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Agroka'atinga System in the Brazilian Semiarid Region

Sistema Agroka'atinga no Semiárido Brasileiro

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***Palabras clave*— Escuela de Familia Agrícola; Cambios climáticos; agricultura sintrópica; Agroka'atinga; Convivencia con la Región Semiárida Brasileña.**

***Mots clés*— Ecole Familiale Agricole; Les changements climatiques; Agriculture syntropique; Agroka'atinga; Vivre avec la région semi-aride brésilienne.**

***Abstract*—** *This article is part of the doctoral thesis entitled "The IRPAA and the Snap of Coexistence with the Semiarid Region as a Paradigm and Political Project in the Optics of Good Living". bring the results obtained in experiments carried out at Escolas Famílias Agrícolas (EFAs), with emphasis on to the school located in the municipality of Sobradinho, state of Bahia/Brazil, serving the young family farmers in the region. In addition to the Alternation methodology used in this modality of teaching community and contextualized education, it was approached here the experience of the Network of Integrated Agricultural Family Schools in the Semi-Arid Region (REFAISA) in the formation of rural youth, especially from traditional communities of pasture, extractivists, agrarian reform settlers, riverside communities, quilombolas and peasant communities, introducing the Technical and Educational Program called Agroka'atinga for Sustainable Agriculture and Market Access, in five Schools Agricultural Families and on fifteen family properties in the states of Bahia and Sergipe. In this context, the EFAs inserted in their teaching-learning process, an approach on climate change, which causes lower thermal amplitude and changes in the pattern precipitation, favoring the appearance of extreme events, such as droughts, prolonged periods and increase in temperature, which will affect the production of some crops agricultural activities, demanding different attitudes and behaviors from populations, based on new paradigms (focus of the doctoral thesis), both in production systems and in the conscious consumption and marketing, ensuring socio-environmental sustainability and of technological innovations that promote the resilience of the Caatinga biome to changes climate change, resulting in the creation of the Agroka'atinga concept in the Brazilian semiarid region.*

***Resumo*—** *Este artigo é parte da tese de doutorado intitulada "O IRPAA e o Estalo da Convivência com o Semiárido como Paradigma e Projeto*

Político na Ótica do Bem Viver". Traz os resultados obtidos nos experimentos realizados nas Escolas Famílias Agrícolas (EFAs), com destaque para a escola localizada no município de Sobradinho, estado da Bahia/Brasil, atendendo aos jovens agricultores familiares da região. Além da metodologia da Alternância, usada nessa modalidade de ensino de educação comunitária e contextualizada, abordou-se aqui a experiência da Rede das Escolas Famílias Agrícolas Integradas do Semiárido (REFAISA) na formação das juventudes do campo, em especial das comunidades tradicionais de fundo de pasto, extrativistas, assentados da reforma agrária, comunidades ribeirinhas, quilombolas e comunidades campesinas, introduzindo o Programa Técnico e Educativo denominado de Agroka'atinga para a Agricultura Sustentável e Acesso a Mercados, em cinco Escolas Famílias Agrícolas e em quinze propriedades familiares nos estados da Bahia e de Sergipe. Nesse contexto, as EFAs inseriram no seu processo ensino-aprendizagem, abordagem sobre as mudanças climáticas, que causam amplitude térmica menor e alterações no padrão de precipitação, favorecendo o aparecimento de eventos extremos, como secas, estiagens prolongadas e aumento de temperatura, o que afetará na produção de alguns cultivos agrícolas, exigindo das populações, atitudes e comportamentos diferenciados, baseados em novos paradigmas (foco da tese de doutoramento), tanto nos sistemas produtivos, quanto no consumo consciente e na comercialização, garantindo a sustentabilidade socioambiental e de inovações tecnológicas que promovam a resiliência do bioma Caatinga às mudanças climáticas, resultando na criação do conceito Agroka'atinga no Semiárido Brasileiro.

