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# Quality of dried banana produced from three cultivars 'Prata-Anã', 'FHIA-18'and 'BRS Platina' under different irrigation levels

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**Abstract**

This study aimed to evaluate the influence of different levels of irrigation on the quality parameters involved in the dried-bananas production from 3 different cultivars. The experimental design was a completely randomized factorial 3 x 3, with three genotypes of bananas (Prata-Anã, FHIA-18 and BRS Platina) produced in the semi-arid region of Minas Gerais.) and three irrigation levels (50, 75 and 100% of crop evapotranspiration - ETC), with three replications. For the processing purpose, the fruits were selected at the maturity stage 6. Then they sanitized in hypochlorite of sodium solution at 100 mg $L^{-1}$, peeled and dehydrated through the drying convective method with hot air, in dryer with forced air, in dryer with forced air circulation at 65ºC for 24 hours. The dried bananas were evaluated according to the following physical and chemical aspects: moisture, length, diameter, firmness, color (brightness, chroma and $^{o}$Hue), soluble solids and titratable acidity, and sensory characteristics: purchase intention and acceptance. The humidity, length, diameter, firmness, color and acidity of dried bananas were influenced by the different studied irrigation levels. In the sensory evaluation, the best result regarding appearance, color, texture and flavor requirements was observed in banana processed from 'Prata-Anã' irrigated with the total level of water (100%). The dried banana processed from 'BRS Platina' was the least accepted in the sensory tests.

**Keywords:** *Musa* spp.; water deficit; processing; quality; cultivars.
**Abbreviations:** ETc_crop evapotranspiration.

## Introduction

Banana is the most consumed in natura fruit in Brazil and in the world whose Brazilian production in 2016 was 6.794.324 tons, being the region northeast the largest banana producers in the country, with production of 2.285.796 tons, followed by the Southeast, South, North and Central West, with production of 2.268.400; 1.035.695; 883.184 and 291.249 tons respectively (Brazilian Institute of Geography and Statistics, 2018).

The prevalence of Prata type banana cultivation in Brazil, with emphasis on 'Prata- Anã' (AAB), highlights the tradition of its cultivation and its good commercial acceptance. Bananas 'FHIA-18' (AAAB) and 'BRS Platina' (AAAB) are also 'Prata' type and are tetraploid genotypes derived from 'Prata-Anã' (Donato et al., 2009).

Due to presenting a large leaf area and water weight corresponding to 88% of the total plant weight, banana tree is a water demanding plant and its adequate supply is a guarantee of good yield and fruit quality (Costa et al., 2008). However, the majority of places where the plant is cultivated presents rainfall below the required, being necessary, therefore the use of irrigation (Azevedo and Bezerra, 2008) which must be used appropriately, reducing the impacts to the environment and ensuring the correct use of available water resources (Almeida et al., 2003).

The drying or dehydration is a conservation technique that reduces the water content present in the food, inhibiting the micro-organisms and enzymes development that alter the same (Pontes et al*.,* 2007). With the water removal, the banana's chemical constituents are changed, such as acidity, which has its value increased with the processing, due to the acid concentration of the own fruit (Jesus et al., 2005). As an advantage of dried banana production, the following advantages stand out: besides a greater retention period, the ease of use and storage and the postharvest losses reduction. Another advantage is the possibility of using fruits that are out of the standards for commercialization such as as small fruits and without classification or fruits already mature at the harvest time.

Vegetables can be dried naturally, recommended in regions of dry weather, with good solar irradiation and with low rainfall, or applying artificial heat, in which the conditions of temperature, humidity and airflow are controlled. This dehydration can happen by applying hot air; with the aid of radiant energy; by electromagnetic energy, microwave and dielectric heating; by lyophilization, in which water is frozen and subsequently sublimated (Gava, 2008).

In *in natura* fruits, some studies have reported the influence of reduced levels of irrigation in the bananas quality, as reported by Castricini et al. (2012) who concluded, in their work with post-harvest characterization of banana cv. BRS Platina ll the characteristics of quality and yield are associated with the absence of hidric deficit in all phases of the culture, except for the resistance to finger drop and firmness. In another study, Castricini et al. (2013) evaluating the post-harvest quality of bananas cv. Princesa, produced under irrigation management by partial desiccation, observed that there was no significant difference for the soluble solids content, differentiated acidity and firmness.

