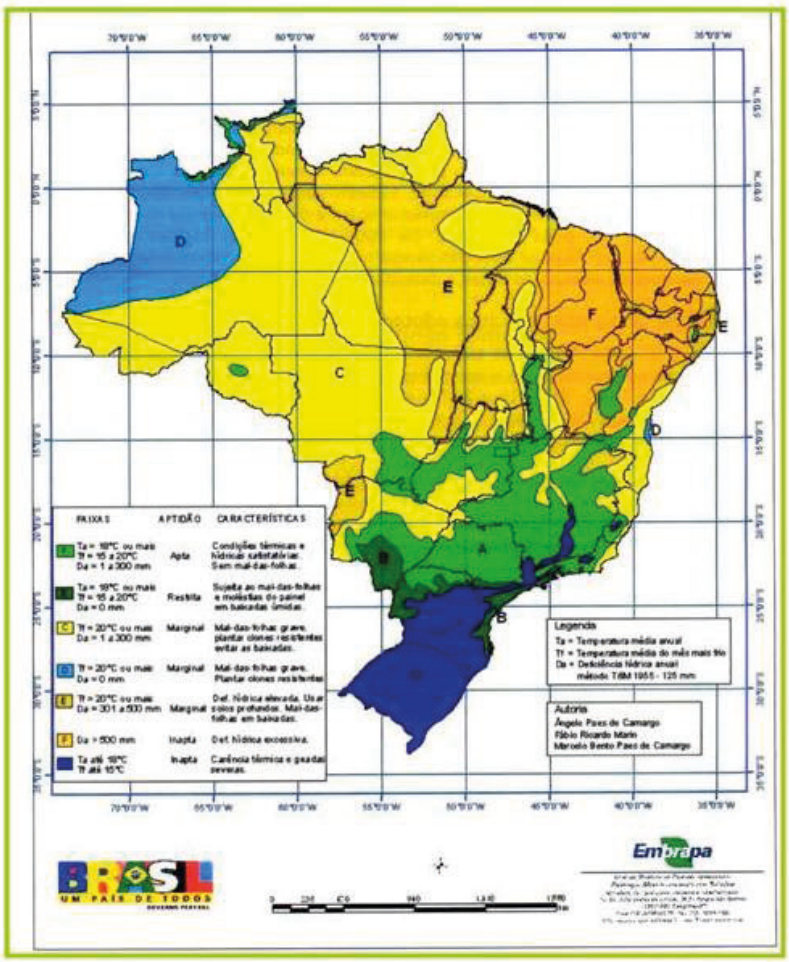


Figure 1: Agroclimatic Zoning Map for rubber trees in Brazil (EMBRAPA, 2003).

