

Socioeconomic and phytosanitary diagnosis of fruit farming in Rolim de Moura, RO, Brazil

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ABSTRACT

The objective of this work was to perform a socioeconomic and phytosanitary survey on the fruit production in Rolim de Moura, RO, Brazil. The research was carried out with 20 smallholders working with commercial fruit growing, to whom 25 objective and discursive questions were addressed, and who were interviewed. The results showed that the labor market attracts the producers' sons to the urban area, reducing the labor force of the fruit farming. Besides, the lack of technical assistance (50%) stimulates production where producers are not alerted for the use of PPE (personal protective equipment), when applying pesticides. There is also the lack of technological resources, a reason that together with the age of the producers contributes to reduce the production quality. However, the main problem faced in the commercialization of fruits is their low price. Plant health was compromised, as diseases were identified in all crops, especially in the passion fruit plantations, since the production decrease caused their abandonment, leading the producers to get involved with other sources of income, such as dairy farming, and only 25% of farmers subsist on fruit growing.

Index terms: family farming, fruit growing, fungicide, pesticide, plant health.

Diagnose socioeconômica e fitossanitária da fruticultura em Rolim de Moura, RO, Brasil

RESUMO

O objetivo deste trabalho foi realizar um levantamento socioeconômico e fitossanitário sobre a produção de frutas na cidade de Rolim de Moura, RO, Brasil. A pesquisa foi feita com pequenos produtores que trabalham com o cultivo comercial de frutas, a quem enviamos 25 questões objetivas e discursivas, e dos quais 20 produtores foram entrevistados. Os resultados mostraram que o mercado de trabalho atrai os filhos dos produtores para a área urbana, o que reduz a força de trabalho para o cultivo de frutas. Além disso, a falta de assistência técnica (50%) estimula a produção em lugares onde os produtores não são alertados quanto ao uso de equipamentos pessoais protetores, quando aplicam pesticidas. Há, ainda, a falta de recursos tecnológicos, uma razão que, acrescentada à idade dos produtores, contribui para reduzir a qualidade da produção. No entanto, o principal problema enfrentado para a comercialização das frutas é seu baixo preço. A sanidade vegetal está comprometida, pois identificaram-se doenças em todas as culturas, especialmente nas plantações de maracujá, pois o decréscimo da produção causou o abandono dos cultivos, o que levou os produtores a se envolverem com outras fontes de renda, como a produção leiteira, e apenas 25% dos fazendeiros subsistem da fruticultura.

Termos para indexação: agricultura familiar, fruticultura, fungicida, pesticida, sanidade vegetal.

Ideias centrais

- Estudo inicial da fitossanidade da fruticultura na região de Rolim de Moura, Rondônia.
- Levantamento de doenças de fruteiras na região estudada.
- Aspectos socioeconômicos de produtores de frutas de Rolim de Moura.

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INTRODUCTION

The state of Rondônia is divided into 10 regions for planning and management, and the Region VIII consists of seven municipalities, as follows: Rolim de Moura, Novo Horizonte D'Oeste, Santa Luzia D'Oeste, Alto Alegre dos Parecis, Nova Brasilândia D'Oeste, Castenheiras, and Alta Floresta D'Oeste (Rondônia, 2008). These municipalities have their economies based on agriculture, especially in beef and dairy cattle, and coffee. According to the Instituto Brasileiro de Geografia e Estatística (IBGE, 2015), Rondônia occupied the 7th rank in Brazil, in the first quarter of 2015, for milk production and cattle slaughter, and the first position for milk production in the North region of the country. As to coffee, the production was 1,626,900 coffee bags in 2016, guaranteeing to the state the fifth largest domestic producer position (Acompanhamento..., 2016).

Another important agricultural activity is the fruit production as they are vitamin source, mineral salts, and fibers, and therefore, an important part of the human diet. Brazil stands out for being the third largest producer of fruits, mainly orange, papaya, lime, tangerine, pineapple, banana. However, it is worth mentioning the problems faced in fruit production, such as deficient infrastructure, difficulty to access credit, and low investment in research and development (Anuário..., 2014).

Rondônia shows a great potential for the production of fruits (Rondônia, 2012); the state has high temperatures, with annual means of 25,6 °C temperature and 1.759 mm precipitation. This state has the Köppen-Geiger's Am climate classification, with characteristics of rains and droughts (Alvares et al., 2013). These conditions favor the production of fruit trees, such as the acerola culture, which shows a profitable production at temperatures of approximately 26°C, tropical climate, and 1.200 to 1.600 mm per year precipitation, and is greatly influenced by solar radiation. Papaya is a plant that develops in tropical climate, between 22 and 26°C temperature, 1,800 and 2,000 mm rainfall per year, and from 60 to 85% relative humidity (Crisóstomo & Naumoy, 2009).

It is important to note that rural properties in Rondônia state are characterized by small properties of family farming, and data show that 98% of fruit growers are smallholders, which justifies the present research (Emater-RO, 2015).

