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Socio-economic and environmental analysis of farmers in the surrounding Jatobá II dan in Princesa Isabel-PB

Análisis socioeconómico y medioambiental de los agricultores del entorno de la presa Jatobá II en Princesa Isabel-PB

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Abstract: Family farming is the most common activity in the Northeast region. This term began to be diffused from the 90's, replacing other commonly used expressions. In this sense, the objective of this work is to analyze the socioeconomic and environmental aspects of farmers living around the Jatobá II reservoir in Princesa Isabel-PB. The methodology used was based on research in scientific articles published in journals, books and conferences for theoretical and empirical basis. In addition, 10 questionnaires were applied in September 2021, containing objective and subjective questions in order to collect information about farmers living in the vicinity of the dam. The results show that the level of education is low, income is composed of pensions, crop insurance and family allowance. Furthermore, few farmers use irrigation systems due to the high cost of implementation and maintenance. Despite producing in the vicinity of the reservoir, some farmers use pesticides, harming the environment.
Keywords: *Northeast; Family Farming; Irrigation; Environment.*

Resumen: La agricultura familiar es la actividad más común que se lleva a cabo en la región del noreste. Este término comenzó a difundirse a partir de los años 90 en sustitución de otras expresiones de uso común. En este sentido, el objetivo de este trabajo es analizar los aspectos socioeconómicos y ambientales de los agricultores que viven alrededor de la presa Jatobá II en Princesa Isabel-PB. La metodología utilizada se basó en la investigación de artículos científicos publicados en revistas, libros y conferencias para construir la base teórica y empírica. Además, se aplicaron 10 cuestionarios en el mes de septiembre de 2021 que contenían preguntas objetivas y subjetivas para recoger información sobre los agricultores que viven en los alrededores de la presa. Los resultados muestran que el nivel de educación es bajo, los ingresos se componen de pensiones, seguros de cosechas y ayudas familiares. Además, son pocos los agricultores que utilizan sistemas de riego debido al elevado coste de implantación y mantenimiento. A pesar de producir cerca del embalse, algunos agricultores utilizan pesticidas, dañando el medio ambiente.
Palabras clave: *Noreste; Agricultura familiar; Riego; Medio ambiente.*

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INTRODUCTION

Family farming plays a fundamental role in the economy and food production in the Northeast region. Food is produced for family consumption, but the surplus is sold in fairs and markets, strengthening the local and regional economy. This activity was regulated by Law 11.326/2006, which determines that to be a family farmer it is necessary that "the property has four fiscal modules, uses predominantly the family's own labor force, and has a minimum percentage of family income coming from its own establishment's activities" (BRASIL, 2006).

In family farming, the main products cultivated are: beans, rice, corn and manioc, among others. These products are the most cultivated by producers in the Northeastern states, because they are subsistence food crops, of fundamental importance for the nutrition of families and permanence of farmers in rural areas (CENSO AGROPECUÁRIO, 2006; LIRA, 2016, p. 16). This activity is characterized by the low use of technologies and inputs, and family labor is used. However, socioeconomic changes that have occurred in recent decades have been noticeable and have had positive repercussions on the quality of life of the rural population of the Northeast. However, the harmful effects of droughts continue to affect productive activities, especially those developed by the poorest farmers (AQUINO, ALVES, and VIDAL, 2020). Recurrent droughts are a problem for farmers, damaging their activities, which has repercussions on their income. This situation occurs in the various municipalities of the Northeast, whose activity is present.

Thus, in the Northeast, family agriculture subsists in the context of ruptures and ecological, economic, technical, social and political limits of the dominant model (TONNEU et al., 1997; SABOURIN and CARON, 2003, p. 43). This activity often occupies economic geographic spaces despised by large landowners and companies. It encompasses a significant part of the northeastern population (FAO, 1996). The planting is done in small areas, whose production potential is minimal, but the farmers use these areas for cultivation, maintaining the activity. The importance of family farming lies precisely in the persistence of the producers in maintaining production, even with the difficulties. In this context, the objective of this work is to analyze the socioeconomic and environmental aspects of farmers living around the Jatobá II dam in Princesa Isabel-PB. Thus, studies that highlight these actors characterizing them are essential to understand the dynamics of this mode of production and the producers' way of life.

