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Characteristics of organic citriculture in Brazil

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Abstract
This study aimed to discuss the main aspects of production, management and marketing adopted by organic growers in the Brazilian citriculture. Therefore, a literature review on this subject and a qualitative research using interviews with certifiers, governmental institutions, farmers, cooperatives and grower associations were carried out. The organic citriculture is characterized by small growers who produce a variety of fruits and vegetables. The productivity of organic citrus is a little smaller than the conventional citrus. The main difficulties in production were the control of pests and diseases, followed by qualified labour, marketing and costs. The most successful organic citrus growers are those who use a lower density of citrus trees, a larger amount of soil covering per area and have a greater diversity of plants.

Key words: *certification, citriculture, sustainability agriculture, organic citrus, agricultural systems.*

1. Introduction

Brazil is the world's largest producer and exporter of orange [*Citrus sinensis (L.)* Osbeck] juice, the main product of the citrus chain. The orange production in the country was of 16.3 million tons in 2013/14 occupying an area of 717 thousand hectares (Ministério da Agricultura, Pecuária e Abastecimento, 2014). The Brazilian citriculture is based on an intensive production system, and it is dependent on the use of agrochemicals and synthetic fertilizers (Turra, 2013; Neves et al., 2010). The sector has significant numbers that reflect the importance of this economic and social activity in the country. The GDP of the citrus sector was US$ 6.5 billion, while the total revenue of the production chain was US$ 14.6 billion, and it was responsible for more than 200,000 direct and indirect jobs (Neves et al., 2010).
Currently, the productive sector has faced significant obstacles in the citrus production, like the increase of phytosanitary costs due to a higher incidence of the HLB (Huanglongbing or greening) disease; the cost and the lack of qualified labor; and increase of opportunity costs regarding other crops (Centro de Estudos Avançados em Economia Aplicada, 2012). Alternatives for the citrus growers to continue their activity are necessary.
Certification has been an option for producers who seek quality assurance of the production process and who want to get better remuneration for their product. The certificate is issued by independent accredited organizations. The main certifications applicable in the citriculture in Brazil are organic, socio-environmental and good

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agricultural practices (Turra et al., 2014).
Organic agriculture is an option for the conventional agriculture as it offers, at first, healthier food. It is based on the minimal use of off-farm inputs and on management practices that restore, maintain, and enhance ecological harmony, envisioning sustainability; despite the avoidance of using external inputs, growers need to use them in order to obtain a better production.
The organic growers must have a holistic view of the property, seeking the integration of crops, livestock and human beings. This system production aims at optimizing the quality of all the aspects of the agriculture and the environment. This management permits to reduce external inputs by avoiding the use of chemo-synthetic fertilizers, pesticides, and pharmaceuticals (International Foundation for Organic Agriculture, 2005). Other advantages are the conservation of natural resources and the reduction of environmental impacts per unit of area, which have been explored by several meta-analysis worldwide (Mondelaers, Aertsens, & Van Huylenbroek, 2009).
Organic agriculture occupies an approximate area of 43 million hectares (nearly 1% of the agricultural area in the world) in 170 countries (Willer & Klicher, 2015). The countries with the largest organic areas are Australia (17 million hectares), Argentina (3.2 million hectares), United States (2.2 million hectares), China (2.1 million hectares), Spain (1.6 million hectares) and Italy (1.3 million hectares). Two million growers were reported, more than three quarters are in developing countries (Willer & Klicher, 2015). The global sales of organic food and drink reached US$ 84 billion in 2014 (Marketline, 2015).
Brazil is one of the world`s most important producers of organic products. This country has an area of 0.7 million certified hectares (Willer & Klicher, 2015), which corresponds to less than 0.4% of its agricultural land area. The country has 12,700 organic producers registered in the Ministry of Agriculture, Livestock and Supply (Ministério da Agricultura, Pecuária e Abastecimento, 2016).
Organic citrus farming covers a surface of 60,709 ha worldwide (International Foundation for Organic Agriculture, 2012), being Italy has a largest area with 28,800 ha (including area in conversion) (Sistema d`informazione nazionale sull`agricoltura biológica, 2013).
The organic citrus can be a viable option for Brazilian growers cause, despite demanding more manpower, it offers a better price when compared to conventional citrus (Turra & Guisi, 2003). However, there are few studies about organic citriculture. This study aims to characterize the organic certification in Brazilian citriculture, mainly the management practices used by growers.