However, the fruit production in Rondônia is not articulated as a supply chain, as there is not a good economic representation, considering the marketing in agribusiness or markets (Emater-RO, 2010). Therefore, the adoption of good agricultural practices is necessary to produce fruits to avoid generating negative effects to human health. For instance, the indiscriminate use of pesticides causes serious damage to health, as the inadequate application or excess products contaminate the water table and rivers and, consequently, fish, accumulating in their fatty tissues, causing cancer to people who eat these animals (Soares, 2010).

Without biological phytosanitary alternatives, many producers choose to use chemical pesticides. The plant protection and speed in the control provided by the use of pesticides in agriculture, as well as the lack of basic information and even the use of obsolete equipment which cause the application of more than the necessary quantity of agrochemicals, led to an increase in the consumption of pesticides in Brazil (Nunes & Ribeiro, 1999).

The lack of technical assistance, regarding the proper use of pesticides, and the lack of indication of alternative methods of control threaten the consumption of fruits, which become contaminated by these products. Thus, instead of vitamin and mineral sources that are ideal for the good and correct functioning of the human body, these fruits cause disease. Several studies report significant amounts of pesticides in crops consumed mainly *in natura*. However, producer should be warned about the risks caused by the use of agrochemicals (Jardim et al., 2009). The chemical control should be used only after applying all available control methods, to avoid future problems (Tavella, 2011).

Fruit growing is an important source of income for the producers, as it improves the quality of life, maintains the employability of the family, besides providing a greater profitability in comparison to those engaged in dairy cattle. As well, this activity is an alternative of subsistence in small properties (Petinari et al., 2008).

In 2014, the state of Rondônia destined the following areas for cropping: 7,842 ha (banana), 899 ha (pineapple), 1,001 ha (watermelon), 471 ha (passion fruit), 631 ha (orange), and 365 ha (lemon), according to IBGE (Levantamento..., 2015). This can be attributed to the importance of the state in the fruit production, as the state have a great variety of fruit orchards and a large and rich extension of land, which makes it a great promoter of fruit production in Northern Brazil.

The objective of this work was to perform a socioeconomic and phytosanitary survey (diseases and weeds) on the fruit production in Rolim de Moura, Rondônia state, Brazil.

MATERIALS AND METHODS

The survey was conducted in farms, in the municipalities of Rolim de Moura and Santa Luzia d'Oeste, in Rondônia state, from August 2014 to June 2015. Smallholders were chosen for their work with fruit farming for trade, and for their connection in some way to agribusiness, and to the Union of Rural Workers of Rolim de Moura and Emater.

A questionnaire with 25 questions was used as a data collection instrument, considering the socioeconomic aspects, commercialization and plant health. The questions were related to the following aspects: ownership of the land; dwelling time; schooling; amount of family member; people working in the property; age of producers; family income; other sources of income; housing type; possession of an electrical network; subsistence agriculture/intended area; influence to produce fruit; provision of technical assistance; soil analysis; cultivation system; irrigation; harvest; acquisition of seeds/seedlings; labor; marketing; problems in commercialization; control diseases; weed control; use of personal protective equipment (PPE); and destination of agrotoxic packaging.

Twenty rural producers were interviewed, from which 18 are from the municipality of Rolim de Moura, and two are from a region bordering the municipality of Santa Luzia D'Oeste; they agreed to participate in this research and signed a free and informed consent form.

In the field, we observed the occurrence of typical diseases of each culture, considering the symptoms and signs, and their identifications were based on the literature related to the subject in observation and to confirmation by the Phytopathology Laboratory of the Universidade Federal de Rondônia. The results were organized and presented in a descriptive manner.

RESULTS AND DISCUSSION

Cultivated species

Thirty-five orchards were evaluated in 20 rural properties, and the cultivation of 11 fruit species was verified in the municipality of Rolim de Moura (Table 1).

Table 1. List of species and percentage of equivalent field.

Fruit common name	Fruit scientific name	Equivalent field (%)
Pineapple	<i>Ananas sp.</i>	11.42
Acerola	<i>Malpighia sp.</i>	11.42
Banana	<i>Musa spp.</i>	14.29
Cocoa	<i>Theobroma cacao</i>	2.86
Cupuaçu	<i>Theobroma grandiflorum</i>	17.15
Guava	<i>Psidium guajava</i>	2.86
Orange	<i>Citrus sinensis</i>	11.42
Papaya	<i>Carica papaya</i>	5.71
Mango	<i>Mangifera indica</i>	2.86
Passion fruit	<i>Passiflora spp.</i>	17.15
Watermelon	<i>Citrulus vulgaris</i>	2.86

Socioeconomic aspects – ownership of the land, schooling, and composition of family members

All producers are owners of the land where they live, 85% of these producers reside for more than 10 years at the site, and 15% live there between 2 and 5 years.

About the schooling, it was found that 40% have unfinished primary education, 40% finished the elementary school, 10% had incomplete secondary degree, 5% have high school, and only 5% have completed the higher education. The results found follow the trend of information obtained by IBGE (2010), with a small reduction in the national percentage. Out of the total producers in the surveyed region, 80% have only the elementary education; 15% have high school; and 5% have a complete higher education.

