FRUIT CULTURE GROWTH IN NORTHEAST BRAZIL AND ITS RELATIONSHIP WITH WORK

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ABSTRACT - Fruit growing in Brazil enhances regional development, as it generates income and absorbs local labor. The Brazilian Northeast presents ideal edaphoclimatic conditions for the development of several fruit trees, mainly in irrigated areas. The objective was to analyze the educational level and the relationship between the wages of men and women employed in the fruit sector, in the Northeast region of Brazil. The selected crops were those of coconut, mango and grape, between the years 2001 to 2018; literacy rate and level of education in Brazil and the northeast region, the relationship between male and female genders, percentage of women in formal jobs in the years 2004 to 2015 and average monthly income in Brazil and the Northeast region and male and female genders in the years 2012 to 2015. There was a reduction in the area cultivated with coconut, however there was no increase in the area for mango and grape crops. Regarding the harvested area, the coconut crop showed a larger cultivated area, however, this area has been gradually reduced. In mango and grape crops, no variations were detected in the harvested areas. As for the average production, the grape crop has higher productivity. In the percentage of formal jobs, literacy and level of education of women, both nationally and regionally, there was a linear growth and higher than those of men. It is concluded that between men and women in the Northeast region, the salary difference was R$ 354.00, even with women with a higher educational level.

Keywords: fruit species, development, gender, education.

CRESCIMENTO DA FRUTICULTURA NO NORDESTE BRASILEIRO E SUA RELAÇÃO COM A MÃO DE OBRA

RESUMO - A fruticultura no Brasil potencializa o desenvolvimento regional, pois oportuniza a geração de renda e absorve a mão de obra local. O Nordeste brasileiro apresenta condições edafoclimáticas ideias para o desenvolvimento de diversas frutíferas, principalmente em áreas irrigadas. O objetivo foi analisar o nível educacional e a relação entre os salários de homens e mulheres empregados no setor da fruticultura, na região Nordeste do Brasil. As culturas selecionadas foram aquelas de coco, manga e uva, entre os anos 2001 a 2018; taxa de alfabetização e nível de escolaridade do Brasil e da região nordeste, a relação dos gêneros masculino e feminino, percentagem de mulheres em trabalhos formais nos anos de 2004 a 2015 e rendimento médio mensal do Brasil e a região Nordeste e os gêneros masculino e feminino nos anos de 2012 a 2015. Observou-se a redução na área cultivada com coco, entretanto as culturas da manga e uva não houve incremento na área. Em relação à área colhida, a cultura do coqueiro apresentou maior área cultivada, entretanto, essa área tem sido reduzida gradativamente. Nas culturas da manga e da uva não se detectou variações nas áreas colhidas. Quanto à produção média, a cultura da uva apresenta maior produtividade. Na percentagem de trabalhos formais, alfabetização e nível de escolaridade das mulheres, tanto a nível nacional e regional, observou-se um crescimento linear e superior aqueles dos homens. Conclui-se que entre homens e mulheres na região Nordeste, a diferença salarial foi de R$ 354,00, mesmo as mulheres apresentando maior nível educacional.

Palavras- chave: espécies frutíferas, desenvolvimento, gênero, educação.

INTRODUCTION

Brazil is the third largest fruit producer in the world, with an estimated production of US$812 million, uses around 16% of the Brazilian agribusiness workforce, employing approximately five million people (ABRAFRUTAS, 2019). The Northeast region is responsible for 27% of the national fruit production, with emphasis on the cultivation of coconut, guava, papaya, mango, passion fruit, pineapple and melon. This agricultural activity has high socioeconomic importance in this region due to low and irregular rainfall (VIDIGAL; XIMENES, 2016) which causes a reduction in many productive activities, a fact that corroborates the impoverishment of a high rate of the population.

In the Brazilian Northeast region in relation to the South and Southeast regions, it appears that the conditions of luminosity, temperature and relative humidity of the air favor the different cultures in the development of more than one productive cycle throughout the year (VIDIGAL;

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XIMENES, 2016). But for that, the use of irrigation must be considered.

Fruit growing is an economic activity that promotes the creation of direct and indirect jobs, contributing to the absorption of agricultural labor in the country (FACHINELLO et al., 2011). In addition to its social role, the economic sector also benefits from exports and the domestic market, generating income and local development.