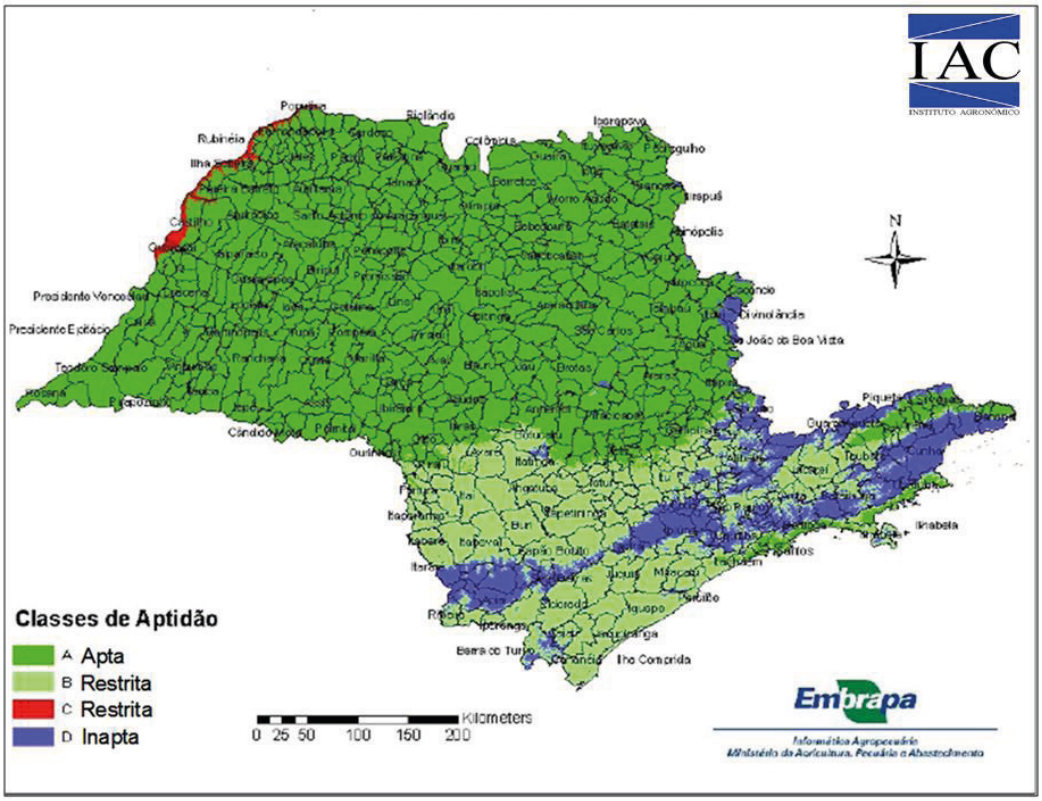


Figure 2: Agroclimatic Zoning Map for rubber trees in the state of São Paulo (Gonçalves et al., 2010).

**- Choice of seedlings:**

The choice of seedlings is directly linked to the success and homogeneity of planting. The producer should not opt for cheap and poor quality seedlings. Give preference to suitable nurseries that have the genetic origin of the seeds used for the production of rootstocks, where it is stated which clone was used and where they were acquired. There are clones that are not recommended as rootstocks due to susceptibility to root rot, others are recommended for drier regions (drought tolerant), others may show incompatibility with the graft (crop). The seedlings must be produced respecting all the phytosanitary recommendations required for the culture and the nursery must be registered in the RENASEM (National Register of Seeds and Seedlings) in the MAP and CDA (Agricultural Defense Coordination) and have a technical manager. In addition, demand the invoice for genetic proof of the material used to make the graft (bubbles), this will guarantee the genetic origin of the seedlings and through this information it will be possible to have the genetic traceability of the plants.

It is worth noting that there were several cases of producers who acquired seedlings of a particular clone, planted them and when the rubber plantations were already 10 years old, it was found that they had bought "cat in a poke". If there is doubt about the origin of the plants, you can choose to do the DNA of the plants and prove the genetic issue.

Considering the quality of the seedlings, there are several studies demonstrating that the greatest means of dissemination of nematodes in rubber trees is through the seedlings, so, before taking contaminated material into your property, ask for a report proving the nematode exemption in the seedlings that are being acquired or send a sample of soil and

roots of the seedlings so that an analysis can be carried out in an accredited laboratory.

In 2011, the agricultural defense office of Barretos/SP, together with the UNESP (Campus of Jaboticabal and Botucatu), carried out a sample survey in 88 nurseries that produced rubber tree seedlings in the state of São Paulo and found that more than 74% of seedling root samples from ground nurseries were contaminated with nematodes. (Gonçalves et al., 2019).

One way to avoid all this inconvenience is to choose to purchase seedlings produced on a suspended bench using substrate. Despite the cost of this seedling being on average R$ 2.00 to R$ 3.00 more than the ground seedling, the advantages that it presents in relation to genetic traceability, phytosanitary quality, higher rate of setting and development, planting homogeneity and anticipation of entry into bleeding, with a higher percentage of suitable plants, make this type of seedling the best option for new plantings.

- **Soil conservation and preparation:**

For the implantation of the culture, activities must be planned, such as: topographic survey, allocation of roads and trails, subdivision of the area into plots and definition of planting.

Depending on the type of relief, different techniques may be adopted for planting:

**a) Flat relief land**

For terrains with flat relief, with uniform unevenness in only one direction (slope 0 to 3%), the most indicated is planting in straight lines, which can happen in two ways: the first, with lines parallel to the upper and lower field; the second, with straight parallel lines obeying the trend of the level lines, which is ideal for terrains with uniform slope in a single direction. In both cases, the demarcation of the pits must be done with the help of intermediate lines.

**b) Land with undulating relief, with more accentuated declivity**

For stands with steep slopes and irregular topography, the planting must be level, with the demarcation of basic level.