In processed fruits, Martineli et al. (2017) evaluating the influence of the partial drying technique of the root system on the quality parameters involved in the dehydrated papaya production, observed that the water deficit caused in plants did not influence the coloring (°Hue), soluble solids and titratable acidity of processed fruits. Thus, considering the need for irrigation in the banana tree cultivation, especially in semi-arid regions such as the North of Minas Gerais, the fourth Brazilian mesoregion producer of bananas (Brazilian Institute of Geography and Statistics, 2018), added to the importance of rational use of water used in irrigation management, it is important to evaluate whether there is change in quality after the fruits dehydration originated from plants subjected to water deficit. In addition, it is also important to assess the water deficit influence in the quality of different banana genotypes. Therefore this study evaluated the influence of different levels of irrigation on the quality parameters and the acceptance of dried banana-produced from different cultivars, since it is common the commercializaton of dehydrated bananas originated from 'Prata-Anã', but from 'BRS Platina' and 'FHIA-18' information is scarce, as well as concerning the final product quality , when originated from fruits produced under water deficit conditions.

## Results and discussion

### *Effect of water deficit on the physical parameters of dried bananas*

In Table 1, the results of moisture, length, diameter and firmness of dried bananas are presented.

The moisture content of processed dried bananas originated from Prata-Anã and FHIA-18 genotypes was influenced by different irrigation levels ($p \leq 0.05$), and the equation that best fit to the data was linear, in that each 1% of increase of water, there was a reduction of 0.1744% and 0.0390% of humidity, respectively. An increase in soluble solids content in Cantaloupes when the plant was submitted to water deficit was observed by Ahmadi-Mirabad et al. (2014) and this higher concentration of soluble sugars in the pulp may promote greater water movement from the peel to the pulp because of the greater water potential difference between pulp and peel (Robinson and Galán Saúco, 2010), which may justify greater humidity in the dried banana from the 50% irrigation level.

Dried bananas originating from the BRS Platina genotype suffered no irrigation effect in humidity ($p>0.05$), whose average value, after processing, was 8%. It is possible to observe that, the dried parts processed with bananas 'Prata-Anã' whose plants received only 50% of the irrigation level presented higher water content after drying, differing from the product from other cultivars. However, the final moisture content of dried bananas derived from the processing of all the studied treatments is within the limit described in the legislation, which is 25% (Brazilian, 2005).

The length of the dried parts of genotype processed from 'BRS Platina' genotype suffered the irrigation effect ($p<0.05$) being the linear equation the one that best fits to the data, with dried parts presenting greater length in the highest irrigation level. The pulp length has a direct relationship with the fruit length. For this reason, longer fruits will produce longer pulp and longer dried banana. This genotype produces fruits of greater length and heavier when produced in the absence of water deficit (Castricini et al., 2012) which explains the greater length of dried banana in the highest applied irrigation level

On the other hand, irrigation effect was not observed in the length ($p>0.05$) for dried bananas of Prata-Anã and FHIA-18 genotypes, whose values were 101.56 and 109.09 mm, respectively. Banana 'Prata-anã' proved to be less sensitive to moderate hydric stress than 'BRS Platina' banana (Santos et al., 2016). Unlike Braga Filho et al. (2011) who found in a study with the variety FHIA, influence of irrigation in the fruit length. It is important to highlight that the dried bananas derived from bananas 'FHIA-18', regardless of the irrigation level, were significantly higher than the other products from the other studied genotypes which is a feature of this genotype (Arantes et al., 2017). The banana genotypes have different responses to water application. In the same way that there are cultivars more or less tolerant to soil hydric deficit, there are also those who have less or greater response to the irrigation application (Coelho et al., 2015).

The dried bananas diameter obtained from FHIA-18 and BRS Platina genotypes were influenced by the leaves ($p<0.05$), and the equation that best fits to the data, for both, was the linear, where each 1% of increase in the water availability, the diameter increased 0.0452 mm and 0.0986 mm. The dried bananas derived from Prata-Anã genotype did not have the diameter influenced by different irrigation levels ($p>0.05$), with an average value of 17.62 mm. Opposite result was reported by Costa et al. (2012) evaluating irrigated banana plant in the semiarid region of Paraíba State, using five irrigation levels, who observed an increase in the fruit diameter between the lowest and highest level (22% and 58%, respectively).