In the fruit growing sector, the continuous qualification and specialization of the workforce employed is necessary, in addition to the best choice of means of production associated with the constant innovation processes (BORDIGNON et al., 2015) necessary for the development of the sector. According to Porter (2009), to achieve high levels of productivity, the following are essential: qualified human resources, technologies developed for specific sectors, infrastructure and funding sources aimed at meeting the needs of the members of the production chain. However, this structure initially collides with the qualification of the workforce used, which has a low level of education, which initially provides a decrease in hiring costs, however, can inhibit the diversification and improvement of production processes (OLIVEIRA et al., 2016) pre and post-harvest.

As labor is difficult to access and, in some cases, scarce, the sector basically maintains the same employees, harvest after harvest, making the workforce of the productive units maintain the same performance every year (SILVA et al., 2018). In these production units, activities are usually divided by gender. In recent years, there has been a greater demand for the female workforce because they have differentiated manual skills and achieve greater productivity. This association of specific female skills produced, at the same time, a wide absorption of women in this labor market accompanied by a difference in the average salary between men and women, in favor of men (SILVA et al., 2017).

Thus, the objective of this work was to analyze the area destined to the harvest, the amount produced and the average yield of the coconut, mango and vine crops, as well as the educational level and the relationship between the wages of men and women employed in the fruit sector in the Northeast region of Brazil.

MATERIAL AND METHODS

In this study, information regarding the agricultural activity of fruit growing in the Brazilian Northeast region and the use of labor were selected, based on data from the automatic retrieval system (SIDRA) of the Brazilian Institute of Geography and Statistics (IBGE, 2019). The selected data was: permanent farming from municipal agricultural production (PAM, 2018), focusing on the area destined for harvest, harvested area, quantity produced, average yield of crop production: coconut, mango and vine between the years 2001 to 2018 constituting a 17-year historical series.

Data on literacy rate and education level (Brazil and Northeast) the relationship between gender (male and female), percentage of women in formal jobs between the years 2004 to 2015 constituting a historical series of 11 years and the average income between Brazil and the Northeast region and the male and female genders between the years 2012 to 2015 (totaling three years of data collection, the historical series was small due to the absence of previous data), were obtained in the social development indexes (IDS), available in the automatic recovery system (SIDRA). The data obtained were processed using a Microsoft Excel spreadsheet (PONTES et al., 2021).

Linear regression was used to process the data, which is an analysis involving two or more explanatory variables for the observed phenomenon (HAIR JÚNIOR et al., 2005), which is obtained according to Equation 1:

$$Y1 = \beta_0 + \beta_1 X1 + i \qquad \text{(Equation 1)}$$

Where:

y = observed value for the dependent variable Y at the i-th level of the Y axes,

β_0 = regression constant. Represents the intercept of the line with the Y axis,

β_i = regression constant. Represents the variation of Y as a function of the variation of one unit of the variable X,

X_i = i-th level of the independent variable X and

ε = residual or forecast error, ie, the difference between the actual and predicted values of the response variable, which is assumed normally distributed with zero mean and variance (HAIR JÚNIOR et al., 2005).

The individual analyzes of the variables were carried out for the Northeast region and for Brazil, and the analysis of variance was performed for the effect of linear regression (SOUZA, 2007), in addition to the determination of the coefficient of determination, between the variables, in order to determine the how much of the observed data can be explained by the proposed equation (EGEWARTH et al., 2017). In the statistical analyses, a 5% error probability was used. The statistical program used was Sisvar (FERREIRA, 2014).

RESULTS AND DISCUSSION

Fruit growing in the Northeast region stands out in the export of coconut, mango and vine crops (OLIVEIRA; PEREIRA, 2019). These are normally produced in irrigated perimeters, which, in relation to mango and vine crops, limits the expansion of their area for cultivation and harvesting, since the main input in this region is water. The behavior related to the cultivated area of these crops, in the period 2001-2018, is shown in Figure 1. The linear equations were adjusted, y = 250761-3171x ($R^2 = 0.7848$), for the coconut crop, y = 44300 + 383x ($R^2 = 0.1507$), for the mango crop and y = 7390 + 187x ($R^2 = 0.5589$), for vine cultivation.