The level of education is essential for the adoption of technologies. The schooling level of rural landowners plays an important role in the management and organization of agricultural businesses, since low schooling compromises the socioterritorial development by hindering the population's understanding of sociopolitical processes, maintaining the influence of dominant political groups, compromising the degree of demand for the improvement of living conditions, restricting the possibilities of professional qualification, and hampering the use of participatory mechanisms and citizenship (Figueiredo, 2014). The educational deficiency of most producers has a negative influence on the marketing processes and on the implementation of new systems, reducing the marketing viability in the globalized market. The results lead to the inference on the importance of this variable for the development of fruit production in the region. In addition, the analyzed municipality have Pedagogy courses offered by three higher education institutions, and one of them – the Licentiate Course in Rural Education – carries out a work aiming at the education of producers in the region, to promote the improvement of life quality, involving technological aspects, commercialization, and property management.

Data showed that 90% of families are composed of 2 to 5 members; out of this 90% families, 5% have one member, and 5% have more than five members. This research found a producer who lives alone, while other families have 10 members. Family members who work in the activity have been displayed by the percentage of people who live in the same house and work at the property (Figure 1), as follows: 65% of the family members with two to five people in the activity; 5% of family members with more than five people in the activity; and 30% of family members who are resident only.

The parameter age of the producers shows that only one of them is under 40 years old. In the other families, there was a migration of the youngest members to the urban area, in search of an industrial and/or logistical labor market, which reduced the workforce for fruit growing. This migration is caused by numerous difficulties in the production, therefore, the producers seek better living conditions in the city (Fonseca et al., 2015). However, they do not always find such “better conditions” and, ultimately, they face unemployment problems due to lack of professional qualifications.

Income

Only 25% of the producers subsist exclusively on fruit production. Thus, most people have other sources of income, from whom a large part (60%) work in dairy or beef cattle production. Apparently, 10% of people have other sources of income, and 5% work in plant extractivism. As to the type of housing, 11 producers have a brick house, and 9 of them have a wood house, with 100% electricity. Data on the subsistence agriculture show that 65% producers do not have a specific area on their land for this purpose; 10% of them have from 20 to 50% of their land in the area destined to subsistence agriculture; and 25% of them destined less than 20% of their land for that purpose.

The producers presented several motivations to dedicate themselves to fruit production, such as the market, successful experiences of friends and lectures (Figure 1), which shows the importance of encouraging actions for the development of smallholding. The encouragement for the industrialization in rural areas and investments in irrigated agriculture and agribusiness stimulate the income increase for the producers and improve the quality of their lives (Alves et al., 2011).

Phytotechnology

One of the aspects to achieve success of an agricultural business is the correct planning carried out by qualified professionals. For the growing of crops, both planning and effective technical assistance are essential. In the present research, we observed that only 50% of the interviewed producers receive technical assistance of the official agency, when they requested it. A study by Gonçalves et al. (2014) shows that technical assistance, guidance, and monitoring of the activities of a dairy farm, followed by a harmonic interaction between the producer and the extension worker, promoted the efficiency of the technology transfer, resulting in the increase of the production and quality of milk.

Despite the contribution of soil analysis to planning and the proper correction of the soil, our study evidenced that 45% of fruit farming producers do not conduct such analysis.

Plant productivity is determined by the length and distribution of the root system, to explore the arable layer of the soil, where most of the nutrients necessary for its development are found. However, the high concentration of aluminum impairs the elongation and causes roots to thicken, hindering the absorption of nitrogen, phosphorus, calcium and magnesium. The presence of aluminum reduced the absorption of P, Ca, Mg, S, Fe, and Mn, affecting the transport of these nutrients to the aerial part of guava plants, according to Salvador et al. (2000). Thus, the application of calcium is recommended to improve the chemical conditions of the arable layer, which makes calcium and magnesium available to plants, neutralizing acidity (Mendonça, 2006). Therefore, this should be a practice for all rural producers who invest in cropping.

For the cultivation system, we observed that nine properties adopted monoculture, six from which undertook consortium with other cultures, like other fruit production, or coffee, one carried out a consortium with the agroforestry system, and four properties have a diverse plantation system, showing in all of them the lack of planning for planting.

Agricultural diversification is one of the strategic options in rural development policy, particularly in rural areas most affected by the decline of some agricultural activities, constituting a process of social, economic, and environmental revitalization. In addition, it reduces the risks of just one activity as the main source of income and family maintenance. To take advantage of niches and market demands for differentiated products, family farmers should be able to diversify their production and develop sustainable production systems, by adopting guidance, research, and adequate technical assistance (Abdo et al., 2008). In Rondônia, this is one of the reasons for the incipient fruit production, despite the government efforts to stimulate the establishment of agro-industries.

Six producers use sprinkler irrigation in the cultivated areas, five of them for drip irrigation; eight farmers do not use this technology, and one producer uses simple hose, but without employing a technical system. The use of irrigation with a perforated "laser" hose increased the incidence of *Colletotrichum gloeosporioides* and *Corynespora cassiicola* in the acerola cherry culture (Generoso et al., 2002).