THEORETICAL FOUNDATION

Family farming

The category family farming began to gain social and political legitimacy in Brazil from the first half of the 1990s, replacing expressions such as small producers or subsistence farmers (AQUINO; ALVES

and VIDAL, 2020, p. 97). Despite this replacement, the terms "small farmers or subsistence farmers" are still popularly used when referring to producers who own small properties or produce food for their own consumption.

Family farming currently gathers the majority of the rural population. In Brazil, it comprises about 6.5 million agricultural production units, more than half of which are located in the Northeast Region (FAO, 1996; SABOURIN; CARON, 2003, p. 42). Despite the effects of the drought that hit this region between the years 2012 and 2017, considered one of the largest recorded in its recent history, family farming remains the main form of production and work in the countryside at the end of the second half of the 21st century, covering 47.2% of the national total (AQUINO; ALVES and VIDAL, 2020, p. 99). This drought lasted for five years affecting farmers who lost their crops, cattle, and goats in different states of the Northeast.

The importance of this activity is not only social, but also economic, for its presence in the markets of food products, whose production is temporary as corn, beans, potatoes, among others, and of exploration as cocoa, coffee, orange among others, of permanent production as for the resources and jobs that this activity provides (VEIGA, 1994; SABOURIN; CARON, 2003, p. 42). These products supply local and regional markets, because the surplus is sold in fairs, generating income for families. Family farming in the Northeast is quite accomplished. According to IBGE (2019) cited by Aquino, Alves, and Vidal (2020, p. 99) this region has 2,322,719 rurais establishments, of these 1,838,846 (79.2%) belonged to family farmers employing 4,708,670 million people (73.8%) of the total (Table 1).

TABLE 1: Number of establishments, total area, and occupied personnel in the different types of agriculture in the Brazilian Northeast region (2017).

Farmer Types	**Establishments**		**Total area**		**Personnel employed**	
	Number	%	Hectares	%	Number	%
Familiar	1,838,846	79.2	25,925,743	36.6	4,708,670	73.8
Non-family	483,873	20.8	44,968,122	63.4	1,668,094	26.2
Total	**2,322,719**	**100.0**	**70,893,865**	**100.0**	**6,376,764**	**100.0**

SOURCE: Adapted from IBGE and Sidra (2019) and Aquino; Alves and Vidal (2020).

These data show that besides producing food and supplying local and regional markets and fairs, family farming also generates jobs, even if they are temporary, collaborating with the maintenance of the economy in this region. This practice is noticeable especially in small towns, where this reality is visible. "The monetary result obtained from the sum of the value of all farming activities developed within the establishments, including self-consumption, shows that family farmers maintain an important contribution" (AQUINO; ALVES e VIDAL, 2020, p. 104).

