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QUALITY OF PLATANES GROWN IN CONSORTIUM WITH TREE SPECIES

ABSTRACT: The objective of this work was to evaluate the quality of plantain fruits, D'Angola, produced in consortium with tree species and in different planting densities. For this, the experiment was designed in strips with four silvibane arrangements, namely: plane tree (*Musa* spp. L.) with eucalyptus Urocam VM01 (*Eucalyptus urophyla* S.T. Blake x *E. camaldulensis* Dehnh.); plantain with casuarina (*Casuarina equisetifolia* L.); sycamore with white taxi (*Tachigali vulgaris* L.F. Gomes da Silva & H.C. Lima) and sycamore with acacia (*Acacia mangium* Willd.). In each strip, three plane tree planting densities were randomly distributed, being: 1,250, 833 and 625 plants hectare, constituting the secondary treatment. The single planting (monoculture) of sycamore cv. D'Angola, was used as a control at a spacing of 4.5 m x 2.0 m x 1.6 m (1,923 plants/hectare). The following physical and physicochemical aspects of the fruits were evaluated: bouquet mass, fruit mass, pulp mass, fruit length, fruit diameter, pulp diameter, pulp/peel ratio, pulp yield, pulp firmness, shell thickness, total soluble solids, total titratable acidity and TSS/TTA (ratio). It was concluded that the plantain produced in the silvibananeiro system has lower fruit mass and length when compared to the single crop. On the other hand, the fruits met the quality standard for commercialization, regardless of the tree species used in the system. The planting density had no effect on the quality of banana cv. D'Angola.

KEYWORDS: Fruit quality, *Musa* sp., Plantain.

QUALIDADE DE PLÁTANOS CULTIVADOS EM CONSÓRCIO COM ESPÉCIES ARBÓREAS

RESUMO: O objetivo desse trabalho foi avaliar a qualidade dos frutos de plátano, cultivar D'Angola, produzidos em consórcio com espécies arbóreas e em diferentes densidades de plantio. Para isso, o

experimento foi delineado em faixas com quatro arranjos silvibananeiros, sendo: plátano (*Musa* spp. L.) com eucalipto Urocam VM01 (*Eucalyptus urophyla* S.T. Blake x *E. camaldulensis* Dehnh.); plátano com casuarina (*Casuarina equisetifolia* L.); plátano com taxi-branco (*Tachigali vulgaris* L.F. Gomes da Silva & H.C. Lima) e plátano com acácia (*Acacia mangium* Willd.). Em cada faixa foram distribuídas ao acaso três densidades de plantio de plátano, sendo: 1.250, 833 e 650 plantas/ha, constituído o tratamento secundário. O plantio solteiro (monocultura) de plátano cv. D'Angola, foi utilizado como testemunha no espaçamento 4,5 m x 2,0 m x 1,6 m (1.923 plantas/ha). Avaliaram-se os seguintes aspectos físicos e físico-químicos dos frutos: massa do buquê, massa do fruto, massa da polpa, comprimento do fruto, diâmetro do fruto, diâmetro da polpa, relação polpa/casca, rendimento da polpa, firmeza da polpa, espessura da casca, sólidos solúveis totais (SST), acidez total titulável (ATT) e relação SST/ATT (ratio). Concluiu-se que o plátano produzido no sistema silvibananeiro apresenta menor massa e comprimento do fruto, quando comparado com o cultivo solteiro. Por outro lado, os frutos atenderam o padrão de qualidade para comercialização, independente da espécie arbórea utilizada no sistema. A densidade de plantio não surtiu efeito na qualidade dos frutos de plátano cv. D'Angola.

PALAVRAS-CHAVE: Banana-da-terra, *Musa* sp., Qualidade de frutos.