Harvesting on all properties is done manually, considering the cultivated species and the availability of labor, which is 80% familiar in this case. Only 20% of the proprietaries hire employees.

Seedlings or seeds are attained as follows: 50% of producers reported making their own seedlings, while 40% purchase them from friends/neighbors, and only 10% of producers purchase them from an accredited nursery. The use of healthy and genetically uniform seedlings of good origin is one of the main requirements for the establishment of a crop. In fruit growing, seedling are of special importance, considering soil pathogens that can be transmitted and established in orchard areas, besides the sensitivity of rootstocks to pathogens. The production of seedlings should follow technical standards for their good development, such as using sandy substrates, avoiding areas subjected to flooding, isolation from the orchard, among other managements. These technique prevent contamination of the seedlings with phytopathogens, according to Fachinello et al. (2010).

Commercialization

The producer can expect a good and vast market to sell his production, from the beginning of production, when investments are made, and after the culture implanted until the end of production with maximum optimization and less expenses. Some producers sell fruits in more than one destination. As a result, it appears that six producers trade in open markets, four of them delivers the production to supermarkets, seven take the production to agro-industries, four have their own agro-industry, and five producers deliver their products to government projects, such as Conab (Companhia Nacional de Abastecimento) and PNAE (Programa Nacional de Alimentação Escolar). The main problem faced in the commercialization is the low price, which was mentioned by 40% of the interviewed producers (Figure 1). This can be attributed to the quality of the production. However, 35% of producers claimed to have no problems in marketing, which indicates the positive point for the region. According to Nascente & Rosa Neto (2005), Amazon has a great potential for fruit growing as wealthy water resources, climate, and soils suitable for fruit production throughout the year, besides the existence of native fruit trees with good possibilities for economic exploitation. Another opportunity to be considered is the potential of local consumption that depends on food imported from other centers for

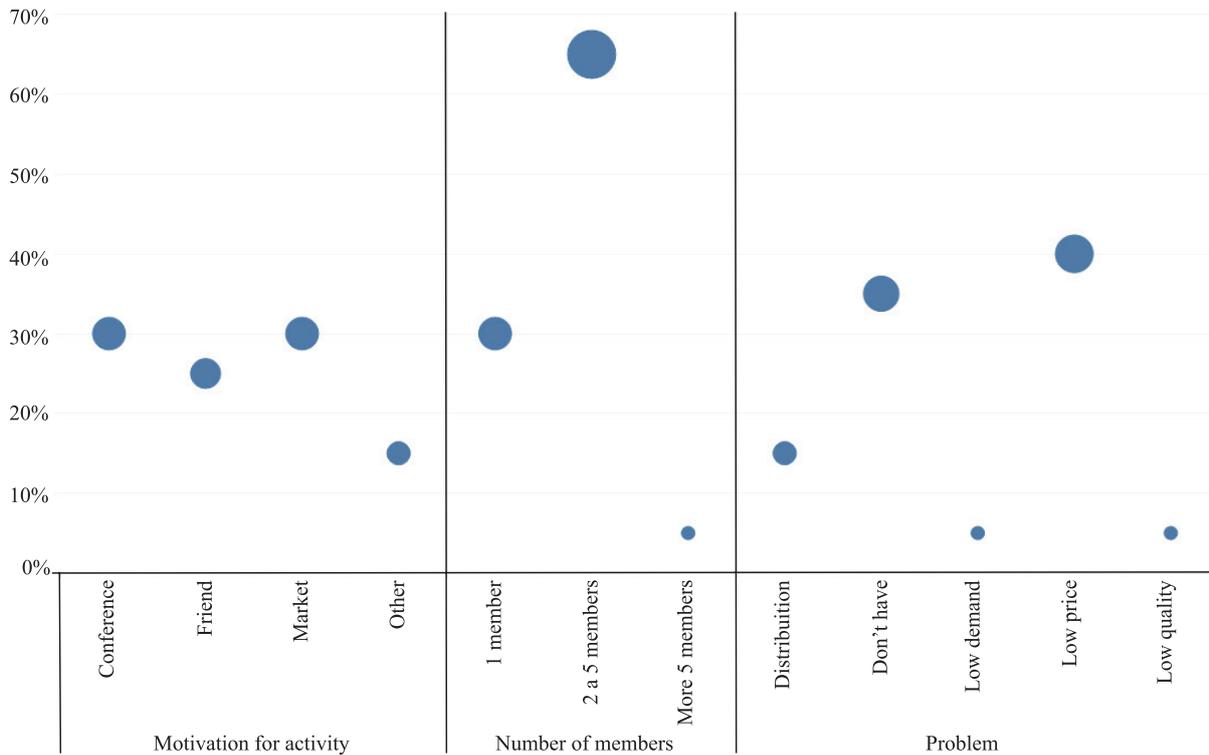


Figure 1. Socioeconomic diagnosis of fruit farming in Rolim de Moura, RO, Brazil.

the livelihood of the inhabitants. Fruit production can still generate jobs and income in the rural area, and generate food locally. However, Nascente & Rosa Neto (2005) points out that one of the threats to production is the critical transport that increases the loss of postharvest fruit, which can reach 50% of the production. In addition to the expensive land transportation, infrastructure is critical. These facts were evidenced in the present survey, in which 15% of producers claimed to have difficulties for the transporting of their production (Figure 1). Only 5% of the producers claimed that their main marketing problem was the low quality of the product, and 5% reported having few buyers.