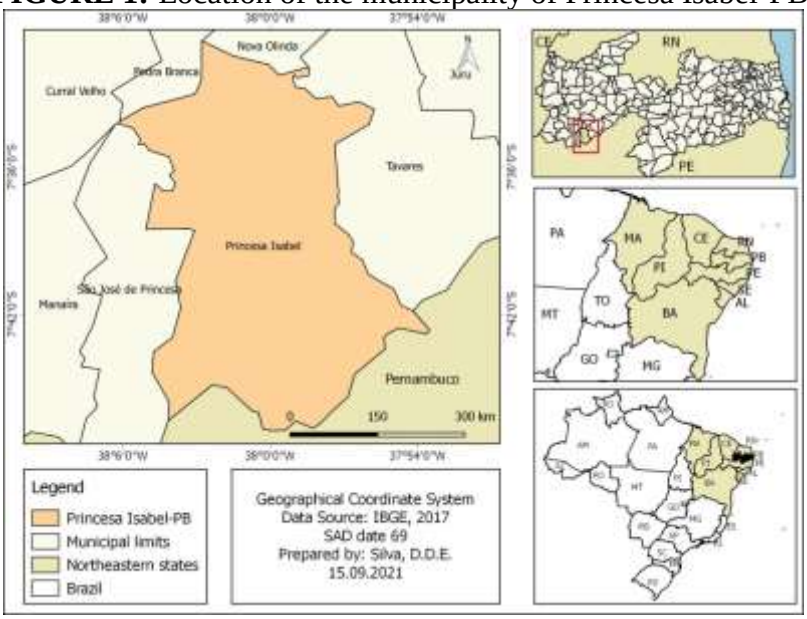
However, many farmers still use unsustainable farming techniques that are passed from father to son, thus remaining the use of practices that harm the environment as the use of pesticides. According to the 2017 Agricultural Census, pesticides were applied in 23.4% of family farming establishments. Moreover, comparing the data from the 2006 and 2017 Agricultural Censuses for the Northeastern semi-arid region, the use of pesticides in this period had an increase of 17.63% in establishments (FORTINI, 2020). Despite this, "family farming plays a very important role in the sustainable development of the region, providing food on a local scale, besides being responsible for the conservation of natural resources and agrobiodiversity" (FORTINI, 2020, p. 18). It is, therefore, an activity that generates jobs and feeds the populations of this region.

METHODOLOGY

Localization of the municipality of Princesa Isabel-PB

The municipality of Princesa Isabel is located in the western region of the State of Paraíba, Mesoregion of Sertão and Microregion of Serra Teixeira (Figure 1). The municipality has 23,749 inhabitants, with an area of 368 km² and a demographic density of 57.84 hab/km2 (IBGE, 2021). The municipal seat has an altitude of 680m and geographical coordinates of 37° 59' 34" West longitude and 07° 44' 13" South latitude (MASCARENHAS et al., 2005).

FIGURE 1: Location of the municipality of Princesa Isabel-PB.



SOURCE: Own elaboration (2021).

According to data extracted from the Brazilian Institute of Geography and Statistics (IBGE), the municipality of Princesa Isabel - PB has a per capita GDP of 9,835.44 (IBGE, 2018); and a Municipal Human Development Index (HDI) of 0.558 (IBGE, 2010).

The main economic activities of the municipality of Princesa Isabel are: commerce, agriculture, industries (poultry farming and clothing factories), and services. Trade is a differential in the local and regional economy, generating numerous formal and informal jobs. As it is a pole city, people from other neighboring towns come to buy goods and sell them in the city. Poultry farming is another highlight, generating countless jobs and exporting its production to other states in Brazil.

Geoenvironmental characteristics of the study area

The Jatobá II dam is the main reservoir that supplies the urban area and surrounding farms (Figure 2). The maximum storage capacity of the spring is 5,660,979 m3 (AESA, 2021). In 2015 it collapsed due to drought, leaving the population of the city deprived of water. This situation remained for months, generating inconvenience. In addition, farmers and landowners were affected by the severe drought, most of them lost their crops and suffered losses. The dam currently has a water volume of 3,505,826 m3 (AESA, 2021). It is approximately 5 km from the city.

FIGURE 2: Location of the Jatobá II weir in the municipality of Princesa Isabel-PB.

SOURCE: Own elaboration (2021).

The predominant climate in the municipality according to the Köppen classification is of the Aw' type - hot and humid with summer-autumn rains (JACOMINE et al., 1972). Temperatures are high during the day, easing at night, with annual variations within a range 23 to 30ºC, with occasional higher peaks, especially during the dry season (MASCARENHAS et al., 2005, p. 3).