All erosion control practices are based on the principle of sectioning off the slope of the terrain (reducing the length of the ramp) by means of mechanical or vegetative barriers, with the aim of reducing the speed of rainwater runoff, preventing the formation of

Photo 2: Seedlings produced with substrate and on a suspended bench (Photo: Elaine Gonçalves)

runoff and provide water infiltration into the soil. Terraces will be built on the level lines, or holes will be demarcated, depending on the chosen practice: simple level planting or terracing..

**a) Marking the level lines**

Level lines must be allocated with precision level employment. First, the spacing between the level lines is determined, using the terrace spacing to which this practice is usually associated, which is found in tables (Coordenadoria de Assistência Técnica Integral, 1994) depending on the culture, the chosen conservation practice, the type of soil and the slope of the terrain.

Having determined the horizontal spacing between the level lines, this spacing is adjusted to a number that is multiple of the distance between the rubber tree streets. Whenever possible, two level lines should be transformed into carriers, leaving a median level line between them. If the terrain has two or more very different slopes, it is advisable to separate these different areas by means of level or slope tracks, depending on the position of the areas.

The lack of dead streets should be a concern of rubber growers, that is, dead-end streets, due to the difficulty they cause for the operations of cultural practices in general. Therefore, the best system for marking holes in level is the one in which, starting from a midline level line, parallels are drawn from the bottom up until finding the upper level line, where a carrier has been marked; from the same median, parallels are drawn downwards until finding the lower level line, where another carreador was marked, thus leaving all the streets with an exit for carreadors.

The lower the slope of the terrain, the better the described process is adapted. A good option for land with a slope between 5% and 18% is to build terraces of medium base along the lines for planting the seedlings.

**b) Terracing**

To mark the terraces, follow the same instructions as for the level lines. Its construction is carried out with a disk harrow or terracing machine. The number of passes with a tractor, for the construction of terraces, depends on the type and moisture of the soil, etc. The important thing is that, in the end, the terrace is large enough to withstand the maximum rainfall in the region. (COORDENADORIA DE ASSISTÊNCIA TÉCNICA INTEGRAL, 1994). In this particular, your section is very important.

The conditions that advise against the construction of terraces are: shallow soils, where just below the surface layer is the rock or layer of impediment; slopes greater than 18%; soils with marked drainage deficiency; land highly compromised by erosion; and, finally, land that receives water from roads or neighboring unprotected areas.

**AREA PREPARATION**

Second MATTOS et al. (2011) the preparation of the area can be carried out by the following systems:

**a) Conventional Preparation**

Prepare the land through stumps, plowing and harrowing, using the spaces between the lines for planting interim crops, such as legumes for plant cover.

**b) Minimum Cultivation**

The vegetation of the planting strip is desiccated, through the application of herbicides, then it is recommended to subsoil and harrow the planting strip. Leaving the lines prepared for planting, which can be done in furrows and opening holes with auger or drill, as long as it does not compact the sides of the hole.

Liming must be done before implantation, based on the results of the soil analysis, with sampling and liming repeated, if necessary, every two years. In case the base saturation

index (V) is less than 40%, it is necessary, through the calculation of the limestone dosage, to try to raise the referred index to 50%, respecting the limit of 2.0 $tha^{-1}$ Yearly.

## DISTRIBUTION AND SIZING OF PLOTS

Square or rectangular plots are suitable for flat or low-sloping terrain. The flatter the terrain, the greater the performance of the bleeder. Irregular plots usually occur on terrains with high slopes and subject to erosion. These plots must not be too large or small and to facilitate management, the total planting area divided into blocks of up to 25 hectares, each block being an entire sub-multiple of the total planted area. It is necessary to evaluate the losses with carriers, which generally consume 6 to 8% of the area destined for planting.

**- Planting:**

The planting of seedlings should preferably be done at the beginning of the rains, respecting the recommended usable area between 18 $m^2$, fertilizing with phosphorus in the pit. The recommended usable area is traditionally 20 $m^2$ for each plant.

- Respect the following precautions when planting the seedlings:

· Cut the bottom of the plastic bag along with the taproot that may be tangled up in the bottom of the bag;

· Make a longitudinal cut in the bag, placing the seedling at the bottom of the hole still surrounded by the plastic bag, preventing it from falling apart;

· Place soil until half of the seedling is still covered by the plastic bag;

· Remove the plastic bag and finish getting the soil into the seedling, without "tapping" it too much;

· Avoid in any way the breaking of the clod, responsible for the death of the plants;

· Make a "crown or basin" around the seedling, with a capacity of at least 20 liters of water;

· Irrigate immediately after planting to accommodate the land next to the clod, avoiding the formation of air pockets;

· Make the necessary replanting so that there are no gaps in the area, even in the first six months of planting.