Resumen— *Este artículo forma parte de la tesis doctoral titulada "El IRPAA y el Broche de Convivencia con el Semiárido como Paradigma y Proyecto Político en la Óptica del Buen Vivir". Trae los resultados obtenidos en las experiencias realizadas en las Escuelas de Familias Agrícolas (EFAs), con énfasis en la escuela ubicada en el municipio de Sobradinho, estado de Bahía/Brasil, que atiende a jóvenes agricultores familiares de la región. Además de la metodología Alternancia, utilizada en esta modalidad de enseñanza de educación contextualizada y comunitaria, la experiencia de la Red de Escuelas Familiares Agrícolas Integradas en el Semiárido (REFAISA) en la formación de jóvenes rurales, especialmente en comunidades tradicionales de pastoreo, extractivistas, agrarios reformar pobladores, comunidades ribereñas, quilombolas y comunidades campesinas, implantando el Programa Técnico y Educativo denominado Agroka'atinga para la Agricultura Sostenible y el Acceso a Mercados, en cinco Escuelas de Familias Agrícolas y en quince propiedades familiares en los estados de Bahía y Sergipe. En este contexto, las EFA incluyeron en su proceso de enseñanza-aprendizaje, un abordaje del cambio climático, que provoca menor amplitud térmica y cambios en el patrón de precipitaciones, favoreciendo la aparición de eventos extremos, como sequías, sequías prolongadas y aumento de temperatura, que afectará la producción de algunos cultivos agrícolas, exigiendo diferentes actitudes y comportamientos de las poblaciones, basados en nuevos paradigmas (foco de la tesis doctoral), tanto en los sistemas de producción como en el consumo y comercialización consciente, asegurando la sostenibilidad socioambiental y las innovaciones tecnológicas que promover la resiliencia del bioma Caatinga al cambio climático, resultando en la creación del concepto Agroka'atinga en la región*

semiárida brasileña.

Resumé— *Cet article fait partie de la thèse de doctorat intitulée « L'IRPAA et l'accrochage de la coexistence avec la région semi-aride comme paradigme et projet politique dans l'optique du bien-vivre ». Il apporte les résultats obtenus dans les expériences menées dans les Écoles Familiales Agricoles (EFA), en mettant l'accent sur l'école située dans la municipalité de Sobradinho, État de Bahia / Brésil, au service des jeunes agriculteurs familiaux de la région. Outre la méthodologie de l'Alternance, utilisée dans cette modalité d'enseignement de l'éducation contextualisée et communautaire, l'expérience du Réseau des Écoles Familiales Agricoles Intégrées dans le Semi-aride (REFAISA) dans la formation des jeunes ruraux, en particulier dans les communautés traditionnelles de pâturages, extractivistes, agraires réformer les colons, les communautés riveraines, les quilombolas et les communautés paysannes, en introduisant le programme technique et éducatif appelé Agroka'atinga pour une agriculture durable et un accès au marché, dans cinq écoles familiales agricoles et dans quinze propriétés familiales dans les États de Bahia et Sergipe. Dans ce contexte, les EFA ont inclus dans leur processus d'enseignement-apprentissage, une approche du changement climatique, qui provoque une amplitude thermique plus faible et des changements dans le régime des précipitations, favorisant l'émergence d'événements extrêmes, tels que les sécheresses, les sécheresses prolongées et l'augmentation de la température, qui affecteront la production de certaines cultures agricoles, exigeant des attitudes et des comportements différents de la part des populations, basés sur de nouveaux paradigmes (objet de la thèse de doctorat), tant dans les systèmes de production que dans la consommation et la commercialisation conscientes, garantissant la durabilité socio-environnementale et les innovations technologiques qui promouvoir la résilience du biome Caatinga au changement climatique, aboutissant à la création du concept Agroka'atinga dans la région semi-aride brésilienne.*

I. INTRODUCTION

The Network of Integrated Agricultural Family Schools in the Semi-Arid Region (REFAISA) has been operating for over 25 years not only in the state of Bahia, but also in the state of Sergipe. It works by articulating thirteen Agricultural Family Schools (EFAs) and has built up an experience in Rural Education with youths involved in family farming, traditional pasture communities, extractivists, agrarian reform settlers, riverside communities, quilombolas and peasant communities.

The Agricultural Family Schools use the methodology of the Pedagogy of Alternation, where student training takes place both in the socio-professional environment (Community Time) and in the school environment (School Time). This methodology allows the link between the student's way of life and the school, where he, from his concrete reality, learns, reflects and takes the questions to be discussed and researched in the school environment, in a process of reflection-action-reflection. In this way, the social, economic and environmental reality of the students' experience are always problematized at school.

Recently, REFAISA has been even more concerned with promoting debates and experiences on Agriculture Resilient to Climate Change, especially in the Caatinga Biome, which has been suffering the consequences of the impacts caused by human actions over the years.