Plant health

The occurrence of diseases that are difficult to control can cause loss of productivity and even the eradication of fruit crops. This is one of the main problems faced by fruit growers in the surveyed region. The weather to influence in the increased disease, mainly humidity and high temperature. Gasparotto et al. (2007) reports that in conditions of high humidity and temperature, progress is made in the development of black sigatoka (*Mycosphaerella fijiensis*), with wind being one of the largest spore dispersers of the pathogen. The table 2 contains the fruit and found relevant diseases.

Table 2. Fruit trees and the respective diseases found.

Host		Disease		Recommended control	Reference
Common name	Scientific name	Disease name	Pathogen		
Banana	<i>Musa</i> spp.	Black sigatoka and yellow sigatoka	<i>Mycosphaerella</i> spp.	Drainage, combating weeds, defoliation.	Kimati et al. (1997)
		Warts	<i>Sphaceloma fawcettii</i>	Avoid sprinkler irrigation, during flowering period and, when new leaves sprout, maintain pruning to promote air circulation	Melo & Andrade (2006)
		Melanosis	<i>Phomopsis citri</i>	Pruning of dry branches of the plants, and use of Bordeaux syrup, or cupric syrup, after pruning.	Melo & Andrade (2006)
Orange	<i>Citrus sinensis</i>	Citrus black spot	<i>Guignardia citricarpa</i>	Pruning and cleaning dry branches, cover of fallen leaves, windbreaks.	Fundecitrus (2003)
		Chlorosis	<i>Xylella fatidiosa</i>	There is no effective way.	Melo & Andrade (2006)
		Sadness	<i>Toxoptera citricida</i>	Control insect vector.	Melo & Andrade (2006)
		Witch's broom	<i>Moniliophthora (Crinipellis) pernicios</i>	Control with the use of essential oils of aromatic species <i>Ocimum selloi</i> and <i>Syzygium aromaticum</i> (L.) (clove). Green pepper basil, <i>Mentha arvensis</i> L. (corn mint)	Chaussê et al. (2011)
Watermelon	<i>Citrullus lanatus</i>	Cresting-gummy	<i>Mycosphaerella melonis</i> and <i>Didymella bryoniae</i>	Preventive applications of fungicides.	Santos et al. (2006)
Guava	<i>Psidium guajava</i>	Fumagine	<i>Capnodium citri</i>	–	–

We observed that 55% of producers use fungicides and bactericides to control the diseases. As for weeds, 17 producers use hoes (manually or mechanized), and 15 producers use pesticides for plant eradication and, in some cases, the producers use both control methods. For everyone who reported using pesticides in fruit production, the use of PPE by 12 producers stood out; however, three producers did not protect themselves with the equipment; the same data show the return of pesticide packaging in the appropriate collection places.

In the region of the forest zone of Rondônia, the presence of symptoms of Sigatoka-black and yellow (*Mycosphaerella* spp.) was observed in banana plantations (*Musa* spp.). Banana is a very commercialized fruit, not only in the region of Zona da Mata Rondônia, but throughout Brazil, and one of the main problems in its production is the attack of fungi responsible for Sigatoka-black and yellow, according to Matos (2012), who highlights that the shading between leaves of banana trees reduce the appearance of this disease; this author alerts that bacterial wilt also causes damage to crops. The presence of wilt in banana leaves was found in a property of a producer; this symptom shows either the presence of bacterial wilt, or the lack of essential nutrients for the plant. According to Matos (2012), bacterial wilt can cause economic damage to crops.

We also verified whether many producers of the forest zone in Rondônia desisted from cultivating passion fruit (*Passiflora* spp.) by observing many problems with diseases. According to Chrysostom & Naumoy (2009), this crop needs hot and humid weather, light, rainfall, high temperatures, and relative humidity around 60% for its successful development. Rondônia has these ideal climate conditions for the development of passion fruit, but these benefits also favor both pests and diseases that reduce the productivity. Therefore, many producers gave up their field and dedicated themselves only to dairy farming and other sources of income, something that is constantly practiced by producers in the region, since, if they have a very small territorial area, they do not adopt livestock.

Acerola (*Malpighia* sp.) is a popular plant in the Rolim de Moura region. According to the producers, the production of the crop is easy to manage. However, there were plants with symptoms of fungal diseases, such as anthracnose and target spot, which can reduce production. According to Petinari & Tarsitano (2002), the consortium of acerola in the first three years with other short-cycle crops can reduce expenses with the implantation of the crop.

