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PRUNING TIME IN TWO PRODUCTION SYSTEMS IN THE GUAVA TREE BACTERIAL BLIGHT CONTROL[1]

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ABSTRACT - In this work, two cultural production systems were compared [conventional (CO) and organic (OR)], and its effects in the guava trees (*Psidium guajava*) bacterial blight (*Erwinia psidii*) control. The experimental design was in radomized blocks, in split-split-plot arrangement, where it was measured the bacterial disease and the fruits production on the 2005/06, 2006/07 and 2007/08 harvests. Four pruning seasons effects were evaluated on the harvests (September, December, March and June) in both production systems. Such systems were constituted of: OR – treatment with bioactive compound (BC), liquid BC and dead coverage, and; CO – chemical fertilization, fungicide and herbicide. In 2007/08, the area under the disease progress curve (AUDPC) of all the treatments in the OR system was lower (~54-107) than the CO one(~233-298). In the 2007/08 harvest the number of fruits for each plant for all the OR treatments was higher (~146-204) than the CO ones (~57-103). In all the harvests, considering all the treatments within each system, there was a significantly lower AUDPC (~93-184) and higher fruits production (~158-188) in the OR one than the CO one (AUDPC: ~208-476; fruits ~18-104). The pruning induced a higher AUDPC and lower fruits production in both production sytems.
Index terms: *Erwinia psidii*, *Psidium guajava*, pruning time.

ÉPOCAS DA PODA EM DOIS SISTEMAS DE PRODUÇÃO NO CONTROLE DA SECA BACTERIANA DA GOIABEIRA

RESUMO - Foram comparados dois sistemas de produção cultural (orgânico = OR; convencional = CO) e seus efeitos no controle da seca dos ponteiros (*Erwinia psidii*) da goiabeira (*Psidium guajava*). O delineamento experimental foi o de blocos casualizados, em arranjo de parcelas subsubdivididas, onde foram mensuradas a bacteriose e a produção de frutos nas safras de 2005/2006, 2006/2007 e 2007/2008. Nas safras, foram avaliados os efeitos das quatro épocas de poda (setembro, dezembro, março e junho) em ambos os sistemas de produção. Tais sistemas constituíram-se de: OR - tratamentos com composto bioativo (CB), CB líquido e cobertura morta; e CO - adubação química, fungicida e herbicida. Em 2007/2008, a Área Abaixo da Curva de Progresso da Doença (AACPD) de todos os tratamentos no sistema OR foi menor (~54-107) que em CO (~233-298). Na safra de 2007/2008 o número de frutos por planta para todos os tratamentos em OR foi maior (~146-204) do que aqueles em CO (~57-103). Em todas as safras, considerando todos os tratamentos dentro de cada sistema, houve significativamente menor AACPD (~93-184) e maior produção de frutos (~158-188) em OR do que em CO (AACPD: ~208-476; frutos: ~81-104). Poda induziu maior AACPD e menor produção de frutos em ambos os sistemas de produção.
Termos para indexação: *Erwinia psidii*; *Psidium guajava*; época de poda.

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INTRODUCTION

The guava tree´s (*Psidium guajava*) bacterial disease, also known as "bacterial blight" (*Ervinia psidii*) has been detected on eucalyptus (*Eucalyptus* spp.) in Argentina and Uruguay (COUTINHO et al., 2011) and in Brazil. This disease is one of the limiting factors to the guava production in the Southeast and Center-West regions of Brazil (MARQUES et al., 2007). A path to this disease control would be to follow some of Hoitink and Changa propositions, and to develop an organic sytem and to evaluate its effects in the disease control.

Traditionally, for the bacterial disease control, it is recommended to pulverize the guava orchard every 15 days with cupric fungicides like cooper oxychloride (REZENDE et al., 2008). However, these products applications may cause phytotoxicity on the leaves and on the fruits (PICCININ et al., 2005; MARTINS et al, 2012). The liquid bioactive compound may be applied over the soil or over the plant and it has nutritional properties for the plants and it reduces diseases (REZENDE et al., 2008). Other techniques like aeration pruning, may contribute with the reduction of diseases on guava tree (IDE; MARTELLETO, 2008; MARTINS et al, 2012). The pruning may be done during dewless periods or with free water over the plants, on sick guava trees it is recommended the removal of smitten fruits or branches (FISHER et al., 2011).In areas with the bacterial disease, constant prunings on the same plant must be avoided, specially those which will induce new blooms during the humid and high temperature periods (FISHER et al., 2011).