The rainfall, besides being low, is irregular with annual averages around 789.2mm/year. In general, it is characterized by the presence of only two seasons: the dry season, which constitutes the summer, and the rainy season, called winter by the country people. The relief is included in the so-called "Planície Sertaneja", which is an extensive flattened pediplane, where locally the "Pd2" stands out, formed by a set of elongated and aligned mountains (CARVALHO, 1982; SANTOS et al., 2016, p.1196).

It should be noted that due to the variation in relief, the rainfall index of the micro-region between Manaíra and Teixeira is higher than the other areas of western Paraiba. The vegetation is small, with cactaceous, shrubs and trees of small and medium size (MASCARENHAS et al., 2005).

Methodological aspects

The methodology used was based on research in scientific articles published in journals, books and congresses for the construction of the theoretical and empirical basis. The research is characterized as qualitative-quantitative, because the activities were described and graphs were built with the data collected through the questionnaire.

Thus, the research had a qualitative and quantitative approach. For Zanella (2013, p. 63) "the qualitative approach or qualitative research works with qualitative data, with information expressed in oral and written words, in paintings, in objects, photographs, drawings, films, etc. The collection and analysis are not expressed in numbers.

The quantitative approach is associated with numbers, statistics. Gil (2008, p. 17) points out that "the statistical method is characterized by a reasonable degree of accuracy. This approach is widely used by researchers to quantify data, providing more information.

About both approaches Minayo (1994, p. 22) states that "the set of qualitative and quantitative data are not opposed, on the contrary, they complement each other, because the reality covered by them interacts dynamically, excluding any dichotomy".

In relation to the objectives, the research is classified as exploratory, since we collected information in loco about the area, and photographic records were taken before the pandemic. To gather more data about the surveyed actors, 10 questionnaires containing objective and subjective questions were applied. The survey occurred in September 2021 with farmers who live or use the land for agriculture around the Jatobá

II weir. The application occurred with the farmers who were on the property. The maps were prepared with the QGIS 2.18.19 free software, and Excel was used in the construction of the graphs.

RESULTS AND DISCUSSIONS

Socioeconomic and environmental aspects of the farmers living around the Jatobá II weir

The data collected shows that among the interviewees 50% are female and 50% are male. The age range varied between 13 and 69 years. The level of education of the producers in this area is considered low, with 50% of the producers having an incomplete elementary school education, 30% stating that they have completed elementary school, 10% are illiterate, i.e., cannot read or write, and 10% have completed college education.

The family income is composed of pensions, crop insurance and family allowance. Most of the interviewees 40% have a family composition corresponding to 3 people, 20% is equivalent to 2 people, 10% said it is 4 people, 10% corresponds to 5 people, 10% said it is composed of 9 people, and 10% live in the city, using the land for agriculture and animal husbandry, remaining on site during the day. The time they have lived on the land ranged from 3 months to 24 years (Table 2).

TABLE 2: Characteristics of the producers interviewed in the survey.

VARIABLE	n (10)	% (100)
SEX		
Female	5	50%
Male	5	50%
AGE GROUP		
13 to 20 years old	1	10%
21 to 30 years old	1	10%
31 to 40 years old	2	20%
41 to 50 years old	1	10%
51 to 60 years	4	40%
> 60 years	1	10%
EDUCATION		
Illiterate	1	10%
Incomplete Primary Education	5	50%
Elementary School Complete	3	30%
Incomplete High School	-	-
Secondary Education Complete	-	-
Undergraduate Education Incomplete	-	-
College Complete	1	10%
FAMILY INCOME		
< Minimum wage	4	40%
1 to 2 Salaries	5	50%
3 to 6 Salaries	1	10%