In addition, there was also the occurrence of diseases in oranges (*Citrus sinensis*). Orange is susceptible to various diseases, such as melanose (*Phomopsis citri*), scab (*Sphaceloma fawcettii*), citrus black spot (*Guignardia citricarpa*), citrus variegated chlorosis (*Xylella fastidiosa*), citrus tristeza (*Citrus tristeza virus*), among others. In the present research, the presence of symptoms such as yellowing, leaf spots, shrinking and mummification were observed. All these diseases reduce the process of photosynthesis that is responsible for the production of carbohydrates. However, it is also stressed that the lack of nitrogen is linked to the yellowing of the leaves, as this nutrient is essential in the structure of chlorophyll.

Symptoms of witches' broom (*Moliniophthora pernicioso*) were detected in cupuaçu plants (*Theobroma grandiflorum*) in the region of Rolim de Moura. This fruit is found in forests in the Amazon region and grows well in shaded areas. It is sought for its typical flavor, and its pulp is used in the food and cosmetics industries (Garcia et al., 2014). Cupuaçu pulp can be used in the manufacture of ice cream with low lactose content, and it is a new alternative for consumers who are intolerant of this sugar, according to Ambrósio-Ugri & Akashi (2013).

Producers also invested in the culture of papaya (*Carica papaya*). In plants in the region, the presence of leaf spots on plants and perforation of leaf tissues were characterized. These symptoms cause economic losses in the production.

Another important crop in the Zona da Mata region of Rondônia is pineapple (*Ananas comosus*). During visits to pineapple producers in the region, plants with different symptoms were found, such as chlorosis (yellowing may characterize the lack of nutrients necessary for the good development of the plant), and the plants undergone the competition of weeds for space and nutrients. In 2014, the North region had 29.6% share of the total planted area in Brazil (IBGE, 2014). According to Matos (2012), pineapple has its origin in the Amazon, and it was domesticated and now commercialized throughout Brazil. Still according to this author, the plant is subject to many diseases, such as fusariosis (*Fusarium guttiforme*), heart rot (*Phytophthora nicotianae*), black rot (*Chalara paradoxa*), and solar burns due to excess exposure parts of the fruit to sun rays.

Watermelon (*Citrullus lanatus*) is another fruit widely traded in the Zona da Mata region of Rondônia. In the region, watermelon plants showed symptoms of gummy blight in apparent leaves, which is caused by ascomycete fungi, such as *Mycosphaerella melonis* and *Didymella bryoniae*. An important measure of control of the disease blight-gummy (*Didymella bryoniae*) is the chemical and genetic control with the use of cultivars resistant to this fungus, according to Santos et al. (2011).

In addition, pests can open holes for fungi and bacteria to enter plants. The infestation of guava leaf (*Psidium guajava*) by fumagine was observed and attributed to the attack of scale insects (*Ceroplastes* spp.); this insect sucks up the sap of the plant and releases sugary excretions, favoring the appearance of fumagine. The presence of the mealybug is verified by the appearance of crusts at the edges of the leaves (Fachinello et al., 2010).

CONCLUSIONS

Family fruit farming in the municipality of Rolim de Moura, RO, Brazil, has many advances to be achieved. The lack of technological resources favors a delay in the fruit production. Due to the wide occurrence of diseases in all crops, mainly in passion fruit plantations, led some producer to abandonment them. Thus, only 25% of farmers live on fruit production alone. In addition, most producers use pesticides to control diseases and weeds. However, it is possible to observe some government programs, such as CONAB and PNAE, which encourage the production and marketing of fruits by smallholder.

Therefore, it is necessary to carry out studies that guide the progress of fruit farming with regard to fruit exports in the state of Rondônia, seeking solutions for the improvement of the production, such as incentives for producers with regard to phytosanitary management, and bring them to the state technologies that favor the cultivation of larger areas of production, thus bringing to the producer new market perspectives.

REFERENCES

- ABDO, M.T.V.N.; VALERI, S.V.; MARTINS, A.L.M. Sistemas agroflorestais e agricultura familiar: uma parceria interessante. **Revista Tecnologia & Inovação Agropecuária**, v.1, p.50-59, 2008.
- ACOMPANHAMENTO DA SAFRA BRASILEIRA [DE] CAFÉ: safra 2016: quarto levantamento, v.3, n.4, dez. 2016.
- ALVARES, C.A.; STAPE, J.L.; SENTELHAS, P.C.; GONÇALVES, J.L. de M.; SPAROVEK, G. Köppen's climate classification map for Brazil. **Meteorologische Zeitschrift**, v.22, p.711-728, 2013. DOI: <https://doi.org/10.1127/0941-2948/2013/0507>.
- ALVES, E.; SOUZA, G. da S. e; MARRA, R. Êxodo e sua contribuição à urbanização de 1950 a 2010. **Revista de Política Agrícola**, ano20, p.80-88, 2011.
- AMBRÓSIO-UGRI, M.C.B.; AKASHI, M.S. Aceitação sensorial de sorvete de cupuaçu com baixo teor de lactose. **Revista Tecnológica**, v.22, p.53-60, 2013. DOI: <https://doi.org/10.4025/revtecnol.v22i1.10612>.
- ANUÁRIO BRASILEIRO DA FRUTICULTURA 2014. Santa Cruz do Sul: Gazeta Santa Cruz, [2013]. 104p.
- CHAUSSÉ, T.C.C.; DIAS, D.B.S.; SILVA, S.D.V.M.; COSTA, J. de C. do B.; COSTA, L.C. do B. Atividade antifúngica de óleos essenciais sobre a vassoura de bruxa do cacauero. **Revista Brasileira de Biociências**, v.9, p.492-496, 2011.
- CRISÓSTOMO, L.A.; NAUMOY, A. (Org.). **Adubando para alta produtividade e qualidade: fruteiras tropicais do Brasil**. Tradução de Lindbergue Araújo Crisóstomo. Fortaleza: Embrapa Agroindústria Tropical; Horgen: Instituto Internacional de Potassa, 2009. 238p. (IIP. Boletim, 18).
- EMATER-RO. Associação de Assistência Técnica e Extensão Rural do Estado de Rondônia. **Relatório de Atividades 2009**. Porto Velho: Emater-RO, 2010. 54p.
- EMATER-RO. Associação de Assistência Técnica e Extensão Rural do Estado de Rondônia. **Relatório de Atividades**: Emater/2014. Porto Velho: Emater-RO, 2015.
- FACHINELLO, J.C.; NACHTIGAL, J.C.; KERSTEN, E. **Fruticultura: fundamentos e práticas**. Pelotas: Embrapa Clima Temperado, 2010.