CALIDAD DE PLÁTANOS CULTIVADOS EN CONSORCIO CON ESPECIES DE ÁRBOLES

RESUMEN: El objetivo de este trabajo fue evaluar la calidad de frutos de plátano, cultivar D'Angola, producidos en consorcio con especies arbóreas. Para ello, se diseñó el experimento en fajas con cuatro arreglos de silvibane, a saber: plátano (*Musa* spp. L.) con eucalipto Urocam VM01 (*Eucalyptus urophyla* S.T. Blake x *E. camaldulensis* Dehnh.); plátano con casuarina (*Casuarina equisetifolia* L.); sicómoro con taxi blanco (*Tachigali vulgaris* L.F. Gomes da Silva & H.C. Lima) y sicómoro con acacia (*Acacia mangium* Willd.). En cada franja se distribuyeron aleatoriamente tres densidades de plantación de plátanos, siendo: 1.250, 833 y 620 plantas hectárea, constituyendo el tratamiento secundario. La plantación única (monocultivo) de sicómoro cv. D'Angola, se utilizó como testigo a un espaciamiento de 4, m x 2,0 m x 1,6 m (1.923 plantas/ hectárea). Se evaluaron los siguientes aspectos físicos y fisicoquímicos de los frutos: masa de bouquet, masa de fruto, masa de pulpa, longitud de fruto, diámetro de fruto, diámetro de pulpa, relación pulpa/cáscara, rendimiento de pulpa, firmeza de pulpa, espesor de la cáscara, sólidos solubles totales, acidez titulable total y SST/ATT (ratio). Se concluyó que el plátano producido en el sistema silvibaneiro tiene menor masa y longitud de frutos en comparación con el monocultivo. Por otro lado, los frutos cumplieron con el estándar de calidad para su comercialización, independientemente

de la especie arbórea utilizada en el sistema. La densidad de siembra no tuvo efecto sobre la calidad del banano cv. D´Angola.

PALABRAS CLAVES: Calidad del fruto, *Musa* sp., Plátano.

INTRODUCTION

The consortium-based cultivation of fruit trees with other crops is a good alternative as a production system for rural properties and family farming (ANDRADE NETO et al., 2015). When well planned, consortia allow numerous advantages compared to monoculture, such as: improvement in the physical, chemical and biological attributes of the soil; increase in the cycling and efficiency in the use of nutrients; assistance in the recovery of degraded areas, in addition to reduction of production cost, diversification and stabilization of income in rural property (ALVARENGA et al., 2010).

Banana (*Musa* sp.) has excellent acceptance in the market because it is a highly nutritious food (STAVER et al., 2013) and for the large amount of starch, which makes it a staple food for thousands of people (ALMEIDA et al., 2019a). It is widely used in consortia because it provides rapid shade, provides a large amount of organic material in the system and is easy to manage (ANDRADE NETO et al., 2015).

In Brazil, bananas are the second most important fruit in terms of planted area and production. According to IBGE (2021), in 2021 the national production of this fruit was approximately 7 million tons, an increase of 4.5% compared to the previous harvest, in a planted area of 465,200 hectares.

The state of Mato Grosso is geographically divided into seven macro-regions (IMEA, 2017). The South-Central region is formed by the Baixada Cuiabana, Pantanal and the beginning of the Parecis Plateau, where the consumption of bananas in cooking is very strong and cultural. Thus, in 1997, due to the influence of this region, the state reached the period of greatest production, reaching a banana

cultivation area of 60,000 ha, being the 5th national producer. With the modification of the state's agricultural scenario, however, the banana cultivation area was reduced to 10% of this total (IBGE, 2021) and, in 2021, it was of 6,762 ha, and production became practically a family farm activity, in small properties. The municipality of Sinop is one of the centers of the Central-North macro-region of the state (IMEA, 2017) and, like the entire state, depends on the import of fruits, including plantains. However, the demand of the Central-North region is due to the strong migratory and cultural influence from Southern Pará (ROMANO et al., 2019).

Terra-type bananas are known internationally as plantains and differ from common bananas by fruit size, orange pulp and high starch content, even when ripe. Their consumption is preferably in cooked or fried form (EMBRAPA, 2016).

The demand for the fruit, added to the practice of consortium-based cultivation, calls for necessary studies that characterize the quality of consortium-based bananas. Moreover, the understanding of the particularities of the banana silviculture system, such as the influence of tree species, is extremely important as a subsidy to fruit producers and in the productive viability of the system.

In this scenario, the objective was to analyze the quality of plantain cv D'Angola fruits, produced in consortium with tree species.

MATERIAL AND METHODS

The experiment was conducted between December 2014 and July 2016, on the agricultural property of the family company Bianchi Alimentos, located in the municipality of Sinop - MT, Brazil, which is a reference in banana production throughout the state of Mato Grosso.