**- Weed Control:**

The rubber tree, like other cultivated plants, is very sensitive to infestation and competition with invasive plants. These species, also called weeds or weeds, have a great ability to compete for sunlight, oxygen, moisture and nutrients, resources necessary for the full growth and development of the rubber tree.

For this reason, plants should always be kept clean, especially at implantation and during the first year. During this period, it is recommended that the soil and the aerial part of the rubber trees be free of any weeds at least one meter on each side of the planting line, during the first two years. (Guzzo, et al., 2014).

This care will avoid competition and allow satisfactory growth and development of rubber trees, suggesting that manual and/or chemical management be carried out in the planting lines and that the weeds preserved between the lines be managed with the use of brush cutters, keeping the weeds cleared as a protector of the soil. Attention must be redoubled in the dry period, when competition for water is accentuated and the risk of fire is increased. Therefore, firebreaks must be made on the edges of the plots and boundaries of the property.

Photo 3: Weed control strip (Photo: Elaine Gonçalves)

**- Sprouts:**

Thinning consists in the elimination of undesirable sprouting, which can occur both in the rootstock and in the developing graft. All sprouting beyond the graft should be removed as soon as it is found, allowing greater vigor to the graft sprout. If sprouting occurs on the stem of the graft, it must be removed manually with the aid of specific tools (knife or pruning shears), as soon as possible, keeping the single stem free of any sprouting up to a height of 2.5 meters. The thinning must be carried out by previously trained labor, which runs through all the planting lines at least once a week. When pruning, care must be taken not to bend the stems of taller plants..

**- Fertilizing:**

"Mineral fertilization is the most important factor in increasing agricultural productivity" (Raij, 1992). This statement reflects the technological potential available to achieve the goals of modern and competitive agriculture. However, fertilization is not a practice that can be considered in isolation, and must be evaluated in conjunction with other practices that also affect production and, therefore, lead to an increased need for nutrients. Examples are: liming, irrigation, control of pests, diseases and invasive plants, the use of more productive varieties, efficient soil management, etc. It is also necessary to know the interactions so that the full potential of fertilizers can be translated into production. Liming is the main factor to guarantee the highest efficiency of fertilization, at a relatively low cost, increasing the availability of nutrients in the soil and their absorption by the plant. In this sense, Bataglia et al. (1988) notaram, em seringais paulistas, that the plots with low productivity (<1,0 t $ha^{-1}$) were associated with soils with higher acidity (V = 27%). Although works on the rubber tree reaction to liming are still scarce, liming is recommended to raise V to 50% in the state of São Paulo (Cardoso, 1992). Roque et al. (2004), observed in rubber plantations in production, that maximum productivity was associated with base saturation of 57% and foliar calcium (Ca) content of 8 g $kg^{-1}$.

## PLANTING FERTILIZATION

In the rubber tree planting phase, it is recommended to incorporate 30 g of

phosphorus into the hole. ($P_2O_{5)}$, 30 g of potassium ($K_2O$) and in zinc deficient soils (content of Zn< 0,6 mg $dm^{-3}$ in DTPA), apply 5 g of Zn. When available, use 20 L of tanned barnyard manure (Bataglia and Gonçalves et al., 1997).

## POST-PLANTING FERTILIZATION (FIRST YEAR)

In addition to the seedling production and planting phase, the post-planting phase is important to induce vegetative vigor to ensure early production in the rubber plantation, in order to obtain satisfactory commercial production as early as possible..

In the post-planting phase, apply nitrogen (N) in top dressing, in 3 plots of 30 g per plant during the first year (Bataglia e Gonçalves et al., 1997).

## TRAINING AND PRODUCTION FERTILIZATION

The fertilization recommendations available in Brazil, for the formation and production phase, are restricted to some rubber-producing states. It is also worth noting that there are variations in fertilization criteria, with some states that use only chemical soil analysis, and others that consider soil chemical analysis and the age of the crop, such as the state of São Paulo (Table 1).