- FIGUEIREDO, S.C. de. Importância do nível de escolaridade para os agricultores na gestão da propriedade rural. In: CONGRESSO INTERNACIONAL DE EDUCAÇÃO E INCLUSÃO, 2014, Campina Grande. [Anais]. Campina Grande: [s.n.], 2014. CINTEDI 2014.
- FONSECA, W.L.; FONSECA, W.J.L.; OLIVEIRA, A.M. de.; VOGADO, G.M.S.; SOUSA, G.G.T.; SOUSA, T. de O.; SOUSA JÚNIOR, S.C. de.; LUZ, C.S.M. Causas e consequências do êxodo rural no Nordeste brasileiro. *Nucleus*, v.12, p.233-239, 2015. DOI: <https://doi.org/10.3738/1982.2278.1422>.
- GARCIA, T.B.; POTIGUARA, R.C. de V.; KIKUCHI, T.Y.S.; DEMARCO, D.; AGUIAR-DIAS, A.C.A. de. Leaf anatomical features of three *Theobroma* species (Malvaceae s.l.) native to the Brazilian Amazon. *Acta Amazonica*, v.44, p.291-300, 2014. DOI: <https://doi.org/10.1590/1809-4392201300653>.
- GASPAROTTO, L.; PEREIRA, J.C.R.; HANADA, R.E. Situação atual da sigatoka-negra no Brasil. In: POLTRONIERI, L.S.; VERZIGNASSI, J.R. (Ed.). **Fitossanidade na Amazônia: inovações tecnológicas**. Belém: Embrapa Amazônia Oriental, 2007. p.37-51.
- GENEROSO, E.C.S.; KONRAD, M.; HERNANDEZ, F.B.T.; PAPA, M.F.S. Ocorrência de fungos patogênicos na aceroleira irrigada, no município de Junqueirópolis, SP. In: CONGRESSO BRASILEIRO DE ENGENHARIA AGRÍCOLA, 31., 2002, Salvador. **A engenharia agrícola para o desenvolvimento sustentável: água, energia e meio ambiente: anais**. Salvador: SBEA, 2002. CONBEA 2002.
- GONÇALVES, A.C.S.; ROMA JÚNIOR, L.C.R.; FONSECA, M.I.; NADRUZ, B.V.; BÜRGER, K.P.; ROSSI, G.A.M. Assistência técnica e extensão rural: sua importância para a melhoria da produção leiteira. Relato de caso. *Revista Brasileira de Higiene e Sanidade Animal*, v.8, p.47-61, 2014. DOI: <https://doi.org/10.5935/1981-2965.20140116>.
- IBGE. Instituto Brasileiro de Geografia e Estatística. **Distribuição das pessoas de 25 anos ou mais de idade, por nível de instrução – Brasil – 2000/2010**. 2010. Disponível em: <<http://www.ibge.gov.br/home/presidencia/noticias/imprensa/ppts/00000011363712202012375418902674.pdf>>. Acesso em: 10 jan. 2016.
- IBGE. Instituto Brasileiro de Geografia e Estatística. **Indicadores IBGE: estatística da produção pecuária: jan.-mar. 2015**. 2015. Disponível em: <https://biblioteca.ibge.gov.br/visualizacao/periodicos/2380/epp_2015_1tri.pdf>. Acesso em: 31 ago. 2015.
- IBGE. Instituto Brasileiro de Geografia e Estatística. **Produção Agrícola Municipal**. 2014. Disponível em: <<https://www.ibge.gov.br/estatisticas/economicas/agricultura-e-pecuaria/9117-producao-agricola-municipal-culturas-temporarias-e-permanentes.html?=&t=downloads>>. Acesso em: 20 out. 2020.
- JARDIM, I.C.S.F.; ANDRADE, J. de A.; QUEIROZ, S.C. do N. Resíduos de agrotóxicos em alimentos: uma preocupação ambiental global: um enfoque às maçãs. *Química Nova*, v.32, p.996-1012, 2009. DOI: <https://doi.org/10.1590/S0100-40422009000400031>.
- KIMATI, H.; AMORIM, L.; BERGAMIN FILHO, A.; CAMARGO, L.E.A.; REZENDE, J.A.M. (Ed.). **Manual de Fitopatologia: doenças das plantas cultivadas**. São Paulo: Agronômica CERES, 1997. v.2.
- LEVANTAMENTO SISTEMÁTICO DA PRODUÇÃO AGRÍCOLA. Rio de Janeiro: IBGE, v.29, jan. 2015.