The Caatinga is an exclusively Brazilian biome that has a semi-arid climate, vegetation with few leaves and adapted to dry periods, in addition to great biodiversity. This biome is found in areas of Northeast Brazil, in the states of Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia and part of Minas Gerais. This entire area covers about 844 thousand km², that is, 11% of the Brazilian territory.

The name Caatinga means, in Tupi-Guarani, "white forest". This name refers to the predominant color of vegetation during the dry season, where almost all plants

shed their leaves to decrease transpiration and prevent the loss of stored water. In winter, due to rain, the green leaves and flowers sprout again.

It is observed that over the years there has been a large process of deforestation in this biome due to several factors, including the extension of livestock and agricultural activities and the implementation of charcoal plants. Despite its ecological importance, it is estimated that 40,000 km² of the Caatinga have already been transformed into an almost desert, which is explained by the cutting of vegetation to serve as firewood and the inadequate management of the soil. In practice, this has generated climate change in the region.

In the studies being carried out at the Brazilian Agricultural Research Corporation (EMBRAPA), it appears that the climate scenarios are alarming. The emission of greenhouse gases are increasingly intense. The increase in the concentration of these gases will have an impact on the increase in the temperature of the atmosphere.

Projecting into the future, climate change will not be homogeneous, but punctual in some months of the year, causing lower thermal amplitude and changes in the precipitation pattern, favoring the appearance of extreme events, such as droughts and temperature increase, which will affect production. of some agricultural crops. Therefore, the socioeconomic strategy is in line with the mitigation measures to reduce the emission of gases.

In view of this, it is necessary to work from a perspective of climate-resilient agriculture, with alternatives that allow a more harmonious coexistence with the Caatinga Biome, and even promote its recovery, where in Brazil there are already experiences of working with the Agroforestry (SAF), inspiring Agricultural Family Schools to create the Agroka'atinga System.

Therefore, REFAISA, through the SAF EDU EFA Project, with support from the Project Adapting Knowledge for Sustainable Agriculture and Market Access (AKSAAM), of the Federal University of Viçosa (UFV), of the Institute of Public Policies and Sustainable Development (IPPDS), from the Arthur Bernardes Foundation (FUNARBE) and the International Fund for Agricultural Development (FIDA), sought to develop a Technical and Educational Program for the implementation of Agroka'atinga Systems in 5 Agricultural Family Schools and on the properties of 15 students in the states of Bahia and Sergipe, in order to have innovative experiments through the Pedagogy of Alternation in School Time and Community Time, understanding the specificities of each region, contributing to sustainable rural development through the systematization and dissemination of knowledge, experiences and good practices, ensuring socio-environmental sustainability and technological innovations that promote the resilience of the Caatinga biome to changes climate ances.

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The purposes of the EFA's with this system is to institute practical-technical laboratories, integrated from rainfed fruit growing, native plants, irrigated fruit growing, forage production, seed production, vegetable production, in order for students to be knowledge multipliers and protagonists of experiences in their communities.

As a result, workshops, field days, training courses and an online workshop were held to educate people about the principles, the implementation process, management and promote debates around the Agroka'atinga theme; and produced technical articles, newsletters, comic books, workshop proceedings and videos, with the aim of informing, disseminating successful experiences and influencing the implementation of new agroka'atinga areas.

The system is based on Ernst Götsch's Syntropic Agriculture, which has as its principles the maximization of photosynthesis, with dense and stratified plantations, enabling greater biomass production; the natural succession and stratification, where each stratum has a percentage of shade that the canopy of the plants occupies in the floor, favoring the development in certain strata and the natural succession; covered soils and dense plantings, and the soil must be permanently covered to favor the structure, fertility, microorganisms, among other aspects, and the density of the planting that allows later thinning, leaving the plants more vigorous in the system; selective weeding and pruning, which are essential for the conduction of the system, removing plants from previous succession systems and pruning the plants so that they develop and bear fruit; concentrate energy, generate biomass efficiently, that is, agglutinate plantations in lines or islands, which in impoverished soils, can receive inputs such as manure, rock dust, etc.; ecophysiology of plants and ecophysiological function of plants, where species that are adapted to the edaphoclimatic characteristics of the region are chosen; synchronize plantings so that plants can develop in different strata; what each being is doing well, observing nature and seeing the role of each being in the system.