The organic matter management in the agroecosystem is a fundamental strategy on the biodiversity conservation, establishing a healthy and mutual relation of the soil, plant and eviroment system. This way, the soil organic matter has a direct correlation with the soil cationic exchange capacity. Consequently the green fertilization use, dead coverage or vegetal, organic fertilization by composting and liquid fertilization or with bioactive compounds; may be one of the instruments to recover the soil and leaf surface biodiversity vitality (HALFELD-VIEIRA et al., 2008; 2015; TOMITA 2010; PANE et al., 2012; REZENDE et al, 2008).

The studies about the interactions between the biological control agents with the microbiological community of the enviroment are very complex, just like the quality and quantity effects of managed compounds on the soil., (HOITINK; CHANGA, 2004) and on the leaf surface (HALFELD-VIEIRA et al., 2008; 2015), these may also be the plants vitality elements of success on field conditions.

Therefore, this work´s objective was to evaluate the bacterial disease control and yield on guava tree exposed to different pruning seasons in organic and conventional system.

MATERIAL AND METHODS

The work was conducted in a farm located in the administrative region of Brazlândia, Federal District, in the "Núcleo Rural Alexandre Gusmão", INCRA-06, where there were established several bacterial focuses in the guava orchards of family producers. The experiment was conducted in a 80.000m^2 area of a guava tree orchard cultivated by a 6 year-old Pedro Sato with a 2.5x6.0m spacing, in a red-yellow latosols. Two organic and conventional production systems were established, its sequence of activities followed a production protocol (Table 1).

The preparation of organic matter and compounds used in the experiment area were adaptations of the compounds production methods reported by Tomita (2010) for the guava trees disease control which presented the following compositions: bioactive compound - soil 1000 kg, forest soil 250 kg, compound 250 kg, rice bran 200 kg, castor bean bran 50 kg, bone flour 100 kg, fish residues 250 kg, ashes 50 kg, molasses 10 kg and water 45% (v/v) – liquid bioactive compound for 1000 L: 25 kg forest land, 25 kg compound, 20 kg rice bran, 5 kg castor bean bran, 10 kg bone flour, 25 kg fish residues, 25 kg ashes, 10 kg molasses, 5 kg starch, 5 kg cornmeal and 800 L of water. The methods and raw materials used for the composting followed the natural agriculture concepts and practices, based on the Rules of Natural Agriculture from "Brazil´s International MOA (Mokiti Okada Association)" (TOMITA, 2010).

During the different seasons of the year, two production systems were analyzed: organic and conventional, composed with four cultural managements ways, related to the soil, with fertilization management (FM); the aerial part of the plant, with the diseases control (MD); in the root interface and the aerial part of the plant, represented by the herbs control (ME) and its complex influence (MADE), relating all the managements in only one event, the soil management, with fertilization; the disease control of the aerial part, and the weed control, which match the cultural management of each agricultural production system.

Conventional production system – In this production system were applied 800 g plant^{-1} of chemical fertilizer (NPK - 04-14-08), on the 30, 75 and 120 days, distributed homogeneously in the cup projection, making up a total of 2.4 kg plant^{-1} harvest^{-1} (Table 1). The diseases control of the guava tree aerial part was carried as conventional production protocol (FISHER et al., 2011; GOES et al., 2004; IDE; MARTELLETO, 2008), applying alternately different organic and cupric defensives. The herbicides use was incorporated to the conventional production system, where every 60 days there were systemic post-emerging (glyphosate, 2 L ha^{-1}) and of contact (paraquat dichloride, 2 L ha^{-1}) herbicide application over the spontaneous plants and weeds.

Organic production system – In this system the management in the guava culture was held with the use of bioactive compound (BC), applying 10 kg plant^{-1}; distributed homogeneously under the guava tree cup projection. Its reapplication was held on the 30, 75 and 120 pruning days, making up a total of 30 kg of BC plant^{-1} harvest^{-1}. In this same organic system of production, closely with the BC application to the soil, it was applied the liquid form to the aerial part, with the goal to control the guava tree bacterial disease with the biological diversity on the leaf surface and on the blooms. It was applied 800 ml of syrup (1 L of BC / 50 L of water) plant^{-1}, with biweekly reapplications. The invaders control was held through hoeing and application of dead grass coverage, distributed in a thickness of 20 cm, under the cup covering fully an area beyond its projection in a 2 m radius, approximately, from the guava tree trunk. The reapplications of dead coverage (BCD) were held as the herbicides reapplication, every 60 days, according to the production protocol established to the organic production system. The agriculture practices contained on the organic production system (Table 1) were based on the literature and practices employed by the producers in Brazilândia (Federal District).