From the regression analysis, there was a decreasing linear relationship for the area destined to the coconut palm harvest, verifying, between the years 2017 to 2018, a reduction of more than 5,000 ha in the area destined

60

Fruit culture growth...   COSTA, B. P. et al. (2022)

to the cultivation of this crop. This reduction is related to the higher water demand of the coconut tree, as well as the low rainfall observed in the region, which limit the availability and use of water in irrigation. Despite this reduction in the cultivated area, the low rainfall and use of irrigation can be positive factors in the appearance of diseases.

The climatic conditions of low relative humidity and high temperatures in the semi-arid sub-region of Brazil represent a barrier to large-scale livestock production and the development of grain cultivation, becoming an advantage when it comes to fruit growing, especially by reducing the appearance of fungal diseases in the southern region of Ceará (GOMES, 2015).
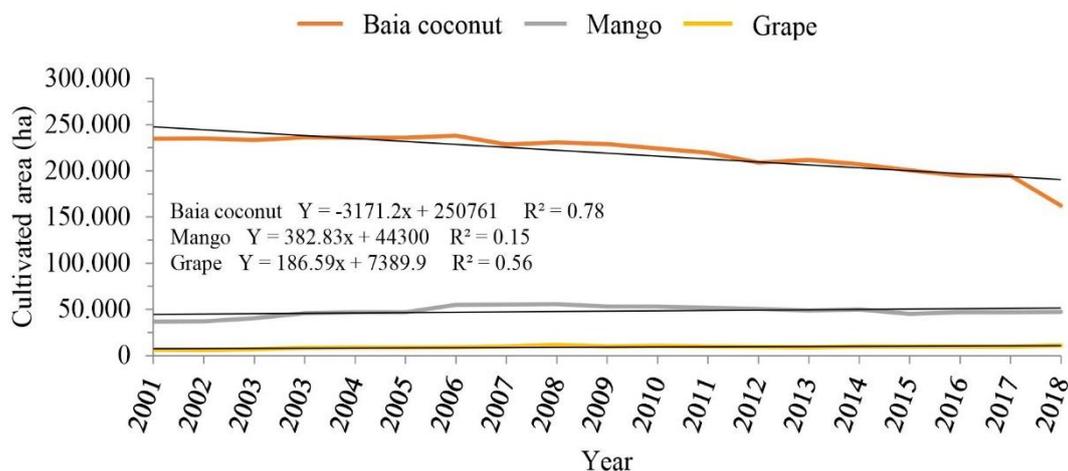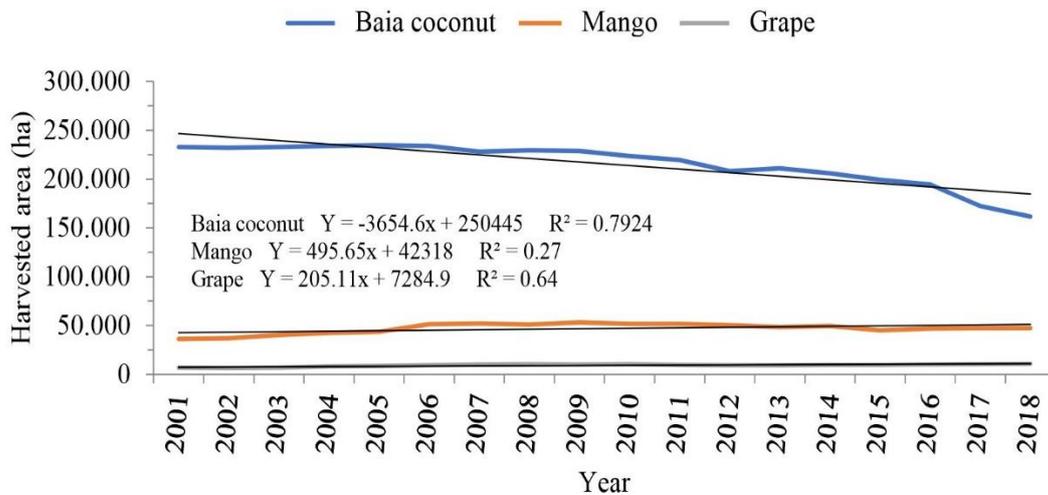

FIGURE 1 - Cultivated area (ha), of coconut, mango and grapevine in the Northeast region, in the period from 2001 to 2018.