II. AGROKA'ATINGA CONCEPT

Agroforestry is a good option for Family Agriculture, as it does not require so many inputs from outside, in addition to assisting in the food and nutritional security of families. It's good for families and consumers alike.

In Agroforestry Systems, there can be fruit plants, native plants, wood, ornamental, medicinal, forage plants in the same area, which are distributed in a way that maintains a diversity in the arrangement. The system is designed so that the family can harvest from the first year of implementation, with different products available for sale at different times of the year. This in fact makes it possible to increase income and also make better use of family farm labor.

The diversification of products provides greater food security, environmental sustainability, low carbon emissions, among other advantages. In addition, it has an increase in soil fertility and a gradual reduction in production costs, all of which make SAF a good option for family farming.

The Agroforestry System of the Caatinga Biome, has been conceptualized as Agroka'atinga System, a term that emerged from the EFA's, its name has the meaning based on the concepts of: Agro - agroecology; Ka'a – woods, vegetation; Tinga – White, of course; this term has the Tupi-Guarani reference.

Fig.1 – Conceptual illustration of the Agroka'atinga System in the Semiarid Region.

Source: (authors, 2021).

The Agroka'atinga System is a perspective of agriculture that is resilient to climate change, appropriate and contextualized to the Caatinga biome and the semi-arid climate, the result of the pedagogy of nature, observation, care, production of knowledge and healthy food through the populations of the field.

They are reborn from the perspective of rebuilding the bonds with nature, it is a walk with nature, observing its processes, learning from it, respecting its cycles. It is the rescue of the human in agriculture, it is a production with interaction, respect and gratitude, it is a path to our own nature. In this sense, it implies a paradigm shift, in the way of being and doing agriculture.

The system, in its principles, brings all the potential for the recovery of areas degraded by inadequate management and all types of secular exploitation, giving rise to forest/caatinga, water and food. To do Agroka'atinga is also to plant sun in the land of consciousness, it is to plant solidarity, affection and compassion giving birth to environmental, human and animal health on the physical, psychic and emotional planes.

In this sense, in order to produce healthy food, it is necessary to learn and meet the pedagogy of nature, developing crops that associate species of native trees, fruit trees, forage and annual crops, and can also associate animal husbandry in areas determined for this purpose.

Protecting the soil, the cradle that generates all life, is an imperative commandment in these systems, with this we guarantee food that supplies us with essential nutrients and vital energies.

Agroka'atingar is rather a process of agroflorescence. It is to find the ancestral memories of communion and unity with the beings of earth, water, air and fire and in that meeting, to find yourself. These are forms of production in which tree species are cultivated in the same space and time in conjunction with perennial, semi-perennial and annual crops, with or without animals.

The system is guided by Living with Biomes and Climates and Agroecology, developing practices that seek harmony between nature and food production, respecting the environment and preserving local biodiversity.

Fig.2 - Percentage of work in the Agroka'atinga System

Source: (authors, 2021).

These systems are able to meet the production needs of food, wood, energy, fodder and fibers from the proper management of plant stratification, in a way that expands production capacity and, at the same time, keeps the system sustainable and resilient to external disturbances. In addition to providing food, it contributes to the food sovereignty of families and generates income from the sale of surplus production and the sale of wood products and fodder, that is, they cover the economic, social, cultural and environmental dimensions.

Fig.3: Illustration of the final possibilities of the Agroka'atinga System.

Source: (authors, 2021).

It is also a way for human beings to reconnect with nature, with Mother Earth, based on care, respect, protection and food production.

Making use of ecological observation, we seek to develop strategies that make it possible to potentiate species adaptable to the semiarid region. In this context, the creole seeds, which are produced and preserved by traditional farmers, have greater resistance and adaptation to the climate and soil of their respective communities when compared to other commercial varieties.

The Agroka'atinga System is built with reference to the biome in which it is inserted. It is a way of producing that resembles nature, with diversity of species, crops and functions. In addition to the purpose of production, they can develop other purposes, such as: recovery of soil and degraded areas, recaating, conservation of Permanent Preservation Areas (APP).

It walks in the integrated dimension that needs to consider public policies, respecting nature, the cosmic dimension, environmental, human and animal health and recovery of the caatinga. It is necessary to overcome isolated crops in order to move towards resilient and sustainable agriculture. Whatever the monocultures, it is known that it does not work in this region, and has directly affected the life of the planet.