For both production systems, biweekly, it was evaluated the bacterial disease incidence, and it was analyzed the pruning seasons efect: Spring/ September (SEP), Summer/December (DEC), Fall/ March (MAR) and Winter/June (JUN). During the bacrterial disease incidence evaluation, it was quantified the bloom damages (60 samples) after the pruning, on the flowers (120 samples), on the “little lead” like fruits (120 samples), fruits with less than 30 mm (120 samples), and on the number of fruits bigger than 200 g (North, East, West and South quadrants of the plant - NEWS), characterized as produced commercials fruits.

In the three harvests (2005/06; 2006/07; 2007/08) the experiment outlining was in randomized blocks with four repetitions, in an arrangement in subdivided portions (4x2x4), composed by pruning in four seasos of the year (Spring / Summer / Fall / Winter), two systems (organic and conventional) characterized by 4 cultivations within each system [conventional – Chemical fertilizers (CF), CF + Fungicide/bactericide (CFF); CF + Herbicides (CFH), CF + CFF + CFH (CFFH); organic – Bioactive compound (BC), BC + Liquid BC (LBC), BC + Dead Coverage (BCD); BC + LBC + BCD (BCLD)]. Each experimental unity was represented by a plant, where the surveys of the disease data were sampled in four positions (quadrants) of the plant on chest height (CH), divided in the North (N), East (E), West (W) and South (S) direction (NEWS), where it was collected the data of the bloom burn, from the flowers and fruits in a sequence biweekly after the pruning, determining the evolution of the disease during its phenological development (AUDPC). The results were collected during three harvests (2005/2006; 2006/2007 and 2007/2008) and the climatic data from these years are found on Table 4.. The obtained data from NEWS formed the values of the area under the disease progress curve (AUDPC), calculated as follows: AUDPC =((Y1+Y2)/2*15) + ((Y2+Y3)/2*15) + ((Y3+Y4)/2*15) + ((Y4+Y5)/2*15) + ((Y5+Y6)/2*15). The Yn values represent the average value obtained from NEWS, two symptoms of the bacterial disease every 15 days, which result in AUDPC. The AUDPC data were submmited to ANOVA and the averages compared by the Tukey test ($P \leq 0,05$).

RESULTS AND DISCUSSION

The use of aqueous extracts resulting from the aerobic fermentation of fish residues (TOMITA, 2010), of the different organic materials aerobic biodigestion or not, may be used for the control of a number of phytopathogenic agents, becoming a potential product used for the control os diseases caused by *Botrytis cinerea*, *Plasmopara viticola*, *Leveillula taurica*, *Sclerotinia sclerotiorum*, *Sclerotium rofsii*, *Rhizoctonia solani* and *Fusarium oxysporum* and others. Still, the bioactive liquid compound known as biological fertilizer may be applied over the soil or over the culture because it possesses nutritional properties for the plants and it reduces the disease incidence (DELEITO et al., 2005; TOMITA, 2010; REZENDE et al., 2008).

In the AUDPC individual analysis of each system (Table 2), the best results within the conventional system (CO) were CFFH for bloom (~193) and flowering (~327) and CFF for fruits (<30mm) (~382), where as the CFH management presented the highest AUDPC on the three phenological states, but it did not differ significanttly from the CF on the flowering and CFF on the fruits (<30mm), however it was significantly diffrent from the CFFH for flowering and fruits (<30mm). The differences between the best and worst result were of the order of 26% for bloom, 34% for flowering and 28% for fruits (<30mm). In the organic system (OR), the BCLD manegement was the one which presented the lowest AUDPCs for bloom (~70), for flowering (~88) and for fruits (<30mm) (~138) and, the least efficient treatment was the BC for the three phenological states with AUDPCs of ~96 for bloom, ~157 for flowering and ~112 for fruits (<30mm), not having any meaningful differences between the OR system treatments, but meaningful when in comparison with the CO system tratments. As for the number of fruits (Table 3), comparatively between the best (OR) and the worst (CO) result, the differences were of 42% for shooting, 47% for flowering and 41% for fruits (<30mm).

