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RESEARCH ARTICLE

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IMPORTANCE OF AGROFORESTRY HOME GARDENS FOR FOOD PRODUCTION AND SUPPLEMENTING THE INCOME OF SMALL RURAL PRODUCERS IN THE AMAZONAS STATE, BRAZIL

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ABSTRACT

Agroforestry home gardens are one of the most important production systems due to their intensive production, providing a diversity of products for local use, contributing to the quality of life of the population and maintaining various products for family consumption, in addition to generating marketable surpluses, collaborating with the regional economy. This study evaluated the importance of agroforestry home gardens in food production and supplementing the income of small rural producers in the Boa Esperança community, in the municipality of Presidente Figueiredo, Amazonas, Brazil. For this study, 30 agroforestry home gardens were selected, which contribute to income generation and food production for the rural families. The work was conducted from structured and semi-structured interviews, associated with the guided tour technique, in addition to the application of questionnaires. For information analysis, a database was built with the information obtained from the interviews and the floristic survey. Subsequently, a descriptive statistic was used where the data were systematized in the Excel for Windows® program. A total of 152 plant species were registered, from 65 botanical families, destined for 10 different uses. The production is intended exclusively for family consumption, with chicken (*Gallus gallus*) being the most consumed food, followed by banana (*Musa paradisiaca* L.) and coconut (*Cocos nucifera* L.). Fruit species are the most consumed by farmers and the surplus production is traded to assist in the composition of family income. Cupuassu and coconut stand out for being species that contribute to the income generation of family properties, since they are among the products most commercialized by farmers.

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INTRODUCTION

In the Amazon, agroforestry home gardens are widely used and are strongly related to the food security of families, due to the production of food to complement the family diet based on the cultivation of food species and medicinal plants (Rocha Garcia *et al.*, 2015). Agroforestry home gardens stand out for containing a greater diversity of agricultural and forest species, combined with animal husbandry, which bring numerous benefits to their owners, as well as being spaces for the conservation of the cultural identity of the family, made through the types of species and the way they are grown, where plants and recipes are exchanged between neighbors and family members, and leisure activities are developed (Figueiredo Junior *et al.*, 2013; Santos, 2013; Almeida *et al.*, 2014). According to Costantin (2010), several models of agroforestry home gardens can be

found, considering that each family has different objectives, needs and strategies, which can be focused on subsistence, commercialization and environmental preservation, also reflecting on the types of species found. However, these models can change over time. Agroforestry home gardens are important, both ecologically and socio-environmentally, as they reflect the owners' ability to diversify these spaces, preserve native species and, consequently, contribute to the conservation of biodiversity, as well as ensuring the well-being of their families (Santos *et al.*, 2017). The economic function of agroforestry home gardens is represented, above all, by the production of food for self-consumption and commercialization, which can provide an improvement in the food of low-income for rural and urban populations. Saragoussi *et al.* (1988) assert that agroforestry home gardens of adequate size and made up of a large number of many perennial species can provide a large part of the food consumed by the farmer and his family. In addition to being used to

complement food and family income, the home gardens can help the producer self-sufficiency. The objective of this study was to evaluate the importance of agroforestry home gardens in food production and to supplement the income of small rural producers in the Boa Esperança community, in the municipality of PresidenteFigueiredo, Amazonas.

MATERIAL AND METHODS

The survey was carried out from September to October 2018, at selected rural properties in the Boa Esperança community, located in the municipality of PresidenteFigueiredo, at km 1,004 (former km 120) of federal highway BR 174, located at geographic coordinates of 01° 56 '506 "S e 60° 02 '667" W, distant from Manaus about 130 km. The climate of the region is characterized according to the classification of Köppen as humid tropical. Regional temperatures are uniform throughout the year and range from a minimum of 20 °C to a maximum of 38 °C, with an annual average of 26.7 °C. The relative humidity of the air is high and uniform throughout the year, with an average of 97%. The highest incidence of rainfall occurs between the months of December and May, with an average annual rainfall of 2,400 mm (Nava *et al.*, 1998; Vilela, 2003). For this study, 30 agroforestry home gardens were selected that contribute to income generation and food production for the rural owners. The techniques used in the field research were according to Albuquerque *et al.* (2008), consisting of structured and semi-structured interviews, in addition to a guided tour. Structured interviews are those in which the questions are standardized and previously established before going to the field. For this study, the questions were designed with a view to obtaining socioeconomic data from family farmers, surveying the species and the food consumed in the home gardens during the year. The semi-structured ones, on the other hand, are those in which the questions are partially asked before going to the field, but presents flexibility, thus allowing a deeper understanding of questions that may be necessary.