Figure 1 shows large areas of cultivation and production in the Northeast region for some fruit species. The explanation for the existence of these areas may lie in environmental factors, such as lower relative humidity, which reduces the appearance of diseases, the availability of water in some regions, which act as a factor of attraction for fruit growers, associated with public policies for support for the production of specific crops (SOUZA et al., 2018). Furthermore, the recent development of fruit growing in the Northeast is linked, among other factors, to the technological development aimed at the sector and the use of irrigation (XAVIER et al., 2006).

However, even with the rational use of water, observed by Vidal and Ximenes (2016), in 2012 there was a reduction in the cultivation of fruit species, which was accentuated with the worsening of the water crisis in 2014. The consecutive years of low rainfall since 2012 have harmed both rainfed crops, such as cashew, and irrigated crops, such as bananas and coconuts, as the reduction in the water level in the reservoirs led to the decision restriction of water availability for irrigation.

In relation to the harvested area, it was verified that it follows the behavior of the cultivated area, where the coconut culture, in 2001, presented a larger area, however, during the evaluation period (years), it gradually reduced. Regarding the cultivation of mango and vine, they did not show a marked variation in the harvested area. The representation of the area harvested in the period from 2001 to 2018, with the linear models adjusted for the coconut, mango and vine crops is shown in Figure 2. The linear equations were adjusted, $y = 250445 - 3655x$ ($R^2 = 0.7924$), for the coconut crop, $y = 42318 + 496x$ ($R^2 = 0.2664$), for the mango crop and $y = 7285 + 205x$ ($R^2 = 0.6408$), for vine cultivation.

61

Fruit culture growth...   COSTA, B. P. et al. (2022)
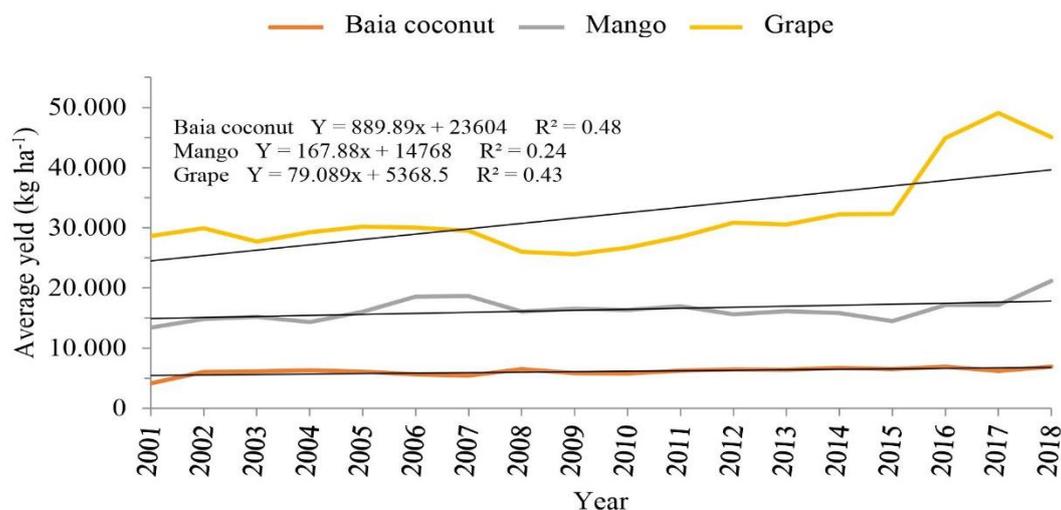

FIGURE 2 - Harvested area (ha) of coconut, mango, and grapes in the Northeast region from 2001 to 2018.

The behavior and the fitted linear models, represented by the R^2, can be seen in Figure 3. The linear equations were adjusted, $y = 23604 + 890x$ ($R^2 = 0.4762$) for the coconut crop, $y = 14768 + 168x$ ($R^2 = 0.2428$) for the mango crop and $y = 5368 + 79x$ ($R^2 = 0.4358$) for vine culture. The mango crop showed a slight increase in the average yield of production, the same behavior observed in the area destined to harvest (Figure 2).