Rizzardi et al. (2003) observed that some herbicides influence the diseases severity, inducing or inhibitting the phytoalexin synthesis. Diphenylethers herbicides generate species oxygen reactives, which measured the defense genes activation responsible for the systhesis of phytoalexin and also for the hypersensitivity reaction. Still, these authors observe that the use of glyphosate in smaller doses cause contrary effects, reducing the production of phytoalexin and raising the diseases severity. The observation of these effects require the adoption of management strategies which minimize its negative impacts or which benefit these effects, as may occur when biological herbicides are used.

The herbicides effects in the diseases development usually result from the interactions of its direct effect on the pathogen and indirect effects in responses mediated by the plants (RIZZARDI et al., 2003). Suppression or the incidence and diseases severity raise by herbicides may occur directly through the only or combined effect on the pathogen, on the plant or on others microorganisms (ZILLI et al., 2008). The effect may also occur in an indirect way, affecting the diseases levels by the weed control, which eliminate alternative hosts and changes its own microclimate. These two effects were widely discussed by Rizzardi et al. (2003).

In the fruits production [State J (SALAZAR et al., 2006)], following the trend, the OR system was superior producing 88% more, considering the four managements within each system, on the three harvests studied, being significantly superior to the CO (Tables 3 and 5). Analyzing the harvests, the best was the 2005/2006 one which presented superior results over the others, probably due to favourable climatic factors (Table 4) to the production and unfavourable to the bacterial disease production. Comparatively between the best OR treatment which was BCLD and the worst CO tratment which was CFH the difference in the fruits production was 193% favourable to the BCLD on the average of the three harvests. Considering harvest by harvest, the 2005/2006 one was considered the best and the 2007/2008 one the worst, the approximate diferences between the best and worst management were of 163% and 255% respectively (Table 3). Between the cultivation systems, the OR one was more efficient producing on the three harvests average, 172 fruits against 93 from the CO, giving it an increase of 85% to the OR system (Table 3).

Comparing the systems, the OR one presented the best result in the carried evaluations. In AUDPC for bloom, the OR system obtained a value of 93 against 208 on the CO, in the flowering the result was 179 for OR and 476 in the CO. As for fruits (<30mm) the values were 184 for OR and 377 for the CO, which amount to a difference of 125% for bloom, 166% for flowering and 105% for fruits (<30 mm) in the incidence and disease severity on the CO system, being significantly the difference between the two systems (Table 2).

Rezende et al. (2008), studying different formulations of cooper fungicides, benzalkonium chloride and liquid bioactive compound for the pointers´drought control in guava trees, reported the phytotoxicity of the cooper in flowers and fruits buttons, causing small stains and depreciating the comercial product. The same authors verified the the use of liquid bioactive compound applied over the culture reduced the disease without causing phytotoxicity. The application of organic compounds have been an important tool in a number of cultures, raising its productivities. The use of organict residues has the purpose of replacing the agrotoxin, since its continued application cause healthy related problems, in addition to raise the culture´s cost.

In the three harvests studied, based on AUDPC, the June and September pruning were the ones that presented less diseases on bloom, flowering and fruits smaller than 30 mm, not only on the CO system but also on the OR one, possibly according to the climatic conditions incidents on the period (Tables 4 and 5). The December pruning, on the other hand, was the one that favoured the emergence of the disease on the three phenological states the most (Table 5). In relation to the number of fruits produced by pruning season, the sequence was March, June, September and December, March being the most productive and December the least one (Table 3). The OR system presented the best average result, producing 25% more fruits in the March pruning and 29% in the December one than the conventional (Table 3). Its reflexes were noted on the fruits formation (<30 mm), which presented the same trend, whereas the March and June pruning caused less disease rate. Pane et al. (2012) observed that the diseases intensity caused by *Phytophthora parasitica* and *Pyrenochaeta lycopersici* varied, and verified that the *P. parasitica* only occurred in the CO areas and the *P. lycopersici*, were not restricted to only one system, however the disease severity was smaller on OR. Such authors still correlate the non-occurrence of the *P. parasitica* and small *P. lycopersici* severity, in the OR due to the small N concentration in the tomato tissues by the capture of the N excess by the soil organic matter, whereas in the CO system occur a small relation.