The soil of the experiment area is clayey Dystrophic Red-Yellow Latosol. The granulometric and chemical analysis (0-20 cm) showed sand content of 550 g kg^{-1}, 91 g kg^{-1} of silt and 359 g kg^{-1} of clay; pH (CaCl2) of 4.9; P ($Mehlich^{-1}$) of 74 mg dm^{-3}; Ca, Mg, K, Al3+, H+Al, cmolc dm^{-3}, 3.01; 0.77; 0.05; 0; and 4.66,

respectively; organic matter of 29.63 g dm^{-3}; base saturation (V) of 45%; and micronutrients, B, Cu, Fe, Mn and Zn, of 0.93; 3.40; 71.00; 18.97; and 39.98 mg dm^{-3}, respectively. The experimental design was in completely randomized blocks, distributed in ranges with five main treatments and three secondary treatments, in three replications.

The main treatments were constituted in an alley cropping agroforestry system with plantains (plantain plant in a consortium with tree species) with four arrangements, being: 1 – Plantain (*Musa* spp. L.) cv. D'Angola with eucalyptus *Urocam* VM01 (*eucalyptus urophyla* hybrid S.T. Blake x *E. camaldulensis* Dehnh); 2- Plantain cv. D'Angola with casuarina (*Casuarina equisetifolia* L.); 3- Plantain cv. D'Angola with *tachi-branco* (*Tachigali vulgaris* L.F. Gomes da Silva & H.C. Lima) and 4- Plantain cv. D'Angola with acacia (*Acacia mangium* Willd.). Monoculture of plantain cv. D'Angola was done, as control.

The definition of the tree species components of the systems was based on the requirements of rapid growth, the edaphoclimatic conditions of the region; high calorific value of the wood, aiming at the firewood market; ability association with nitrogen-fixing bacteria and the canopy structure that favored light penetration, in addition to the agreement of the producer.

The planting of seedlings of the tree species occurred on 12/15/2014 and the planting of the plantain on 01/15/2015. The agroforestry arrangement adopted was that of culture in alley crops with two rows of trees (A) and a row of plantain (B) alternately (A A B A A B A A B A A). The planting spacing of the tree species was 4.0 m x 2.0 m (1,250 pl ha^{-1}), while we opted to test three spacings for the plantains, being: 8.0 m x 1.0 m (1,200 pl ha^{-1}), 8.0 m x 1.5 m (900 pl ha^{-1}), 8.0 m x 2.0 m (600 pl ha^{-1}). The control, plantain in monoculture, was conducted with spacing of 4.5 m x 2.0 m x 1.6 m (1,923 pl ha^{-1}). The experimental plot occupied an area of 864 m^2 (36 m x 24 m). Each plot was formed by six rows of tree species and three rows of plantain, located in the center of the alternating rows of the tree species.

For the physical and physicochemical analyses, the fruits of the first cycle,

harvested in February 2016, were analyzed. After harvest, the second hands of each bunch, in stage 1 maturation, of three plants of each plot were sent to Embrapa Agrossilvipastoril's postharvest laboratory. The hands were arranged in trays and stored in a chamber with controlled temperature (25±1 °C) for ripening.

When most of the fruits of the hands reached stage 7 of maturation (completely yellow peel), three fruits were individualized and evaluated for: mass of the bouquet, fruit and pulp, using precision scale; fruit length, diameter of the fruit and pulp and thickness of the peel, utilizing digital caliper; and, pulp yield, calculated by the pulp ratio by the total fruit mass.

Pulp firmness was measured in the fruits using a TA.TX2i model texturometer, equipped with a 6 mm diameter stainless steel probe (P/6N), which measured the penetration force with a descent speed of 2 mm s^{-1} and with a maximum input distance of 3 mm.

The fruit pulp of each bouquet was homogenized in a beaker for the analysis of total soluble solids (TSS), through direct reading in a portable digital refractometer and titratable total acidity (TTA), by titration with NaOH 0.1 mol L^{-1}. The TSS/TTA ratio was obtained by the quotient between these two parameters.

Data on the physical and physical-chemical quality of plantain fruits were submitted to variance analysis by the F test (5%) and the means grouped by the Scott-Knott test at 5% probability, with the aid of the Genes software, adopting the random block model with additional controls.

RESULTS AND DISCUSSION

The results of the analysis to determine the physical characteristics of the fruits of plantain cv. D'Angola produced in consortium with tree species are shown in Table 1. It was noticed that there was a statistical difference between monoculture and alley cropping agroforestry system with plantain for bouquet mass, fruit mass, pulp mass and fruit length. However, no statistical difference was observed for fruit and pulp diameter.

Table 1. Average mass of the bouquet (MB), fruit mass (FM), pulp mass (PM), fruit length (FL), fruit diameter (FD) and pulp diameter (PD) of the fruits plantain cv. D'Angola cultivated in monoculture and alley cropping agroforestry system with plantains, and among the component tree species. Sinop-MT, 2016.