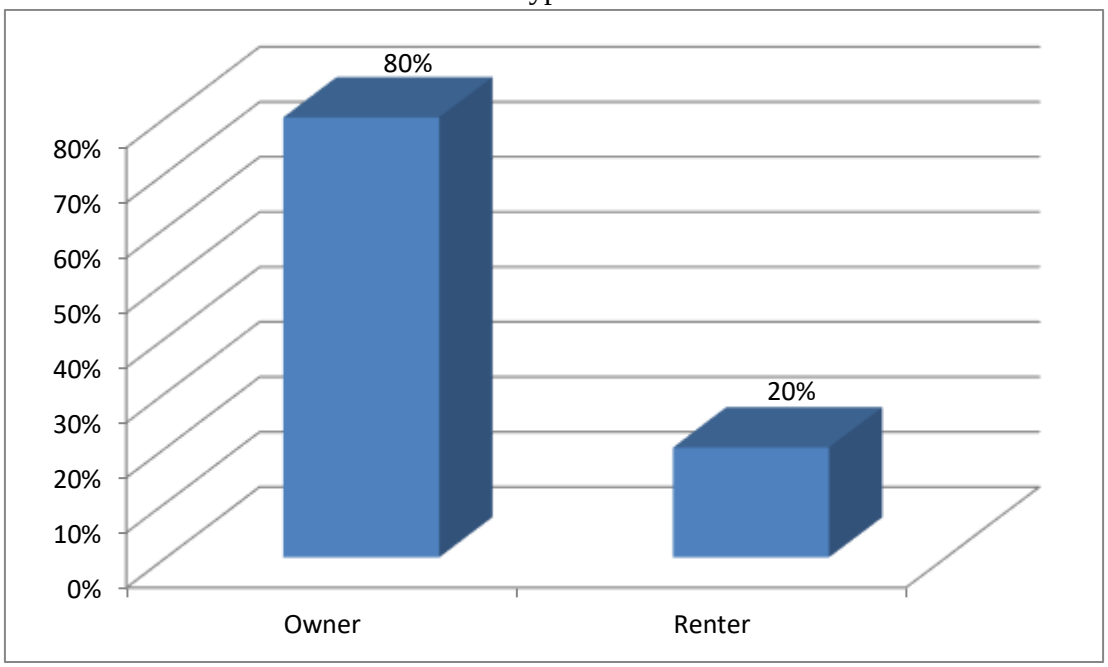
NUMBER OF RESIDENTS PER HOUSEHOLD		
	2	20%
2 people	4	40%
3 people	1	10%
4 people	1	10%
5 people	1	10%
9 people	1	10%
Does not live on the premises		
LENGTH OF TIME LIVING THERE		
	1	10%
Up to 1 year	4	40%
2 to 10 years	3	30%
11 to 20 years	2	20%
>20		

SOURCE: Own elaboration (2021).

Low education compromises the access to information, which is usually done through the radio, TV, or when they go to the city; moreover, it influences the use of products that impact the environment.

Regarding land tenure, most of the interviewees, 80% are owners, 20% are renters, people who take care of the land (Figure 3).

FIGURE 3: Type of land tenure.



SOURCE: Own elaboration (2021).

The size of the land varied between 2 and 8 hectares, according to the information collected. In this area, agriculture is widely practiced, being a culture passed from generation to generation, from father to son. In this context, "the organization of production around the social arrangement itself and that permeates

the social life of producers marks the notion of ownership and belonging to the territory" (THOMPSON; COSKUNER-BALLI, 2007; DALMORO et al., 2017, p. 98).

The activities developed by the producers are related to family farming, where the production is used for the family's own consumption, and the surplus can be sold. Around the weir there are many deforested areas being used for farming and planting grass for animal grazing (cattle, goats, horses) (Figure 4).

FIGURE 4: Area with grass plantation in the vicinity of the Jatobá II weir.