- MATOS, A.P. de. (Ed.). **Produção integrada de fruteiras tropicais**. Cruz das Almas: Embrapa Mandioca e Fruticultura, 2012.
- MELO, M.B. de; ANDRADE, L.N.T. Principais doenças da citricultura em Sergipe e seu controle. In: MELO, M.B. de; SILVA, L.M.S. da. (Ed.). **Aspectos técnicos dos citros em Sergipe**. Aracaju: Embrapa Tabuleiros Costeiros, 2006.
- MENDONÇA, J.F.B. (Ed.). **Solo: substrato da vida**. Brasília: Embrapa Recursos Genéticos e Biotecnologia, 2006.153p.
- NASCENTE, A.S.; ROSA NETO, C. **O agronegócio da fruticultura na Amazônia: um estudo exploratório**. Porto Velho: Embrapa Rondônia, 2005. (Embrapa Rondônia. Documentos, 96).
- NUNES, G.S.; RIBEIRO, M.L. Pesticidas: uso, legislação e controle. **Pesticidas: Revista de Ecotoxicologia e Meio Ambiente**, v.9, p.31-44, 1999. DOI: <https://doi.org/10.5380/pes.v9i0.39601>.
- PETINARI, R.A.; TARSITANO, M.A.A. Análise econômica da produção de acerola para mesa, em Jales-SP: um estudo de caso. **Revista Brasileira de Fruticultura**, v.24, p.411-415, 2002. DOI: <https://doi.org/10.1590/S0100-29452002000200026>.
- PETINARI, R.A.; TERESO, M.J.A.; BERGAMASCO, S.M.P.P. A importância da fruticultura para os agricultores familiares da região de Jales-SP. **Revista Brasileira de Fruticultura**, v.30, p.356-360, 2008. DOI: <https://doi.org/10.1590/S0100-29452008000200015>.
- RONDÔNIA. Lei Complementar nº 414, de 28 de dezembro de 2007. Estabelece as Regiões de Planejamento e Gestão para o Estado de Rondônia e dá outras providências. **Diário Oficial [do] Estado de Rondônia**, 3 jan. 2008.
- RONDÔNIA. Secretaria de Estado do Desenvolvimento Ambiental. **Boletim Climatológico de Rondônia – 2010**. Porto Velho: Coge, Sedam, 2012.
- SALVADOR, J.O.; MOREIRA, A.; MALAVOLTA, E.; CABRAL, C.P. Influência do alumínio no crescimento e na acumulação de nutrientes em mudas de goiabeira. **Revista Brasileira de Ciência do Solo**, v.24, p.787-796, 2000. DOI: <https://doi.org/10.1590/S0100-06832000000400011>.
- SANTOS, G.R. dos; LEÃO, E.U.; CASTRO, H.G. de.; NASCIMENTO I.R. do; SARMENTO, R. de A.; SARMENTO-BRUM, R.B.C. Crestamento gomoso do caule da melancia: Etiologia, epidemiologia e medidas de controle. **Journal of Biotechnology and Biodiversity**, v.2, p.52-58, 2011. DOI: <https://doi.org/10.20873/jbb.uft.cemaf.v2n2.rodriuessantos>.

SANTOS, G.R.; CAFÉ-FILHO, A.C.; REIS, A. Resistência de *Didymella bryoniae* a fungicidas no Brasil. **Fitopatologia Brasileira**, v.31, p.476-482, 2006. DOI: <https://doi.org/10.1590/S0100-41582006000500007>.

SILVA JUNIOR, G.J. da. **Pinta preta**: medidas essenciais de controle. Araraquara: Fundecitrus, 2016.

SOARES, W.L. **Uso dos agrotóxicos e seus impactos à saúde e ao ambiente**: uma avaliação integrada entre a economia, a saúde pública, a ecologia e a agricultura. 2010. 150p. Tese (Doutorado) – Escola Nacional de Saúde pública Sergio Arouca, Fundação Oswaldo Cruz, Rio de Janeiro.

TAVELLA, L.B.; SILVA, I.N.; FONTES, L. de O.; DIAS, J.R.M.; SILVA, M.I. de L. O uso de agrotóxicos na agricultura e suas consequências toxicológicas e ambientais. **Agropecuária Científica no Semi-Árido**, v.7, p.6-12, 2011.