The managements held with herbicides present a bigger disease incidence on the majority of different pruning seasons done on the three harvests, 2005/2006 to 2007/2008, its AUDPC averagens were , respectively, 185;302 and 298 (Table 2); and the smaller averages were verified on the OR system with a complete BCLD management, which reduced significantly the disease incidence, 56, 99 and 54, and the same trend were noted in the phenological development of the plant, always showing the best disease supressor in the different states of the plant´s growth (Tables 2 and 5). Descalzo et al. (1998), observed that the use of paraquat or glyphosate herbicide allowed, in a short period, the growth of the *Pythium ultimum* and *P. coloratum* populations into sunflower.

In the flowering stage (2005/2006), the incidence of bacterial disease under CFH management (346) was 29% bigger than BCLD (88), and this treatment differed significantly from all the managements held includind chemical fertilization, presenting a 271% difference in relation to the best CO system treatment, CFFH (327) (Tables 3 and 5). When analyzing the fruits symptoms (<30mm), the bioactive compound management was more efficient in the disease control, separating itself significantly from the chemical fertilizantion managements, and among those, the management held with the use of herbicide presented a bigger bacterial disease susceptibility (Tables 2 and 5).

The fruits production characterize the biggest answer from the OR production system in different pruning seasons and from the enviromental seasonality influence.In 2005/06, the bacterial disease provided the smallest productivity of the CFH and CF managements, with average productivity of 79 and 92 $plant^{-1}$ fruits. On the other hand, the BC management, produced 161 fruits and, with dead coverage (BCD) or BCLD, these presented productivity of 194 and 216 $plant^{-1}$ fruits (Table 3). The LBC, also known as biological fertilizer and liquid fertilizer may be applied over the soil or over the culture and it possesses nutritional properties for the plants and it reduces the disease incidence (DELEITO et al., 2005; TOMITA, 2010; REZENDE et al., 2008). Veberic et al. (2005) reported that apples produced in organic system presented a bigger concentration of phenols in the peel and in the pulp than those stemming from the integrated production system, with chemical fertilizers and agrochemicals. Such fact may be related to the lowest disease incidence in organic apples. Therefore, this justification, may be associated to the lowest bacterial disease incidence in organic guava presented in this study.

TABLE 1 -Organic (OR) and conventional systems of production protocol applied considering the guava tree phenological stage (*Psidium guajava*).