Fig.4: Graphic illustration of the Agroka'atinga System in the Semiarid Region.

Source: (authors, 2021).

III. LITERATURE REVIEW

The term Agroka'atinga is relatively new in the literature, and no works were found that conceptualize it. Silva et al. (2018), when implementing a Technical Demonstration Unit of Agroforestry Systems, based on the semiarid conditions, at the Federal University of Rio Grande do Norte – Campus de Ipanguaçu, cites the Agroforestry System as being an Agrocaatinga.

The Cooperativa Agropecuária Familiar de Canudos, Uauá and Curaçá (COOPERCUC), executes a project called AgroCaatinga and conceptualizes it as "a socio-productive and environmental action that basically takes place through a similarity of AFS agroforestry areas", which was called in this way, because the experience is located in the semi-arid region (Facebook Coopercuc/ATER, 2021).

REFAISA, in 2021, deepened the concept of Agroka'atinga, adding in the spelling of the word elements that refer to the origin of the term Caatinga (ka'a = forest, vegetation, tinga = white, clear), in addition to the prefix "Agro" that means agroecology (COSTA & SILVA, 2021).

IV. IMPLEMENTATION STEPS

For the implementation of the Agroka'atinga System, some steps are used, as briefly described below:

Diagnosis: diagnosis with a holistic and participatory approach is the first thing that must be done before the implementation of Agroka'atinga, using participatory diagnosis tools, such as the Transversal Walk, the FOFA matrix (Strength, Opportunity, Weaknesses and Threats) and the Timeline. Still at this stage, the characterization of the area is of paramount

importance, as it will allow the identification of the soil, vegetation and the local climate and microclimate.

• Soil: allows the identification of possible characteristics that may harm or favor the growth and development of the species that will be implanted, as well as serving to elucidate more assertive management measures. It is important to carry out physical and chemical analyzes of the soil.

• Local vegetation: facilitates the process of choosing the native species that will compose the Agroka'atinga to be implanted, and thus will guide how the system should be managed based on the phytophysiognomy of the place.

• Local climate and microclimate: it serves to determine how and when the species will be implanted and which of them are most suitable for the given location.

With the knowledge of the area, planning can be done from the local reality, implementing activities that are effective in solving the problems encountered and adapting the implementation according to the characteristics of the environment.

Choice of Species: the species that will be implanted must be chosen together by the group or family, obeying the objectives to be achieved with the system and the adaptability of the species to the climatic characteristics of the place.

In order to define the species and the spacing, a previous study must be carried out, observing the size of the plants and the light requirement so that there is a harmonious and diversified combination of the arrangement. This arrangement can involve several fruits, native and forage species, making it possible to obtain higher yields in less time. It can be focused on species for human food, species for animal feed, species for recovery of degraded areas or all together. In all contexts, there must be the presence of species that make up the native flora of the region, so that the concept of Agroka'atinga is given to such a system and that it is not just a mixed crop of species and purposes.

Sketch Planning: in this stage, a design is made of the area to be implanted with its respective species, identifying the spacing between the plants and between the planting lines. In the arrangement design, the components must be distributed in time and space, observing the stratification of the plants and the life and production cycles of each one. In this way, the species will make more efficient use of sunlight, in addition, it will be possible to obtain food, flowers and seeds at all times of the year.

Isolation of the Area: this is an important action to provide greater protection to the area where the Agroka'atinga System will be implemented. Prevents the entry of medium and large domesticated animals that can cause damage to seedlings, seeds, fruits and already established species.

Soil preparation: the soil must be prepared to receive the seeds, seedlings and cuttings. The type of preparation will depend on how the area is at the moment, the type of soil, fertility, slope of the land, among others. A general rule is always to keep the soil covered with green or dry cover, such as the rest of weeding, pruning and straw, as it favors the maintenance of humidity for a longer time, prevents erosion and excessive heating of the soil, in addition to promoting the development of micro, meso and macro-organisms beneficial to the soil.

The addition of organic matter is also an extremely important factor for achieving success in the process of planting the species of an Agroka'atinga, as it acts in the process of improving the quality of the physical, chemical and biological properties of the soil. It can be added through goat, sheep, bovine manure, etc., tanned or in the form of compounds, from the agroecosystem itself, making the activity as self-sustainable as possible.

It is important to carry out a physical-chemical analysis to verify the fertility and texture of the soil and, based on the result, if necessary, to outline strategies for its improvement, such as: addition of organic fertilizers, planting of nitrogen-fixing and biomass-producing species for ground cover etc.