Mangoes produced in the Northeast are export type, due to their high quality, meeting quality specifications such as: average sugar level, color variation, average fruit size, requirements in relation to packaging (CAVALCANTI; DIAS, 2015) and for meeting the requirements imposed by international legislation (PBCE, 2013). It is a fruit with a high price in the market, a fact that contributes to the increase in the adoption of technologies in the orchard that allow an increase in productivity, without increasing the area destined for harvest and, as a consequence, increasing the average yield of production (VIDAL; XIMENES, 2016).

Also according to the authors, technological advances and productivity gains, the growth of fruit production in the Brazilian Northeast occurred, mainly due to the spatial scope that fruit growing has reached. As evidenced by Silva et al. (2017), fruit growers in the Northeast are largely concentrated in the irrigated areas and mainly in the region supplied by the waters of the São Francisco Valley (LIMA et al., 2016) with more adequate structural and productive viability.

FIGURE 3 - Average yield (kg ha^{-1}) of coconut, mango and grape productions, in the Northeast region, in the period from 2001 to 2018.

For coconut cultivation, the harvested area showed a different behavior to the average production yield, since it is observed in Figure 2 that, over the years, there is a reduction in the harvested area, which is explained by a decreasing linear behavior, a fact that contrasts with the average production yield, a fact that may indicate an increase in the productivity of the coconut crop. This is easily absorbed by the domestic and foreign markets, mainly by the tourism sector, but there are no statistics on quantities and values traded (BRAINER; XIMENES, 2020). The crop has a long cycle and high water (ALENCAR et al., 2018) and nutritional demand. Also according to the authors, periods of prolonged drought can influence the production and maintenance of the crop in the field, which can lead to a reduction in the production area, which was not observed in the present work, since there is an increase in production at the end of the year evaluated period, in 2018.

The fluctuations observed in the area destined for harvest and average yield may be related to the climatic variation of the region and the water sensitivity of the crops, directly influencing the productivity of this sector (SILVA et al., 2015). In addition to these, productive efficiency tends to be higher in places where planning is more appropriate, thus generating productivity gains and, consequently, competitiveness, in relation to other producers (SOUZA et al., 2018).

Even with the smallest area destined for harvesting, the vine crop (Figure 2), it presented the highest average production yield (Figure 3), which in 2001 was above 2000 kg ha^{-1}, but between 2001 and 2018 it reached 4000 kg ha^{-1}. This fact, linked to the level of technology used in this activity, favorable climatic conditions for production in quantity and quality, such as light and relative humidity, which restricts the emergence of fungal diseases, in addition to the workforce, which has been qualifying for meeting the internal and external needs of the table and wine grapes market, constitute a set of factors for increasing yield (GOMES, 2015).

In terms of the percentage of women in formal employment, both nationally and regionally, there was an increasing linear relationship, but with a difference between approximately 40% and 24% (Figure 4). In the Northeast region, the percentage of formal jobs is lower when compared to Brazil, which may be related to the migration of local labor to other regions of the country, especially to large urban centers (SIQUEIRA, 2015). Other related factors may be the low availability of formal jobs and the inclusion of many women in underemployment or family farming (SOUSA; SILVA, 2012). The adjusted linear regression models, in percentage of women in formal jobs in Brazil and in the northeast region, have R^2 of 0.9306 and 0.9323, respectively, shown in Figure 4. The linear equations were adjusted, y = 40.16 + 1.72x R^2 = 0.9306, for Brazil and y = 24.37 + 1.50x R^2 = 0.9323, in the Northeast region.