Period	Conventional Product / Activity	Organic Product / Activity
Flowering*, Soil/Sep	Dolomitic limestone, 3000 kg ha^{-1}; Agricultural plaster; Herbicida (glifosato), 2 L ha^{-1}; Fertilizer - 04-14-08;	Dolomitic limestone, 2000 kg ha^{-1}; Dead coverage, 10 cm; Thermophosphate Yoorim Master, 684 kg ha^{-1}; Wooden ash; Bioactive compound, 8000 kg ha^{-1}
Pruning	Blue Cupravit (copper oxychloridede) - 3 kg ha^{-1}	Liquid bioactive compound - Fish - 500 L ha^{-1}; Bouveril - 2 kg ha^{-1}
Flowering, F0	Lebaycid (fenthion) - 100 mL 100L^{-1}; Condor (bromuconazol) – 750 mL ha^{-1}; Blue Cupravit (copper oxychloridede) 3 kg ha^{-1}	Xantara – *Bacillus thuringiensis* - 2 L ha^{-1}; Liquid bioactive compound - Fish - 500 L ha^{-1}; Metarhill - 2 kg ha^{-1};
Flowering, F2F1	Manzate (mancozeb) -5 kg ha^{-1}; Danimen - 150 mL ha^{-1}; Dipterex (triclorfon) - 300 mL 100L^{-1}; Priori Extra (strobilulin + triazol) - 0,5 L ha^{-1}	Liquid bioactive compound - Fish -500 L ha^{-1}; Bometil – 2 kg ha^{-1}; Dipel – *Bacillus thuringiensis* - 2 L ha^{-1}
Soil	Urea; MicroNutri (Zn, B, Mn); Yoorim Master Thermophosphate 100 kg ha^{-1}; Potassium chloride - 100 kg ha^{-1};	Bioactive compound (CB) - 6000 kg ha^{-1}; Yoorim Master Thermophosphate - 100 kg ha^{-1}; Wooden ash + Borax - 5 kg ha^{-1};
Fruit setting, Ch1Ch0	Weed with Folicur (tebuconazole) grower - 75 mL 100L^{-1}; Alto100 (cyproconazol) - mL 100L^{-1}	Dead coverage - 10 cm; liquid BC - Fish - 500 L ha^{-1}; Metharhil - 2 kg ha^{-1}Dipel – *Bacillus thurigiensis* - 2 L ha^{-1}
Fruit setting, Ch3Ch2	Amistar (strobilulin) – 150 g ha^{-1}; Lebaycid (fenthion) - 100 mL 100L^{-1}; Danimen - 150 mL ha^{-1} Condor (bromuconazol) - 750 m L ha^{-1}	Liquid BC - Fish - 500 L ha^{-1}Metharhil - 2 kg ha^{-1} Dipel – *Bacillus thurigiensis* - 2 L ha^{-1}
Soil	Urea; MicroNutri (Zn, B, Mn); Yoorim Master Thermophosphate 100 kg ha^{-1}; Potassium chloride - 100 kg ha^{-1};	BC - 6000 kg ha^{-1}; Yoorim Master Thermophosphate - 100 kg ha^{-1}; Wooden ash + Borax - 5 kg ha^{-1}; Dead coverage - 10 cm
Fruits, Fr2Fr1	Alto100 (cyproconazol) – 20 mL 100L^{-1}; Amistar (strobilulin) - 150 g ha^{-1}; Cartap (Cartap hydrochloride) - 120 g 100L^{-1}	Liquid BC - Fish - 500 L ha^{-1}; Metharhil - 2 kg/ha; Dipel - *Bacillus thurigiensis* - 2 L ha^{-1}
Fruits, Fr4Fr3	Folicur (tebuconazole) - 75 mL 100L^{-1}; Danimen - 150 mL ha^{-1}; Premier + (imidacrop triadmenol) - 3 L ha^{-1}	Liquid BC - Fsih - 500 L ha^{-1}; Metharhil - 2 kg ha^{-1}; Dipel - *Bacillus thuringiensis* - 2 L ha^{-1}
Soil	Urea; MicroNutri (Zn, B, Mn); Yoorim Master Thermophosphate 100 kg ha^{-1}; Potassium chloride - 100 kg ha^{-1}	BC - 6000 kg ha^{-1}; Termofosfato Yoorim Master - 100 kg ha^{-1}; Wooden ash + Borax - 5 kg ha^{-1}; Dead coverage - 10 cm
Maturation, M2M1	Ato100 (ciproconazol) - 20 mL 100L^{-1}; Cartap (cartap hrdyochloride) - 120 g 100L^{-1}; Manzate (mancozeb) - 5 kg ha^{-1}; Actara - 100 g ha^{-1}	Liquid BC - Fish – 500 L ha^{-1}; Metharhil - 2 kg ha^{-1}; Dipel - *Bacillus thuringiensis* - 2 L ha^{-1}; Liquid bioactive compound - Fish - 500 L ha^{-1}
Maturation, M4M3	Danimen - 150 mL ha^{-1}; Manzate (mancozeb) - 5 kg ha^{-1}; Folicur (tebuconazole) - 75 mL 100L^{-1}; Condor (bromuconazol) - 750 mL ha^{-1}	Metharhil - 2 kg ha^{-1}; Dipel - *Bacillus thuringiensis* - 2 L ha^{-1}; liquid CB - Fish - 500 L ha^{-1}; Bouveril - 2 kg ha^{-1}; Xantara - *Bacillus thuringiensis* - 2 L ha^{-1}
Maturation, M5	Harvest (50 to 60% of ripe fruits)	Harvest (50 to 60% of ripe fruits)

*Phenological states: F = flowering (0-2); Ch = Fruit setting (0-3); Fr = fruit (1-4); M = maturation (1-5).

TABLE 2 - Area under the disease progress curve (AUDCP) of the bacterial blight (*Erwinia psidii*) in the guava tree different phenological stages, in different kinds of cultural management, under different production systems.