2. Methods

A literature review of the subject and a quali-quantitative research were carried out. The interviews involved a research using open methods, e-mails, telephone and sometimes face-to-face interactions with accreditation bodies (Institute of Metrology, Standardization and Industrial Quality - INMETRO), certifiers, governmental institutions (Embrapa Fruticultura; Ministério da Agricultura, Pecuária e Abastecimento – MAPA), farmers, cooperatives and grower associations. Most of the certifiers provide the total certified project and the crops, but do not provide data on the certified area for each crop.

The instrument used for the survey was a questionnaire, designed from the theoretical sources discussed along this work, with questions about location, citrus area, production, pests and diseases, marketing, production costs and profitability. According to data of certifiers about 400 organic citrus growers were contacted by e-mail. The research tallied up to 36 citrus growers interviewed. Two of them do not have more citrus anymore due to huanglongbing or greening disease. It was difficult to get full questionnaires of organic citrus growers.

Qualitative methods produce contextual explanations for a small number of cases, with an emphasis on the significance of the phenomenon (Nogueira-Martins & Bógus, 2004). This research method focuses on ensuring objectivity, possibility of generalization and reliability (Steckler et al., 1992).

3. Results and Discussion

The farms location were at the central and southeast regions of the state of São Paulo and north area of the state of Paraná. The area range was some meters to 120 ha with average of 8 ± 18 ha. Turra et al. (2014) estimated an area of 2500 ± 700 ha with certified organic citrus in Brazil, considering that about 95% of the growers` areas range from few square meters to 10 ha.

In this research irrigation is present at 28% of the surveyed properties. Most of the interviewed (95%) are small producers who produce a variety of fruits and vegetables.

Most of organic citrus production (60%) is aimed for industrial processing. The orange sweet [*Citrus sinensis (L.)* Osbeck] juice is the main organic citrus juice produced in Brazil; however, there are other options for the consumer, such as the acid lime (*Citrus latifolia* T.) juice, produced in the state of São Paulo, and the tangerine (*Citrus reticulata* Blanco) juice, produced in the states of Rio Grande do Sul and São Paulo.

According to Table 1 most of organic citrus growers cultivated are sweet orange [*Citrus sinensis* (L.) Osbeck]. Some of them have more than one citrus variety. The plants more old are Tangerine (*Citrus reticulata* Blanco) variety.

Table 1. Varieties of citrus, number of properties, plants age and productivity.

Variety	Number of properties	Plants age (average per plant)	Productivity (average per plant)
Sweet orange [*Citrus sinensis* (L.) Osbeck]	25	5 ± 4 years old	1,7 ± 0,5*
Acid lime (*Citrus latifolia* T.)	9	4 ± 4 years old	2,2 ± 0,6**
Tangerine (*Citrus reticulata* Blanco)	10	7 ± 6 years old	3,1 ± 0,8**

* Box of 40.8 kg ** Box of 25 kg

Considering the productivity (six proprierties – three conventional and three organic) with aged plants of 8 - 12 years, the organic citrus trees [*Citrus sinensis* (L.) *Osbeck*] showed a production about 15% lower than conventional citrus trees (1.5 to 2.3 boxes of 40.8 kg per plant).

3.1 Organic Citriculture Management

Organic citrus growers that were interviewed considered the main difficulties in production the control of pests and diseases (54%), followed by qualified labour (35%), marketing (27%) and costs (16%).

In recent years, the number of pests and diseases has increased on citriculture and controlling them has become increasingly difficult. In Brazilian citriculture, an important pest can attack organic and conventional citriculture; *Helicoverpa armigera,* a caterpillar which has caused major damage in several crops in Brazil (Fundo de Defesa da Citricultura, 2014).