If necessary, selective weeding should be carried out, eliminating only undesirable plants, as well as cutting/pruning trees and shrubs. After this process, the sites for the beds are defined, which will be specially prepared to receive the seedlings, cuttings and seeds.

Irrigation: in places where rainfall is scarce or irregular, at least rescue irrigation is recommended to ensure the survival of the species during critical periods. In this way, Agroka'atinga should be implemented close to water sources, such as a river, tubular well, artesian well, dams or implement social technologies, such as the trench barrier and rainwater harvesting cisterns.

It is interesting that the irrigation system is low cost, easy to maintain and operate, so that implementation and production are not burdened. In this sense, we suggest a drip irrigation system that works using the force of gravity, without the use of a motor pump (fuel or hydroelectric energy), making the system more sustainable.

Planting of seedlings, cuttings and seeds: the planting of seedlings, cuttings and seeds will be carried out along the beds and must obey the planning elaborated in

the sketch. The spacing between plants and between rows will depend on the species and the stratum to which it belongs. It should happen in the early hours of the day or late in the afternoon, to avoid exposing the plants to very hot temperatures. It is recommended to plant seedlings that are native and/or adapted to the climate of the region, so that they can express their full genetic potential and fully develop in Agroka'atinga. Fruit, forage and timber, arboreal, shrub or herbaceous species can be planted.

The cradle for planting the seedlings must be prepared in advance and sized according to the size of the material that will be implanted. The earth removed for the preparation of the crib must be mixed with organic fertilizers, such as tanned manure and organic compounds, and replaced when the plant is accommodated in the place, for its support and nutrition.

After planting the seedlings, the beds are covered with dry matter, with the aim of maintaining humidity in the place and building a microclimate favorable to the development of the plant.

Then, in the same bed where the seedlings were planted, the species that are propagated by cuttings are planted. Cuttings must be prepared according to each species. In general, they can be 25 to 30 cm long and the base cut should be made in a bevel, just below a gem. They can be planted in beds for rooting and after taking to a definitive place or planted directly in the field, being placed perpendicular to the ground or slightly inclined, with at least one or two buds exposed.

Seeds are planted by placing them in small holes in the bed, which must already be covered with organic matter, a process carried out in the previous steps. It can be done by placing seeds of the same species in the holes or by mixing seeds (muvuca), depending on the strategy planned for the moment.

It is important to use seeds from various matrices in the region, given that the system seeks to imitate nature, which has as a strategy the production of diversity, with plants of great genetic variability, where they are selected naturally, according to genetic characteristics. that are suitable for each environment.

Therefore, it is recommended to plant many more seeds than expected to germinate, in this way, the most adapted to the environment will establish themselves.

It is necessary to plant service species, which have good vegetative growth and the ability to produce enough biomass. These plants will be pruned, cut or shredded and placed as ground cover.

The soil between the lines must also always be covered, either by native vegetation, by dry matter or by planting specific crops for this purpose.

The jack bean (Canavalia ensiformes) is an excellent species to plant between the lines of the system. It promotes the coverage and green manuring of the soil, improving the physical, chemical and biological characteristics. The plant fixes nitrogen in the soil and at the time of flowering it can be incorporated or the shoot can be cut to cover other areas.

In the process of implanting the seedlings, cuttings and seeds, the soil must have sufficient moisture to guarantee the establishment of the species. Therefore, plantations must be carried out during the region's rainy season or the location must have conditions for irrigation.

Management of Agroka'atinga: the management performed is very important for the success of Agroka'atinga. From the managements it is possible to conduct the system for the recovery and maintenance of soil moisture, better photosynthetic efficiency of plants, production of biomass and products for consumption and commercialization. The following are some of the main practices for system maintenance.

Mowing: mowing consists of cutting spontaneous or planted vegetation for green manure and ground cover, between the lines of Agroka'atinga. The cut can be performed manually or by machines, such as a brush cutter. The advantage of this process is that the soil is always covered, either by the species that are growing in the place or by the material resulting from the mowing, in addition, it allows the rapid regeneration of the cut plant.

Selective weeding: it is the uprooting or cutting of spontaneous herbaceous plants that develop close to the seedlings. Unwanted species that can hinder the development of the main plant, competing for water and nutrients, are removed.