**- Pest and disease control:**

The rubber tree cultivation [*Hevea brasiliensis* (Willd. ex. Adr. de Juss.) Müell. Arg.] in monoculture areas, it has favored the emergence and development of several pests and diseases. The monitoring and control of pests and diseases in the different stages of the crop are very important to guarantee the good development of the plants, the homogeneity of the planting, guaranteeing good productivity. In Brazil, many insect species are reported in association with rubber trees in various regions of the country, in native areas, nurseries and monoculture areas. The species considered pests of economic importance in the rubber tree are: mites, lace bug, mandarová, ants, mealybugs, thrips, trunk pests and beetles. The period of formation of the rubber plantation is a phase of great importance for the future of the enterprise.

The uniformity of planting should be the rule, taking only the best seedlings to the field, if possible with two mature releases. At this stage, diseases must also be avoided and controlled, so as not to compromise the "stand", plant growth, canopy formation and the number of plants that must be bled in the future. The foliar diseases are practically the same that occur in the clonal garden phase, however the attack intensity depends on the planting region, the clones used and the time of year. Regarding the diseases that have affected the plantations in the different states of cultivation, during the formation phase. we can mention: leaf blight, anthracnose, powdery mildew, graft canker,

| Age | Nitrogen | P resin | | $K^+$ exchangeable, $mmol_c\ dm^{-3}$ | |
|---|---|---|---|---|---|
| | | 0-12 | >12 | 0-1,5 | >1,5 |
| Years | N, kg $ha^{-1}$ | $P_2O_5$, kg $ha^{-1}$ | | $K_2O$, kg $ha^{-1}$ | |
| 2-3 | 40 | 40 | 20 | 40 | 20 |
| 4-6 | 60 | 60 | 30 | 60 | 30 |
| 7-15 | 60 | 50 | 30 | 60 | 30 |
| >16 | 50 | 40 | 20 | 50 | 30 |

Table 1. Production fertilization recommendation based on chemical analysis of soil, leaves and productivity (Bataglia e Gonçalves et al., 1997).

black crust, root rot, rubellosis, shoot dryness in *Phomopsis*, and the genus nematoides *Meloidogyne* and *Pratylenchus*.

The nematode M. exigua is a species native to Brazil, which is currently widespread in all areas cultivated with coffee in the country, since coffee is its main host. Several studies show that populations from coffee and rubber trees present biochemical differences regarding the esterase enzyme, with the detection of four phenotypes, E1, E1a, E1b and E2 and physiological races, with Race 3 of M. exigua parasitizing only the rubber tree (and not the coffee tree), while Race 1 is composed of individuals that infect only coffee and pepper and Race 2 by individuals that infect infect coffee, pepper and tomato plants. Therefore, as the nematode M. exigua Race 3 only parasites the rubber tree, its dissemination to open areas will occur mainly through contaminated rubber tree seedlings. (Oliveira & Oliveira, 2019).

**- Preparation of the syringe for entry into bleeding:**

When the rubber plantation is about to go into production, normally around six to eight years after the seedlings are planted, some measures must be taken in order to rationalize the exploitation operations. A survey of plants suitable for bleeding must be carried out.

This is done with the aid of a tape measure, determining how many and which plants present conditions for entering the exploitation regime. Plants suitable for bleeding are those that at 1.30 m from the ground have a circumference equal to or greater than 45 cm and have a bark thickness of at least 6 mm. Once the technical condition is satisfied, socioeconomic factors must be analyzed, such as the price of the product, number of suitable trees per hectare, cost of labor and economic return of the operation. Analyzing them, a decision is made whether or not to bleed the rubber.

## FINAL CONSIDERATIONS

Rubber cultivation is a high-risk activity if we consider all the care that must be taken in the implantation of a rubber plantation and being a long-term investment, any error or failure during the implantation and management of the rubber plantation could compromise the future investment. Follow the main tips and care presented here, avoid fads, recommendations made by adventurers without integrated technical knowledge and experience in the subject. Avoid using so-called miraculous products, not scientifically evaluated, however, invest in seedlings with quality and genetic guarantee. The success of a rubber enterprise essentially depends on specialized, qualified and honest monitoring and technical guidance.

## REFERENCES


GONÇALVES BATAGLIA, O.C.; CARDOSO, M.; CARRETERO, M.V. Situação nutricional de seringais produtivos no Estado de São Paulo. **Bragantia**, v. 47, n.1, p.109-123,1988.

BATAGLIA, O.C.; GONÇALVES, P.S. Seringueira. In: RAIJ, B.van, CANTARELLA, H., QUAGGIO, J.A, FURLANI, A.M.C. (Eds.).**Recomendações de adubação e calagem para o Estado de São Paulo.**Campinas: Instituto Agronômico/Fundação IAC, 1997. p.243. (Boletim técnico, 100).