Production System	MB (g)	FM (g)	PM (g)	FL (cm)	FD (mm)	PD (mm)
Monoculture	904.44 a*	301.45 a*	227.47 a*	29.69 a*	42.95 ns	37.95 ns
Alley cropping agroforestry	599.87 b	222.77 b	168.45 b	24.21 b	40,93	35,97
Tachi-branco	660.25 ns	237.14 ns	184.00 ns	23.90 ns	42.55 a*	37.79 a*
Acacia	637,72	232,95	175,41	25,43	40.39 b	35.59 b
Casuarina	580,49	204,18	152,75	23,46	40.66 b	35.53 b
Eucalyptus	521,01	216,81	161,61	24,05	40.12 b	34.96 b
CV (%)	18,32	13,43	14,98	6,77	4,78	4,90

ns non-significant by the Scott-Knott test (p>0.05). *Averages followed by equal letters in the column do not differ from each other by the Scott-Knott test (p>0.05). CV=Coefficient of Variation.
Source: prepared by the authors.

The average s of the mass of the bouquet, fruit and pulp of the fruits produced in monoculture cultivation were higher than the averages of the alley cropping agroforestry with plantain, with higher difference for the mass of the bouquet. The fruit mass was lower than the ones obtained by Prata et al. (2018), cv. D'Angola in monoculture cultivation, who found an average of 414 g. On the other hand, Nomura et al. (2021), when evaluating the productive performance of different banana genotypes of the Terra subgroup, they found the mass of the cv. D'Angola fruit of 333 g and 227 g for the first and second planting cycles, respectively, similar to the average of this study.

When analyzing the tree species used in the alley cropping agroforestry with plantain, it was observed that there was no difference in the mass of the bouquet, fruit and pulp, indicating that the type of tree species used in the system did not influence the mass parameter of the plantain fruits. Mass parameters, such as mass of the fruit, of the bunch and of the hand, are important for the commercialization of bananas, as they directly interfere in the productivity (PRATA et al., 2018).

Regarding length, the fruits grown in the single cultivation had higher average (29.69 cm) compared to those produced in the banana silviculture system (24.21 cm). Andrade Neto et al. (2015), when evaluating the agronomic performance of the consortium between cv. D'Angola and açai trees (*Euterpe precatoria* Mart.), found banana fruits with an average length of 27.42 cm. However, the authors did not observe a difference in cv. D'Angola length among the banana silviculture and single cultivation systems, as seen in this study. The average length of the fruits was similar to those obtained by Dantas (2010), Faria et al. (2010), Almeida et al. (2019a) and Nomura et al. (2021) with values of 29.3, 26.1, 27.35, 29.5 cm, respectively, in monoculture of plantain.

Same as for the mass parameter, the type of tree species used in the system did not influence the length of the plantains cv. D'Angola.

Despite the fact that there was no difference between monoculture and banana silviculture systems for fruit and pulp diameter, there was a difference when observing the averages of these physical characteristics within the banana silviculture system. Amongst the component species, plantain associated with *tachi-branco* produced fruits with greater diameter of fruit and pulp, differing statistically from the other species.

The diameter of the fruit was lower than that obtained by Andrade Neto et al. (2015), in a consortium of cv. D'Angola with açai tree, harvesting fruits with an average of 50.55 mm in diameter. However, the authors also did not observe statistical difference when comparing the agroforestry with the monoculture cultivation system, same as verified in this study.

In other studies, in monoculture, the average diameter of the cv. D'Angola fruit was 40.6; 50.63 and 45 mm for Faria et al. (2010), Almeida et al. (2019 a) and Nomura et al. (2021), respectively. This variation in fruit diameter found in the literature can be attributed to agronomic practices and local edaphoclimatic conditions (CHITARRA; CHITARRA, 2005; CASTRICINI et al., 2016).

The length and diameter of the fruit are one of the main physical characteristics used in the classification, quality and commercialization of bananas, and consequently in the remuneration of fruit producers (AZEVEDO et al., 2010). According to the classification standards suggested by PBMH e PIF (2006), the length guarantees the homogeneity of the fruits of the same batch, determining their classes. While the diameter is used to determine in which category each group of bananas belongs.

The fruits of plantain cv. D'Angola produced in consortium with tree species, were classified as Class 22 (length between 22 and 26 cm) and in the extra category (minimum diameter of 34 mm). Thus, the fruits of plantain produced in the banana silviculture system met the standard for commercialization, regardless of the tree species used in the system.