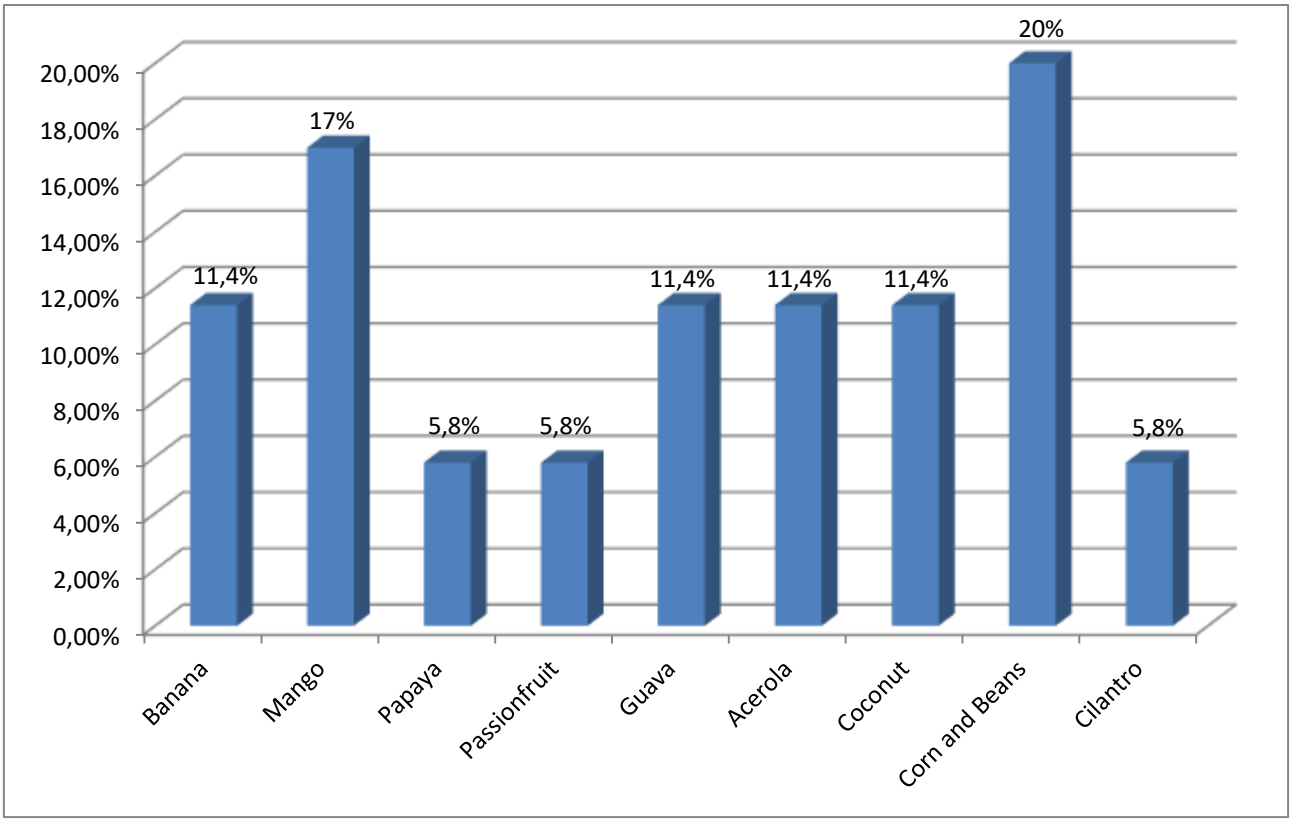
SOURCE: Own elaboration (2021).

The substitution of vegetation for pasture to maintain agriculture and cattle-raising occurs mainly in sloping areas around the dam. Thus, "deforestation and cultivation in Caatinga areas increase. Forage grass pastures spread considerably" (SABOURIN and CARON, 2003, p. 41), increasing the degraded areas. Silva, Felizmino, and Oliveira (2015, p. 151) state that "the inadequate techniques cause a series of impacts that are visible in the landscape, especially in the soils, which are tired and devoid of vegetation and nutrients."

The growing environmental degradation around the dam and in the hydrographic basin contributes to the silting up of the reservoir, considering that with the rains the particulate material (soil) is carried by the waters to the lower part of the basin, accumulating in the spring, reducing the storage capacity.

The main crops produced are temporary and permanent. The temporary crops are: corn, beans, chives, peppers, cilantro, etc. Permanent crops are: guava, coconut, mango, orange, soursop, etc. According to 20% of the interviewees, beans and corn are the most produced crops (Figure 5).