Fruit growing stands out as an important generator of formal jobs in the rural Northeastern area (SOUZA et al., 2018) and, as it demands a high amount of labor, it is estimated that for each hectare planted, at least two direct jobs are generated in the rural area. field (ABRAFRUTAS, 2019). In this sector, female labor is absorbed in large quantities, especially in the phase of classification and selection of fruits, such as grapes, mangoes and melons (CAVALCANTI et al., 2002), due to their manual skills and greater productivity (SILVA et al., 2018).
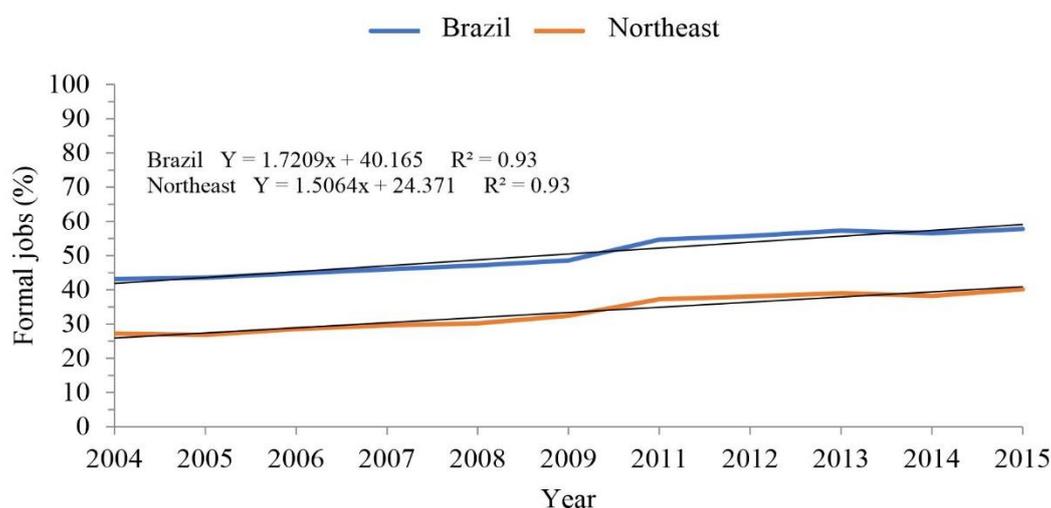

FIGURE 4 - Percentage of women in formal jobs in Brazil and the Northeast region from 2004 to 2015.

In the percentage of literacy between females and males, aged 15 years or over, in the northeast region, between the years 2004 and 2015, a reduction in the level of illiteracy is observed, representing a linear growth in the level of schooling of this region. population, with emphasis on the higher percentage of women and which follows the national perspective (QUIRINO, 2012), (Figure 5). This condition results from the insertion of women in the formal job market, which demands a higher level of education, opening of schools or availability of school transport in this

region. On the other hand, many men have a lower level of education, because they have greater physical strength used since adolescence in agricultural activities in the family

area, and when they reach adulthood, many follow the flow of migration to other regions, in periods of harvest. large crops (SIQUEIRA, 2015), such as sugar cane and citrus.
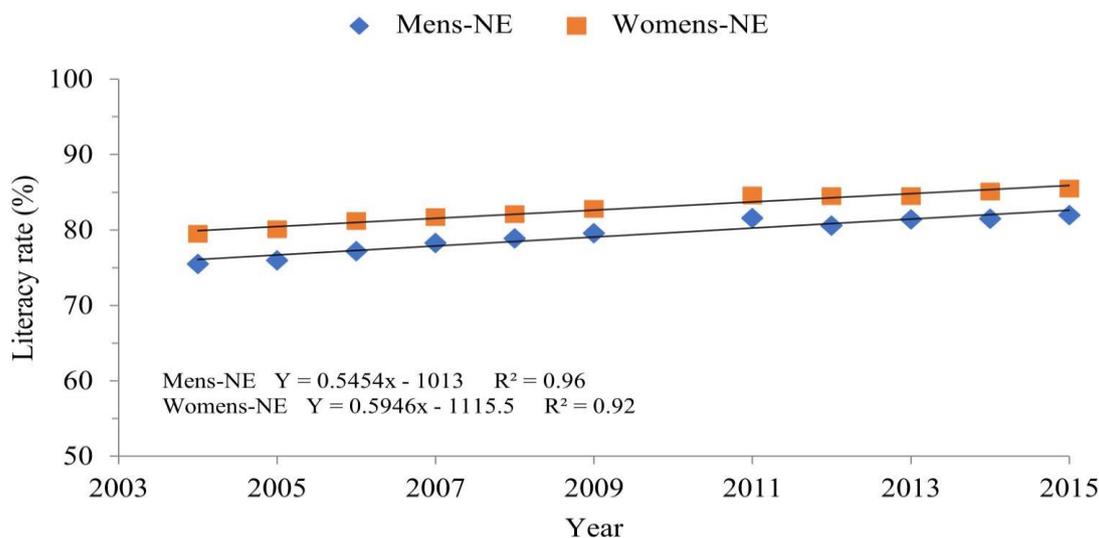
FIGURE 5 - Literacy rate in the Northeast region, in relation to male and female gender, aged 15 and above, for the period from 2004 to 2015.