Pruning: pruning plays a fundamental role in the development of systems, favoring plant productivity and the ecological functions of the environment. It allows the entry of light and the development of plants in different strata, in addition to providing nutrients and improving the structure of the soil. Through this management, it is possible to enhance and accelerate some processes that occur naturally in nature through the action of winds, lightning, rain, etc.

There are different types of pruning, which will be carried out according to the management objective, such as: formation pruning, cleaning pruning, production or fruiting pruning and renewal and regeneration pruning.

The thinnest leaves and branches resulting from pruning should be shredded or chopped and placed as ground cover. The most woody part should be cut into smaller pieces and placed in direct contact with the ground to accelerate its decomposition. In this way, in addition to protecting the soil, it allows the use and cycling of nutrients.

The moon influences the plant and the sap, so when planning pruning, its phases must be observed. It is recommended to perform pruning during the waning moon, as it favors the formation of new roots before regrowth. Pruning should be avoided in times of crescent or full moon, as it weakens the plant.

V. MONITORING AND EVALUATION

Monitoring consists of observing, collecting and analyzing information, in order to observe the progress of the system and possible changes over time. It can be carried out from the analysis of several attributes such as: soil recovery, production, social fabric, environment, satisfaction, etc. Based on the attributes, the indicators and the methodology that will be used to analyze them must be listed.

As mentioned, monitoring can be performed from several analyses. An example is the monitoring and evaluation of the implanted species, observing the growth and initial development of these, to analyze whether there have been any losses of planted specimens for possible replacements, to observe how the attachment (adaptation) of the plants in the planting area is being and finally, it is interesting to carry out a biometric test to monitor the development of some plants over a current period, in order to obtain data for possible systematization of the system's experience**.**

Another example is the monitoring of production from the system, with the objective of understanding its importance for the family agroecosystem as a whole, as well as giving visibility to the importance of food security and income for peasant families.

VI. FINAL CONSIDERATIONS

The Agroka'atinga System brought a new way of producing to EFAs and young people in the countryside, enabling better use of the planting area, with planting of perennial and annual crops. This social technology allowed for an increase in food production and diversity, improving the condition of the soil and stimulating the use of the property's resources, in addition to allowing the cultivation of native plants in the same space, contributing to the increase in income and social and environmental sustainability. environmental.

The dissemination and sharing of information about Agroka'atinga was one of REFAISA's main objectives, through Agroka'atinga, in a contextualized way, including drinking from existing scientific knowledge, it was discussed and deepened about resilient agriculture to climate change, the form of production in harmony with nature and as a real possibility for its implementation in the semi-arid region.

The production of didactic, audiovisual and technical materials, such as Booklet in Comics, Newsletter, Technical and Educational Bulletins quarterly, called "Agroka'atingando no Semiárido", videos about the experience within the Agricultural Family Schools and through the National Workshop on Agroka 'reacha in the Brazilian Semiarid, in an online way, the Annals of the event were produced and the videos are available on the TV EFA Channel, on YouTube.

Priority was given to working with young people from Escolas Famílias Agrícolas, who were able to discover a new way of producing, until then little known to them, participating in the training that permeated the entire project. They were also able to learn in practice, through the implementation of their Agroka'atinga areas and the managements necessary to conduct the system. The training also aroused interest on the subject in several people from communities of family farmers and Pasture Funds, who participated in the activities.

Most of the Agroka'atingas implanted, whether in student areas or in EFA's areas, were in degraded areas, in the process of degradation or already eroded by consecutive cultivation over the years. In this way, after the implantation, it was noticed an improvement in the contribution of organic matter in the soil, in the coverage and retention of water in the soil, in the vigor of the plants and in the progressive reduction of pests and diseases, all this obtained as a consequence of the different managements adopted.

Agroka'atinga provides great diversification in the families' plantations, both of food crops and native species of the caatinga. The production is primarily intended for family consumption, with the surplus being sold. It is worth noting that production is not only for human consumption, with a large part destined for animals, mainly corn in grains and in the form of silage, forage palm, leucaena and gliricidia.

Therefore, the implementation of the Agroka'atinga System in the Brazilian Semiarid region and the training processes helping to build socio-environmental awareness made it possible to initiate processes of recovery of

degraded areas or areas in the process of degradation, improve soil conditions, produce annual and perennial crops, for human and animal food, and with that, improve the environment, food and nutrition security and the income of peasant families.

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