FIGURE 5: Main crops produced around the Jatobá II weir.

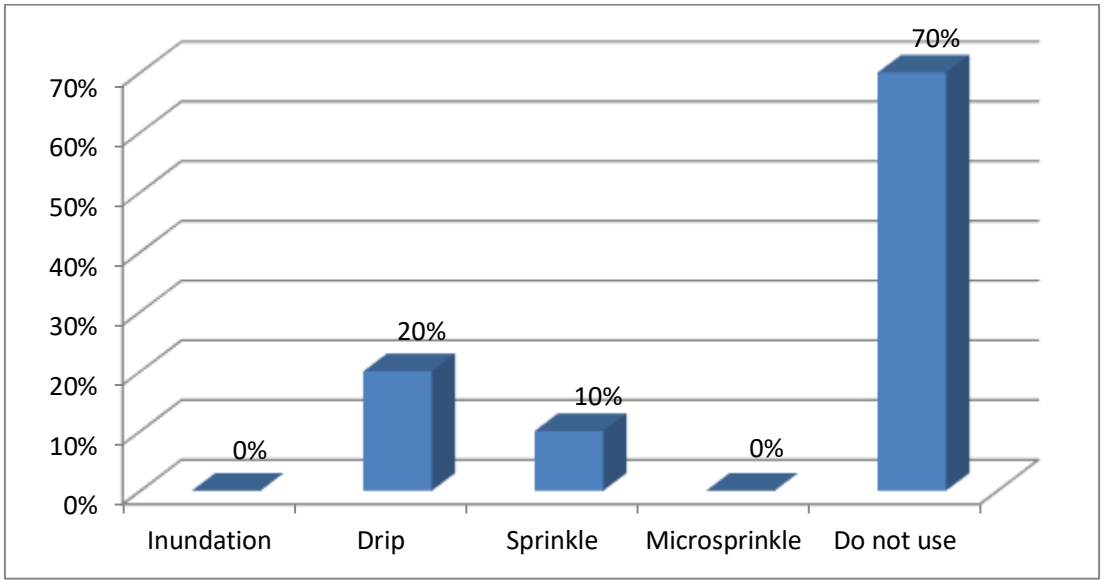


SOURCE: Own elaboration (2021).

The products from agriculture are used for the family's consumption during the year. The surplus is sold and the value obtained is used to supplement food, i.e., to buy other foods that are not produced locally. In addition, to supplement their income, the families raise animals such as chickens, pigs, guinea pigs, among others, which are sold when they need an extra income.

Some farmers use irrigation in the production of permanent crops. However, this is not a common practice in the area due to the high costs of implementation and maintenance of the irrigation system. Among the interviewees, 70% do not use irrigation on their farms, 20% use drip irrigation, and 10% stated that they use sprinkler irrigation (Figure 6).

FIGURE 6: Irrigation use by respondents.



SOURCE: Own elaboration (2021).