Most of the workforce used to harvest fruit usually has a low level of education, which makes it less expensive at the time of hiring, however, it can inhibit the diversification and improvement of processes, being essential to the qualification of this workforce. of work for the growth and gain of competitiveness in this sector (OLIVEIRA et al., 2016).

Figure 6 shows the level of education between females and males, aged between 25 and 64 years, who studied a total of 11 years, in Brazil and in the Northeast region, observed in the period from 2009 to 2015, with a linear growth in the level of education of this population, with emphasis on the greater number of women, both nationally and regionally, who have completed high school. Women who have a higher level of education than men stand out. The linear equations were adjusted, y = 5,107 + 106x (R^2 = 0.9681) for women in Brazil and, y = 5,107 + 945389x (R^2 = 0.9583), for men in Brazil. In the Northeast region, y = 1.107 + 323995x (R^2 = 0.9457) for women and y = 1.107+ 259009x (R^2 = 0.9461) for men.

The sophistication of demand stimulates the qualification of workers, since to meet the needs of customers, companies invest more in technology and need employees with technical knowledge from a high level of

education, enough to innovate, and often, the very company bears the costs of employee training (OSINSKI et al., 2014).

In relation to wages, even with a few years in the series, a discrepancy between wages at the level of Brazil and the Northeast region is noticeable (Figure 7), where, in 2012, the difference between men's wages at the national and regional level was R BRL 556.00 and for women BRL 352.00. In 2015, this salary difference was BRL 709.00 for men and BRL 463.00 for women, however, it is noteworthy that in 2015, in the Northeast region, there was a salary difference between the genders of BRL 354.00, even women with a higher educational level. In relation to linear regression models, the adjustments are classified as good, when the coefficients of determination (R^2) of the equations from 0.99 to 0.92 are verified.

Fruit growing is an intense activity that contributes to the economy of the Northeast region, since tropical and temperate fruits are produced mainly in semi-arid areas, enabling the possibility of developing these historically fragile economies (QUINTINO et al., 2010). The association of women's special skills with productive activities allowed a large absorption of female labor by the fruit sector, without, however, equating the average level of remuneration (CAVALCANTI et al., 2002) between genders.