CARDOSO, M. Seringueira. In: RAIJ, B. van; SILVA, N.M.; BATAGLIA, O.C.; QUAGGIO, J.A.; HIROCE, R.; CANTARELLA, H.; BELINAZZI JÚNIOR, R.; DECHEN, A.R.; TRANI, P.E. (Ed.). **Recomendação de adubação e calagem para o Estado de São Paulo**. Campinas: Instituto Agronômico, 1992. 285p. (Boletim Técnico, 100).

COORDENADORIA DE ASSISTÊNCIA TÉCNICA INTEGRAL. Terraceamento agrícola. Campinas, 1994. 39p. (CATI. Boletim Técnico, 206).

EMBRAPA, 2003. Camargo, Ângelo Paes de. **Zoneamento climático da heveicultura no Brasil** / Ângelo Paes de Camargo, Fábio Ricardo Marin, Marcelo Bento Paes de Camargo. – Campinas: Embrapa Monitoramento por Satélite, Documentos, 24, 2003. 19 p.

GONÇALVES, E. C. P., et al. **A cultura da seringueira para o Estado de São Paulo.** 2. ed. Campinas: CATI, 2010. 163 p. (CATI. Manual técnico, 72).

GONÇALVES, E.C.P., OLIVEIRA, M.D.M., SCHMIDEK, A., SILVA, J.A.A. **Desenvolvimento de mudas de seringueira no campo, produzidas em bancada suspensa.**Pesquisa & Tecnologia, vol. 16, n. 2, p 1-6 Jul-Dez 2019.

GONÇALVES, P. S.; AGUIAR, A. T. da E.; COSTA, R. B. da; GONÇALVES, E. C. P.; SCALOPPI JÚNIOR, E. J.; BRANCO, R. B. F. Genetic variation and realized genetic gain from rubber tree improvement. Scientia Agrícola, Piracicaba-SP, v.66, n.1, p.44-51, 2009.

GUZZO, C. D.;CARVALHO, L. B.;ALVES, P. L. C. A.;GONÇALVES, E. C. P.; GIANCOTTI, P. R. F. **Weed control strips influences on the rubber tree growth.**American Journal of Plant Sciences, v. 05, p. 1059-1068, 2014.

MATTOS, M. A. N.;VISCHI FILHO, O. J.;DE LUCCA, C.A.;GONÇALVES, E. C. P.; BACCHIEGA, A. N.; MARTINS, A.L.M. **Práticas conservacionistas na heveicultura**. Revista Lateks, v. 11, p. 50-54, 2011.

OLIVEIRA, M. D. M.; OLIVEIRA, C.M.G. **Nematoides em seringueiras: um relato de baixa rentabilidade.** Análises e Indicadores do Agronegócio, v. 14, n.7, julho 2019. Pagina?

OLIVEIRA, M.D.M; GONÇALVES, E.C.P. **Impactos do SarS-CoV-2 na produção de borracha natural no estado de São Paulo.** Análises e Indicadores do Agronegócio, v.5, n.8, p. 1-9, 2020.

RAIJ, B. van. Algumas reflexões sobre análise química de solo para recomendação de adubação. In: REUNIÃO BRASILEIRA DE FERTILIDADE DO SOLO E NUTRIÇÃO DE PLANTAS, 202. Piracicaba, 1992. **Anais**. Campinas, Fundação Cargill, 1992. p. 71-87.

ROQUE, C.G., PRADO, R.M., NATALE, W. et al. Estado nutricional e produtividade da seringueira em solo com calcário aplicado superficialmente. **Pesquisa Agropecuária Brasileira**, v.39, n.5, p.485-490, 2004.

SOARES, N. S.; SILVA, M. L. da; VALVERDE, S. R.; ALVES, R. R.; SANTOS, F. L. dos. **Análise econométrica da demanda brasileira de importação de borracha natural, de 1964 a 2005**. Revista Árvore, Viçosa-MG, v.32, n.6, p.1133-1142, 2008.

WILCKEN, S. R. S.; GABIA, A. A.; BRITO, P. F.; FURTADO. E. L. **Nematoides fitoparasitas em seringais do Estado de São Paulo.**Summa Phytopathologica, Botucatu-SP, v. 41, n.1, p. 54-57, 2015.