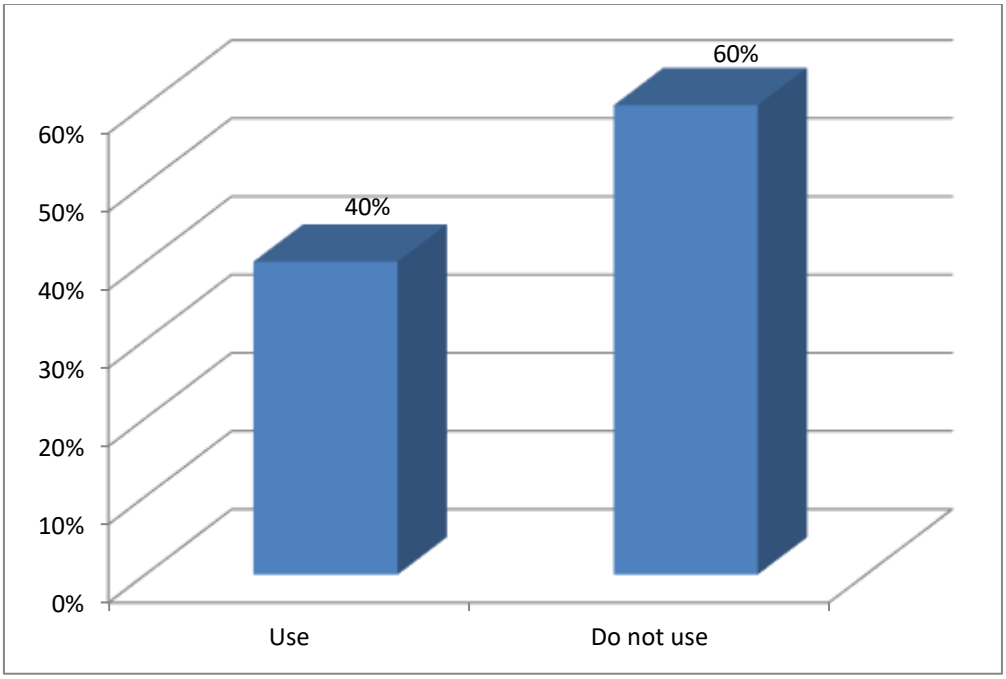
Drip irrigation is the most suitable for use in the semi-arid region because it requires less water consumption. According to Esteves et al. (2012, p. 4), this system "applies water to only part of the area, thus reducing the wetted soil surface exposed to losses by evaporation. With this, the efficiency of application is much greater and water consumption is lower. Irrigation is used in permanent crops such as coconut, acerola, lemon and orange (Figure 7).

FIGURE 7: Drip irrigation.

SOURCE: Own elaboration (2021).

Even though it is a small-scale agriculture, covering the family unit, the lack of information still persists in this region. The use of practices harmful to the environment and consequently to the health of the producers is still maintained. Regarding the use of agrochemicals that are better known by the farmers as "poison", 60% said they use such chemicals and 40% said they do not use them (Figure 8).

FIGURE 8: Agrochemical use among the interviewees.



SOURCE: Own elaboration (2021).

According to the farmers themselves, ant killers are generally used to contain the ants that cause losses in production and herbicides to eliminate the vegetation. The application of formicides usually occurs in a specific point in the anthills. Herbicides, on the other hand, are used throughout the entire area. Among the best known herbicides is glyphosate which is used to exterminate the vegetation. Silva (2017) in his master's dissertation proved that pesticides such as "Glyphosate" are used by farmers to eliminate vegetation in the vicinity of the reservoir.

In addition, Silva (2012) in a study conducted in the neighboring municipality of Tavares-PB found that farmers used in agriculture, pesticides such as formicides and DDT (Dichloro-Diphenyl-Trichloroethane). In this context and according to the literature, pesticides are harmful to human health, biodiversity, and the environment. They cause diseases, contaminate water, and kill animals and insects. However, using pesticides is not a crime, but their use must follow the legislation, as well as the specific rules for handling and use.

CONCLUSIONS

Family farming keeps local and regional markets supplied with food, thus strengthening the economy. These activities are essential to the region. However, low education and lack of information cause farmers to use pesticides that are harmful to the environment; in addition, there are inadequate agricultural practices that are culturally rooted.

Over the years this class has gained notoriety and policies have been implemented so that farmers remain in the field. Examples of policies are PRONAF (Programa Nacional da Agricultura Familiar) and Seguro Safra (Safra Insurance), programs developed to help producers and collaborate with their permanence in the rural area.

Thus, family farming is important for local development and for feeding the population of this region. Even with the droughts, the farmers persist in maintaining this activity. In this sense, the development of actions and policies aimed at improving the living conditions of these people is fundamental for them to continue producing and staying in the field. Furthermore, better conditions to assist farmers by informing them about environmental protection laws are necessary, as well as new information that encourages environmental protection such as payment for environmental services.

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