Currently, the disease that has caused more losses in the citrus growers is the greening or huanglongbing (HLB). To control it, lime sulphur or neem oil are commonly used in organic citriculture. There is a smaller number of input options to control pests and diseases in organic farming when compared to the conventional one. Sulphur, copper oxychloride and lime sulphur are some agricultural supplies used in organic fruticulture in Brazil (Turra, Fernandes, Bacchi, & Kato, 2013). The ecological solutions include the restoration of the ecological balance of the agricultural ecosystem.

Integrated Pest and Disease Management (IPDM) is the most common approach used by growers. It is based on production using healthy plants from the beginning of the plantation, which may reduce the dependence on external inputs. In this management approach it is important to understand the causes and not only the effects (pests and diseases). The increased biodiversity of the citrus ecosystem must be part of IPDM. The high degree of biodiversity creates the habitat for natural enemies of pests (Kilche, 2005).

The second factor that hinders the production of organic citrus is qualified labour. According to OCED/FAO (2015), the labour productivity in the agricultural sector is low compared to the rest of the Brazilian economy. The labour productivity gap in Brazilian agriculture is declining, with rapid improvements in labour productivity driven mainly by more capital-intensive production. According to Centro de Estudos Avançados em Economia Aplicada (2015) the labour represents about 27% of total operating costs for producing conventional citrus to industry.

In relation to marketing, 24% of interviewees had difficult to sell their product. An alternative to facilitate the commercialization are cooperatives. About 55% of organic citrus growers sell their production through a cooperative. Ecocitrus cooperative in Montenegro, state of Rio Grande do Sul, is a good example. The cooperative is currently representing 42 families and working in partnership with more than 150 other families. The purpose of this cooperative is to promote local and organic farming with the active participation of small producers. The cooperative seeks to stabilize its revenue base and protect its environment by diversifying its crops. It therefore sells various citrus fruits such as oranges, tangerines or lemons (Alter Eco, 2013). They develop the raw products to produce packaged juices which are sold across Brazil.

The main production costs are related the labour and the control of pests and diseases.

In this study, all the properties have legal reserve areas outside the Legal Amazon area. Legal reserve area is a mandatory practice on Brazilian private lands with recognized importance for biodiversity conservation. A private property needs to distribute 20% of it's total area for legal reserve and, those properties located in the Legal Amazon forest needs to distribute 80%, in wich percent the Permanent Preservation Areas can be

included. Furthermore, the private properties located in the Cerrado area must distribute 35% of it's lands to the politic programme (Zakia & Pinto, 2014).
About 86% of interviewees said that having a cost control program. This is very important for good administration.
Organic citrus growers with larger areas try to maintain the same density as the one in the conventional system. In this condition, citrus growers have a greater difficulty in controlling pests and diseases. High-density plantings reduce ventilation and light incidence, contributing to increasing the pest and the disease pressure (Kilche, 2005).
Most of Brazilian organic citrus growers (90%) use practices like the diversification and the crop rotation, the maintenance and incorporation of mulching, the use of composted animal manure, and the inputs of low toxicity. By incorporating the mulching, it is possible to increase humus concentration. This practice in organic farming has a significant climate benefit as it helps the carbon sequestration process (International Foundation for Organic Agriculture, 2010). The mulching also contributes to weed and ant controls.

Conclusions

The productivity of organic citrus is a little smaller than the conventional one. The largest part of the organic citrus production is aimed for the industrial processing.
The success of management in organic citrus farming is crucial for the ecossystem sustainability. The growers use, when necessary, inputs such as lime sulphur, copper oxycloride, sulphur, biofertilizer, extract or neem oil, among others, to control pests and diseases. Other practices used by growers include diversification and crop rotation, maintenance and incorporation of mulching, biofertilizers and composted animal manure, as well as the use of inputs of low toxicity, contributing to a more sustainable agriculture. The most successful organic citrus growers are those who use a lower density of citrus trees (100 to 200 plants per ha), a larger amount of soil covering per area and have a greater diversity of plants.

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