Regarding the guided tour, a walk was carried out in the rural property during the interview, to obtain specific information about the plants present, such as, for example, the purpose of using the species by the owner. Por se tratar de uma pesquisa que depende do ser humano para a sua realização, o presente estudo foi encaminhado para análise e aprovação do Comitê de Ética na Pesquisa com seres humanos (CEP), do Instituto Nacional de Pesquisas da Amazônia (INPA). Este procedimento teve por objetivo proteger a integridade, dignidade e conhecimentos dos indivíduos amostrais das pesquisas. De acordo com as exigências do CEP-INPA, todos os agricultores devem assinar o termo de Consentimento Livre e Esclarecido (TCLE). All information was obtained with the authorization of family farmers who participated in the research and were transcribed as obtained in the interviews, using the same terminologies used by them. As it is a research that depends on the human being for its realization, the present study was sent for analysis and approval by the Ethics Committee on Research with Human Beings (CEP), from the National Institute for Research in the Amazon (INPA). This procedure was to protect the integrity, dignity and knowledge of the individuals sampled in the research. According to the requirements of CEP-INPA, all the farmers must sign the Free and Informed Consent Form (FICF). To carry out the analyzes, a database was built with the information obtained from the interviews and the floristic survey. Subsequently, descriptive statistics were used where the data were systematized in the Excel for Windows® program. The graphics package Origin®, version 6.0 (Microcal Origin®, 6.0, USA) was used to make the graphics. It should be noted that in many cases, there was more than one answer to the same question. Thus, the answers to some questions presented a total percentage greater than 100%.

RESULTS AND DISCUSSION

The species registered in the 30 agroforestry home gardens totaled 831 individuals, distributed in 152 species, belonging to 65 botanical

families. The categories with the highest number of species were fruit, with 54 species (35.5%); followed by the ornamental use group, with 38 species (25%); medicinal, with 33 species (21.7%) and the spice, with 9 species (5.9%), with the remaining 11.9% being composed of species destined for other purposes (Table 1).

Table 1. Percentages of species found in the home gardens, according to their use by residents of rural properties

Category of use of plant species	(%)
Fruit	35.5
Ornamental	25.0
Medicinal	21.7
Spice	5.9
Oleracea	5.3
Woods	2.6
Stimulants	1.3
Mystics	1.3
Food	0.7
Utensils	0.7

In the Central Amazon, Rayol and Miranda (2019), researching agroforestry home gardens, found that most plants had food as their main use (41.1%), while species used for medicinal purposes occupied the second position with 29.8% %, followed by ornamental (23.5%), timber (4.5%) and artisanal (1.2%). Almeida and Gama (2014), studying agroforestry home gardens in rural settlements in the Brazilian Amazon, found that species intended for food use totaled 39 species (32%), while those used for medicinal purposes were 38 species (31, 1%). Ornamental trees accounted for 29 species (23.8%) of the population, followed by condiment (spice) with 7 species (5.7%), four with mystical significance (3.3%), two with wood potential and three used for other purposes (2.5%).

When asked about the fate of the production of agroforestry home gardens, 100% of respondents answered that the products generated are intended for family consumption. Figures 1 and 2 shows the most important species consumed by the rural owners. In addition, 47% stated that the production surplus is for commercialization in local markets, contributing significantly to the composition of family income (Figure 3). Cultivation for own consumption is considered an important source of food in this community, especially with regard to the diversification of fruit trees. Similar results were obtained by Gervazio (2015) in a study carried out in agroforestry home gardens in the city of Alta Floresta-MT, where it was found that most of the production (56.7%) of the home gardens is for family consumption. For Souza *et al.* (2017), the food consumed in the home gardens contributes to the longevity of residents, who make use of these nutrients with quality and adequate nutritional quantity, maintaining a balanced diet with healthy foods, reflecting in the improvement of life quality. Regarding the most consumed foods from the home gardens (Fig. 1), chicken (*Gallus gallus*) is the most consumed by family farmers in the Boa Esperança community, being cited by almost 70% of them, followed by banana (*Musa paradisiaca* L.) and coconut (*Cocos nucifera* L.), mentioned by more than 50% of farmers. Similar results were obtained by Miranda (2011) studying the contribution of agroforestry home gardens for the Food Security of Family Farmers in BaixoIrituia, Northeast Paraense. He found that the most consumed foods were fruit with 50% of family farmers, citing pineapple, banana, cupuaçu, cashew, lemon, orange and guava; the most consumed animal species was the chicken. In this study it was possible to observe that fruit species are the most consumed by farmers and the surplus of fruit production is commercialized to assist in the composition of family income. Cultivation for own consumption is considered an important source of food security in this community. Studies in Itapuranga, Goiás, carried out by Vieira (2010), found that the most common activity found in the surveyed home gardens was domestic fruit growing and that, according to the interviewees 'report, the fruits of the home gardens have a huge weight in the families' food. Vieira *et al.* (2012) found that in the agroforestry home gardens of Bonito-PA, 56.7% of the cultivated species produce fruit used in human food, demonstrating that fruit trees are the preferred species of local farmers. According to the authors, this is because the fruits contribute to both nutritional and

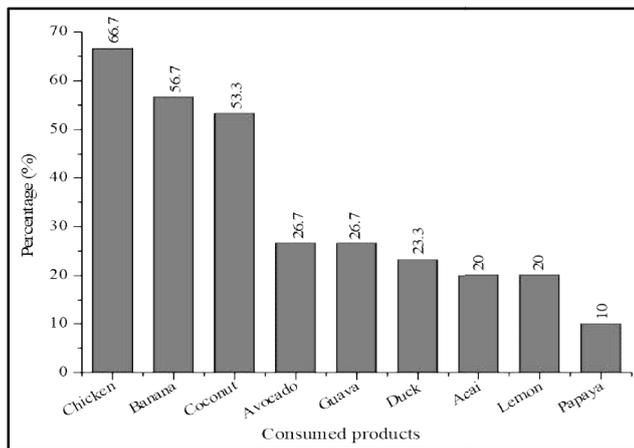


Figure 1. Main products consumed by the 30 agroforestry home Garden owners from the Boa Esperança Community, PresidenteFigueiredo, AM.