It was observed that there was no statistical difference between monoculture and the banana silviculture systems for pulp/peel ratio, pulp yield, pulp firmness and peel thickness, with a general average of 3.21, 75.37%, 4.34N and 2.49 mm, respectively (Table 2).

In relation to the species used in the alley cropping agroforestry with plantain, it was found that there was a difference in the averages for the pulp/peel ratio. Plantain in consortium with *tachi-branco* produced banana fruits with higher pulp/peel ratio, differing statistically from the other tree species. However, this particularity was not observed for the other physical characteristics, i.e., the type of tree species used in the system did not influence the yield and firmness of the pulp and the thickness of the peel.

The fact that there was no difference in the pulp/peel relationship between the monoculture and banana silviculture systems indicated that the presence of tree species did not interfere in the ripening of the plantain fruits. Since during ripening, the peel loses part of its water to the fruit pulp and, by transpiration, to the environment, it

results in an increase in the pulp/peel ratio (SILVA et al., 2016).

Studies with other banana cultivars showed different values for this physical relationship, and this difference is probably related to the genetic material of each variety. In single cultivation of bananas, Silva et al. (2013), with the cultivar Thap Maeo, and Silva et al. (2016), with the cultivars *Maravilha* and *Preciosa*, obtained an average pulp/peel ratio of 4.13; 1.94 and 1.81, respectively.

Table 2. Average pulp/peel ratio (PPR), pulp yield (PY), pulp firmness (PF), peel thickness (PT), total soluble solids (TSS), total titratable acidity (TTA) and ratio of plantain cv. D'Angola cultivated in monoculture and alley cropping agroforestry system with plantains, and among the component tree species. Sinop-MT, 2016.

Production System	PPR	PY (%)	PF (N)	PT (mm)	TSS (ºBrix)	TTA	Ratio
Monoculture	3.13 ^{ns}	75.14 ^{ns}	4.60 ^{ns}	2.50 ^{ns}	33.60 a*	1.06 ^{ns}	32.56 ^{ns}
Alley cropping agroforestry	3,30	75,60	4,08	2,48	28.17 B	0,77	43,20
Tachi-branco	3.79 a*	77.61 ^{ns}	3.86 ^{ns}	2.35 ^{ns}	28.73 ^{ns}	0.70 ^{ns}	48.70 ^{ns}
Acacia	3.28 B	75,71	4,20	2,40	27,36	0,77	41,47
Casuarina	3.10 B	74,37	4,23	2,56	29,29	0,81	42,45
Eucalyptus	3.05 b	74,70	4,05	2,58	27,33	0,79	40,21
CV (%)	16,21	4,70	17,82	17,65	7,30	27,10	25,40

^{ns} not significant by the Scott-Knott test (p>0.05). *Averages followed by equal letters in the column do not differ from each other by the Scott-Knott test (p>0.05). CV=Coefficient of Variation.
Source: prepared by the authors.

Table 2 also describes the data obtained regarding the chemical attributes analyzed of the fruits of plantain cv. D'Angola produced in consortium with tree species. There was a significant difference between the production systems for total soluble solids, however, the same did not happen for the total titratable acidity and ratio. When analyzed within the system, no difference was observed for these variables regarding the type of tree species consorted with plantain.

The fruits produced in the monoculture presented higher average for total soluble solids, while the general

average for total titratable acidity and ratio were 0.91 and 37.88, respectively. According to Chitarra e Chitarra (2005), the contents of total soluble solids, titratable acidity and ratio are the attributes that best define the quality of bananas, however few data are found in the literature for plantain cv. D'Angola.

In a consortium of plantain with açai tree, Almeida et al. (2019b) showed no statistical difference between monoculture and in consortium cultivation for contents of total soluble solids, titratable acidity and ratio with average values of 17.23 °Brix, 0.53 and 33.18, respectively. In monoculture of plantain cv. D'Angola, Almeida et al. (2019 a) found average total soluble solids, total titratable acidity and ratio of 17.48 °Brix, 0.54 and 34.22, respectively. Hansen et al. (2012) harvested the fruits of bananas type Terra (Maranhão variety) with values of total soluble solids of total titratable acidity values ranging from 17 to 28.7 °Brix, and 0.45 to 0.60, respectively.