Phenology / Management		Harvest			
		2005/2006	2006/2007	2007/2008	Average
Growth	CF*	143.2 ab	304.9 a	249.6 a	232.6 a
	CFF	144.4 ab	247.5 ab	232.5 a	208.1 ab
	CFH	185.0 a	301.9 a	297.8 a	261.6 a
	CFFH	124.5 bc	222.4 ab	232.5 a	193.1 a-c
	BC**	96.0 a-c	160.7 ab	107.2 b	121.3 b-d
	LBC	92.1 a-c	137.3 ab	92.8 b	107.4 cd
	BCD	72.7 cd	110.3 b	70.1 b	84.3 d
	BCLD	55. 8 d	99.3 b	54.4 b	69.8 d
	VC (%)	-	-	-	29.5
Flowerings	CF	314.5 ab	628.4 ab	504.6 ab	377.9 ab
	CFF	298.2 b-d	524.4 bc	440.3 b-d	345.6 b
	CFH	425.9 a	718.1 a	627.9 a	493.2 a
	CFFH	264.7 b-d	515.5 bc	451.5 a-c	327.0 b
	BC	157.4 de	343.2 cd	189.3 b-d	168.0 c
	LBC	130.6 de	303.6 d	164.3 cd	141.8 c
	BCD	111. 5 de	248.2 d	129.6 cd	117.5 c
	BCLD	86.4 e	196.2 d	91.9 d	88.2 c
	VC (%)	-	-	-	27.8
Fruits < 30 mm	CF	249.3 ab	552.5 ab	517.0 ab	439.6 ab
	CFF	220.4 bc	482.1 bc	444.5 a-d	382.3 b
	CFH	337.4 a	645.0 a	612.5 a	531.6 a
	CFFH	201.9 b-d	517.7 ab	493.7 a-c	404.5 b
	BC	112.2 c-e	308.2 c	285.2 b-d	235.2 c
	LBC	99.7 c-e	270.5 c	271.9 b-d	214.0 c
	BCD	85.2 de	241.3 c	206.4 cd	177.6 c
	BCLD	65.1 e	195.1 c	153.4 d	137.9 c
	VC (%)	-	-	-	24.3

*CF – Chemical fertilization (04-14-08); CFF – CF + diseases control (cooper and antibiotics); CFH – CF + Herbicide (glyphosate and gramoxone); CFFH– CF + F + H (Conventional management); **BC – Bioactive compound; LBC – Liquid BC ; BCD - BC + Dead Coverage and BCLD (organic management). The numbers followed by the same letter in the column (phenology and harvest) do not significantly differ among themselves (Tukey P ≤ 0.05). VC = Variation coefficient.

TABLE 3 -Number of guava fruits (Maturation stage M1) produced on three harvests in different production systems and pruning times under the bacterial blight (*Erwinia psidii*).

Management / System	**Harvest**			
	2005/2006	**2006/2007**	**2007/2008**	**Average**
BC – organic (OR)	161 c*	140 abc	146 b	149 c
LBC – OR	178 bc	149 abc	156 b	161 bc
BCD – OR	194 ab	161 ab	173 ab	176 b
BCLD – OR	216 a	183 a	204 a	201 a
CF – conventional (CO)	92 ef	78 b	72 cd	81 e
CFF – CO	117 de	99 cd	93 b	103 d
CFH – CO	79 f	69 b	57 d	69 e
CFFH – CO	130 d	108 bcd	103 c	114 d
VC (%)	9	19	11	-
Pruning Season / System	**2005/2006**	**2006/2007**	**2007/2008**	**VC (%)**
September – OR	209 a**	196 a	152 a	19
September – CO	103 b	75 b	78 b	
December– OR	162 a	47 a	97 a	23
December – CO	72 b	21 b	32 b	
March – OR	204 a	187 a	223 a	14
March – CO	128 b	118 b	122 b	
June – OR	174 a	204 a	207 a	13
June – CO	113 b	141 b	92 b	

Organic [BC – Bioactive compound; LBC – BC Liquid (L); BCD – BC + Dead coverage (M); BCLD – LBC+D]; Conventional [CF – Chemical Fertilization; CFF – CF + Fungicide (F); CFH – CF + Herbicide (H); CFFH – CF+F+H]; VC = Variation coefficient. *Averages on the columns followed by the same letter don´t signifcantly differ among themselves (Tukey $P \leq 0.05$). ** Averages on the columns on the same pruning season followed by the same letter don´t significantly differ among themselves (Tukey $P \leq 0.05$).

TABLE 4 – Meteorological data summary on the local of the experiment, Brazlândia, Federal District, Brazil.