64

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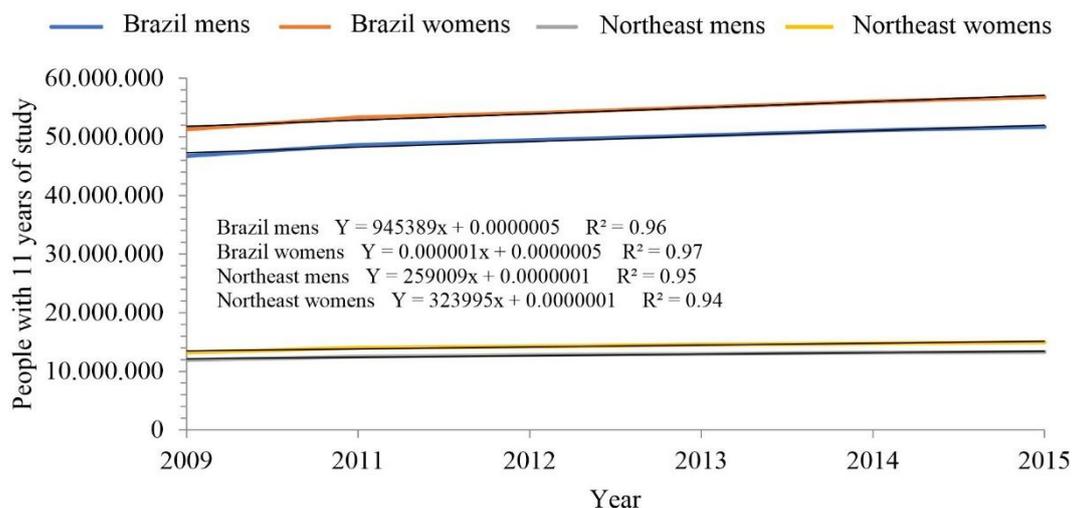
FIGURE 6 - Schooling (11 years of study) of men and women aged 25 to 64 years in Brazil and the Northeast region in the period from 2009 to 2015.
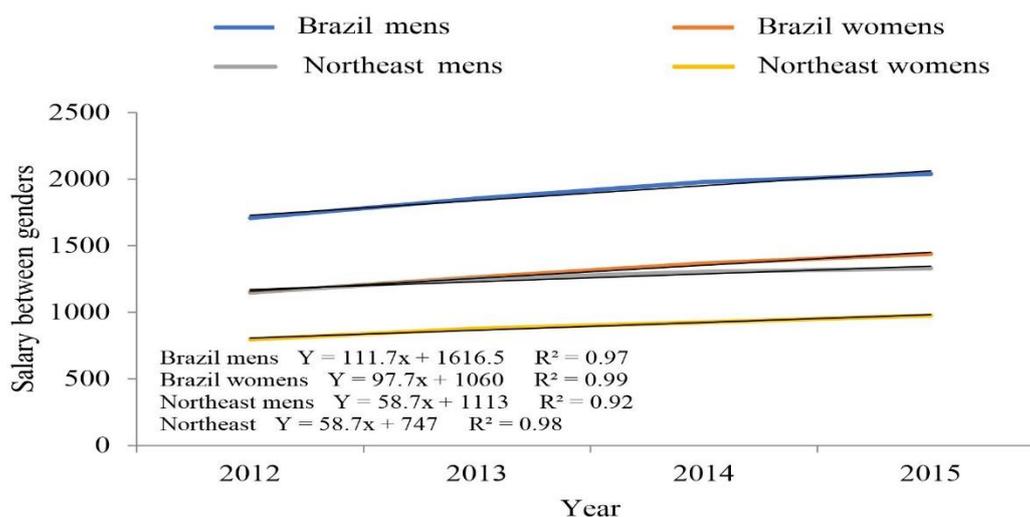
FIGURE 7 - Wage gap between men and women in Brazil and the Northeast region for the period 2012 to 2015.

Gender representations, socially and culturally constructed, influence the ways in which women and men enter the world of work. According to Silva et al. (2018), such representations are constructed as fundamental factors of occupational segmentation and the sexual division of labor. For Hirata and Kergoat (2007), the social division of labor has two organizing principles: the principle of separation into men's jobs and women's jobs and the hierarchical principle where a man's job is worth more than a woman's job.

In the region, the idea was formed that mango cultivation is for male workers, as it demands greater physical strength and resistance in its execution. In relation to viticulture, the workforce is mostly female, due to its greater sensitivity, because it is poorly mechanized and socially accepted as more adequate (SILVA et al., 2018).

The author adds that, even with the skills they present, women's work remains at lower levels of remuneration compared to men's, which is not a specific dynamic of agricultural production, nor of this region.

CONCLUSIONS

The area destined to the cultivation of coco-da-baía presents a reduction of more than 5 thousand ha $^{-1}$ related to the dry period that the cultivation region passes through.

The grape crop has a smaller harvest area, but its yield was 4000 kg ha $^{-1}$ over the years 2001 to 2018.

The percentage of formal work among women at the national and regional levels respectively showed a difference of 40% and 24%, between 2004 and 2015.

There was an increase in the level of education among men and women at the national and regional level

65

Fruit culture growth...   COSTA, B. P. et al. (2022)

between 2009 and 2015, with emphasis on the greater number of women who completed high school.

Regarding salaries at the national and regional level, there was a difference in 2015 of R$ 709.00 for men and R$ 463.00 for women.

Among men and women in the Northeast region, the salary difference was R$ 354.00, even if women had a higher educational level.

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66

Fruit culture growth...   COSTA, B. P. et al. (2022)

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