The total soluble solids content indicates the amount of sugars present in the fruit, as well as acids, vitamins, amino acids and some pectins (KLUGE et al., 2002) and, associated with total titratable acidity, also serves as a flavor attribute. Thus, fruits with higher levels of soluble solids are more desirable, because they promote better flavor for consumption, whether *in natura*, fried, cooked or industrialized (HANSON et al., 2012).

Tables 3 and 4 present the averages of the physical-chemical characteristics of the plantain cv. D'Angola fruits as a function of planting density of 1,250; 833 and 625 plants ha^{-1}.

It was verified that there was no difference for any physical-chemical variable, so the distance between the banana trees in the planting line (1.0, 1.5 and 2.0 m) did not influence the quality of the plantain cv. D'Angola fruits produced in the banana silviculture system. However, although not significant, the spacings in the banana trees planting line of 1.0 and 1.5 m, for the densities of 1,250 and 833 plants ha^{-1}, respectively, were the ones that presented the best results for most of the physical-chemical aspects of the fruit.

Table 3. Averages of bouquet mass (BM), fruit mass (FM), pulp mass (PM), fruit length (FL), fruit diameter (DF) and pulp diameter (PD) of plantain cv. D'Angola fruits cultivated in the alley cropping agroforestry system as a function of planting density (plants ha^{-1}). Sinop-MT, 2016.

Planting Density	BM (g)	FM (g)	PM (g)	FL (cm)	FD (mm)	PD (mm)
1.250	585.15^{ns}	227.31^{ns}	169.88^{ns}	242.86^{ns}	41.06^{ns}	36.22^{ns}
833	620,33	223,85	169,86	240,22	41,11	35,85
650	594,11	217,16	165,59	243,24	40,63	35,84
Average	599,87	222,77	168,45	242,12	40,93	35,97
CV (%)	18,32	13,43	14,98	6,77	4,78	4,90

^{ns} not significant by the Scott-Knott test (p>0.05). CV=Coefficient of Variation.
Source: prepared by the authors.

Table 4. Pulp/peel ratio (PPR), pulp yield (PY), pulp firmness (PF), peel thickness (PT), total soluble solids (TSS), total titratable acidity (TTA) and ratio of plantain cv. D'Angola fruits cultivated in alley cropping agroforestry system as a function of planting density (plants ha^{-1}). Sinop-MT, 2016.

Planting Density	PPR	PY (%)	PF (N)	PT (mm)	TSS (ºBrix)	TTA (%)	Ratio
1.250	3.41^{ns}	75.77^{ns}	2.42^{ns}	3.92^{ns}	28.35^{ns}	0.81^{ns}	44.29^{ns}
833	3,10	74,60	2,64	4,31	28,63	0,82	41,31
650	3,40	76,43	2,37	4,01	27,55	0,67	44,10
Average	3,30	75,6	2,48	4,08	28,18	0,77	43,23
CV (%)	16,21	4,70	17,82	17,65	7,30	27,10	25,40

^{ns} not significant by the Scott-Knott test (p>0.05). CV=Coefficient of Variation.
Source: prepared by the authors

Lima (2015), evaluating plantain cv. D'Angola fruits in the densities of 1,600 and 3,200 plants ha-1, found no difference in fruit diameter averages, peel thickness, diameter and pulp yield, and total soluble solids with values of 40.03 mm; 4.44 mm; 33.88 mm, 65.13% and 11.07 º Brix, respectively.

Prata et al. (2018), analyzing different planting density (4,166, 3,125, 2,777 and 2,500 plants ha-1) in the growth and production of plantain cv. D'Angola, found no statistical difference for the

fresh fruit mass and fruit length. Andrade Neto et al. (2015), when analyzing the agronomic characteristics of the plantain cv. D'Angola in consortium with açai tree (*Euterpe precatoria* Mart.), state that different spacings in the banana plantation line did not influence the qualities of the fruits, such as the diameter and length of the fruit.

CONCLUSIONS

The results regarding the physical-chemical quality indicate that the banana silviculture system, when compared with monoculture, produces plantain cv. D'Angola fruits with less mass, length and total soluble solids contents. On the other hand, the fruits grown in the banana silviculture system satisfactorily meet the quality standard for commercialization.

Among the tree species used in the agroforestry system, plantain associated with tachi-branco produces fruits with better physical-chemical quality.

The distance between the banana trees in the planting line (1.0, 1.5 and 2.0 m) does not influence the physical-chemical quality of plantain cv. D'Angola fruits produced in the banana silviculture system. However, the shorter distances indicate better results for most physical-chemical aspects of the fruits.

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