Figure 2. Fruit species found in the 30 home gardens studied at the Boa Esperança Community, PresidenteFigueiredo, AM

food security and to the income generation of family farmers in the Amazon. As for the main commercialized species coming from the home gardens, the fruit that stood out were cupuaçu (*Theobroma grandiflorum*), followed by banana (*Musa paradisiaca* L.), coconut (*Cocos nucifera* L.) and single açaí (*Euterpe precatoria*) which are frequently sold fresh or minimally processed into pulp, such as cupuaçu (Fig. 2).

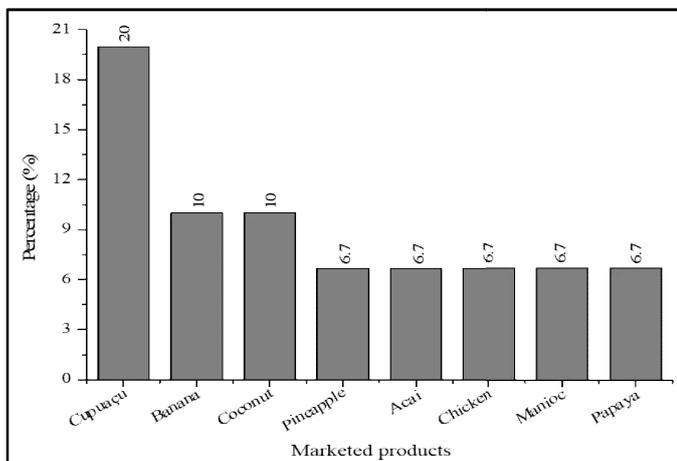


Figure 3. The most marketed products from the 30 home gardens from Boa Esperança Community, PresidenteFigueiredo, AM.

Machado (2016) observed similar results at the Ramal do Pau-Rosa, on the highway BR 174, Manaus, AM. According to the author,

cupuaçu and açaí stand out as key species for the generation of income from family properties, as they are among the products most commercialized by farmers. In this study it was also possible to verify that chicken (Fig. 3) stands out as one of the products that contribute to the income generation of the producer. When asked about the new species they wish to plant in their home gardens, the most cited were: açaí (*Euterpe oleracea* Mart. and *Euterpe precatoria* Mart.), lemon (*Citrus aurantiifolia* (Christm.) Swingle), papaya (*Caricapapaya* L.), banana (*Musa paradisiaca* L.), orange (*Citrus sinensis* L.), coconut (*Cocos nucifera* L.) (Fig. 4).

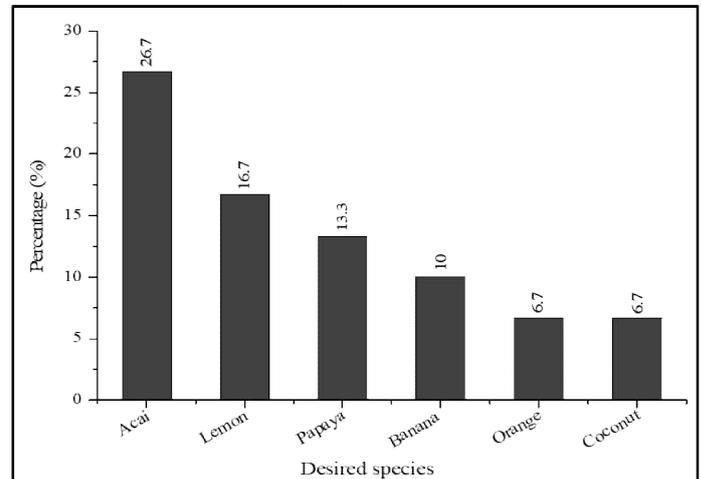


Figure 4. Desired new species which farmers would like to introduce in their properties at the 30 home gardens from Boa Esperança Community, PresidenteFigueiredo, AM.

CONCLUSIONS

- In the agroforestry home gardens of the Boa Esperança community, production is used almost exclusively for family consumption, with chicken (*Gallus gallusdomesticus*) being the most consumed food, followed by banana (*Musa paradisiaca* L.) and coconut (*Cocos nucifera* L.).
- Fruit species are the most consumed by farmers, and the surplus of their production is traded to assist in the composition of the family's income.
- Cupuaçu and coconut stand out for being species that contribute to the income generation of family properties, since they are among the products most commercialized by farmers.
- Home gardens play an important role in the production of medicinal plants, as well as in maintaining associated knowledge about the use of these plants.

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