	Pruning Season	**September**	**December**	**March**	**June**
Precipitation[1] mm	2005/2006	55.9 - 226.5	123.1 - 422.2	35.1 - 257.9	0.1 - 52.8
	2006/2007	40.3 - 526.4	182.1 - 265.9	7.5 - 50.1	0.0 - 0.0
	2007/2008	0.0 - 224.9	231.6 - 275.0	22.3 - 194.3	0.0 - 0.3
Temperature °C	2005/2006	21.5 - 24.8	21.1 - 22.3	20.1 - 21.6	18.6 - 21.8
	2006/2007	21.2 - 22.4	21.4 - 22.1	20.8 - 22.6	19.9 - 20.4
	2007/2008	22.5-24.0	21.5 - 21.9	20.6 - 21.6	18.7 - 21.4
URA %	2005/2006	79.8 - 45.7	79.4 - 67.7	79.9 - 62.2	58.9 - 47.3
	2006/2007	80.9 - 52.8	79.0 - 77.0	64.8 - 56.2	53.2 - 37.2
	2007/2008	69.9 - 34.4	74.1 - 71.0	70.1 - 58.7	49.1 - 43.2

[1]Precipitation variation, temperature and average relative moisture of the air (URA) in the pruning period (Sep/Nov; Dec/Feb; Mar/May; Jun/Aug).

TABLE 5 - Area under the disease progress curve (AUDPC) due to the guava (*Psidium guayava*) bacterial disease(*Erwinia psidii*) on the phenological stages (EF; SHO = shooting; FLO = flowering; FRU = fruits < 30mm), according to the cultivation system [organic (OR) or conventional (CO)], harvest year and pruning season.

			AACPD			
EF	**System**	**Harvest**	**Pruning Season**			
			September	**December**	**March**	**June**
SHO[3]	**OR**	2005/2006	56.0 BC[1]	135.4 A	96.1 AB	29.1 C
		2006/2007	56.5 C	256.2 A	147.0 B	38.0 C
		2007/2008	54.7 A	101.7 A	95.9 A	72.2 A
		2005/2006	108.4 C	253.7 A	171.0 B	64.0 C
	CO	2006/2007	116.3 C	519.6 A	365.0 B	75.8 C
		2007/2008	113.3 D	438.2 A	265.2 B	193.7 C
	OR	-	55,7 b[2]C	164,4 b A	113,0 b B	46,4 b C
	CO	-	112,7 a C	403,8 a A	267,1 a B	111,2 a C
FLO[4]	**OR**	2005/2006	80.8 B	260.9 A	98.7 B	58.5 B
		2006/2007	159.3 B	578.4 A	220.3 B	133.2 B
		2007/2008	209.1 A	187.6 A	83.1 B	95.3 B
		2005/2006	305.5 B	624.6 A	212.9 C	160.3 C
	CO	2006/2007	454.1 B	1075.0 A	430.6 B	426.8 B
		2007/2008	635.2 B	876.5 A	246.6 C	266.1 C
	OR	-	149.7 b B	342.3 b A	134.0 b BC	95.7 b C
	CO	-	464.9 a B	858.7 a A	296.7 a C	284.4 a C
FRU[5]	**OR**	2005/2006	69.5 AB	142.3 A	89.9 AB	61.9 B
		2006/2007	108.5 C	575.0 A	242.2 B	89.3 C
		2007/2008	149.8 B	534.7 A	115.2 B	117.2 B
		2005/2006	205.4 BC	425.3 A	217.2 B	140.3 C
	CO	2006/2007	405.9 BC	1004.1 A	442.4 B	345.2 C
		2007/2008	418.5 B	1150.2 A	245.3 C	253.8 C
	OR	-	109.3 b BC	417.4 b A	149.1 b B	89.5 b C
	CO	-	343.2 a B	859.9 a A	301.6 a B	246.4 a C

[1]Averages on the line followed by the same capital letter don´t differ among themselves (Tukey, P ≤ 0.05).
[2]Averages on the column followd by the same lower case don´t differ among themselves (Tukey, P ≤ 0.05).
[3]VC (%) SHO: system = 52.1; crop = 16.2; EP = 17.0. [4]CV (%) FLO: system = 68.1; crop = 12.8; EP = 14.8. [5]CV (%) FRU: system = 65.1; crop = 10.9; PT = 12.5.

CONCLUSIONS

- The organic system presented smaller bacterial blight rates when compared to the conventional system on the three phenological states analysed;
- The liquid bioactive compound + dead coverage stood out on fruit productions on all harvests seasons, being presented as the best guava tree management against bacterial disease;
- In all of the years, the pruning held in Decebmer was the one which favoured the most the bacterial disease development, however, the prunings held in March and June were the best pruning seasons, which resulted in the highest productivities.

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