**Table 1.** Moisture (%), length (mm) diameter (mm) and firmness (Newton) of dried banana processed from genotypes irrigated with different irrigation levels.

| Genotypes | Irrigation levels | | | | | |
|---|---|---|---|---|---|---|
| | 50 | 75 | 100 | *Mean* | Equation | $R^2$ |
| Moisture (%) | | | | | | |
| Prata-Anã | 16.01 a | 9.51 a | 7.29 a | - | $\hat{Y}$ = 24.0250 – 0.1744x | 0.93** |
| FHIA-18 | 9.21 b | 8.41 a | 7.26 a | - | $\hat{Y}$ = 11.2255 – 0.0390x | 0.99** |
| BRS Platina | 7.70 b | 8.00 a | 8.20 a | - | $\hat{Y}$(mean) = 7.96 | - |
| *Mean* | - | - | - | | | |
| CV (%) | 8.97 | | | | | |
| Length (mm) | | | | | | |
| Prata-Anã | 100.82 b | 102.08 c | 101.80 b | - | $\hat{Y}$(mean) = 101.56 | - |
| FHIA-18 | 108.08 a | 109.36 a | 109.85 a | - | $\hat{Y}$(mean) = 109.09 | - |
| BRS Platina | 90.34 c | 92.36 b | 98.04 b | - | $\hat{Y}$(mean) = 82.0333 + 0.1540x | 0.93** |
| *Mean* | - | - | - | | | |
| CV (%) | 1.80 | | | | | |
| Diameter (mm) | | | | | | |
| Prata-Anã | 16.33 a | 17.93 a | 18.59 a | - | $\hat{Y}$(mean) = 17.62 | - |
| FHIA-18 | 15.06 a | 14.73 b | 14.90 b | - | $\hat{Y}$ = 14.2255 + 0.0452x | 0.95** |
| BRS Platina | 10.53 b | 12.96 b | 15.46 b | - | $\hat{Y}$ = 5.5894 + 0.0986x | 0.99** |
| *Mean* | - | - | - | | | |
| CV (%) | 6.27 | | | | | |
| Firmness (N) | | | | | | |
| Prata-Anã | 21.13 a | 29.25 a | 22.83 a | - | $\hat{Y}$(mean) = 24.41 | - |
| FHIA-18 | 21.53 a | 21.93 b | 21.82 a | - | $\hat{Y}$(mean) = 21.76 | - |
| BRS Platina | 25.63 a | 22.42 b | 20.92 a | - | $\hat{Y}$ = 30.0650 – 0.0943x | 0.96* |
| *Mean* | - | - | - | | | |
| CV (%) | 10.36 | | | | | |

Average values within a column with different letters are significantly different according to Tukey's test ($p<0.05$)
* and ** (Indicates significant differences at $p< 0.05$ and $p<0.01$, respectively)

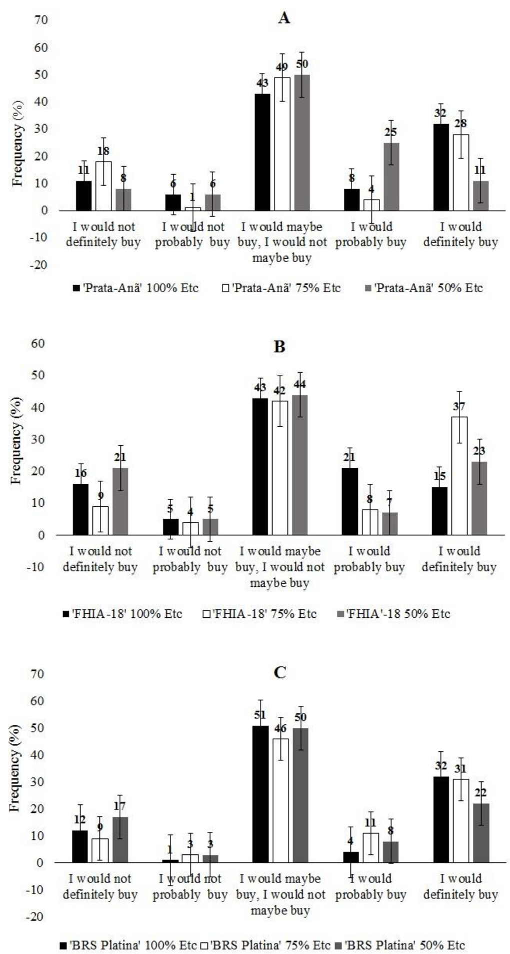


**Fig 1.** Distribution of the grades frequency (%) regarding purchase intention of 100 consumers: 5-point structured scale, which ranged from "I would not definitely buy" (1) "I would definitely buy" (5). A: 'Prata-Anã'; B: 'FHIA-18' and C: 'BRS Platina'.

**Table 2.** Instrumental color (Luminosity - L*, Chroma - C*, angle of color - °Hue), soluble solids and titratable acidity (g malic acid 100 g $^{-1}$ pulp) of dried bananas processed from irrigated genotypes with different irrigation levels.

| Genotypes | Irrigation levels | | | | | |
|---|---|---|---|---|---|---|
| | 50 | 75 | 100 | *Mean* | Equation | $R^2$ |
| L* | | | | | | |
| Prata-Anã | 44.38a | 58.33a | 52.04 a | - | $\hat{Y}$= -44.2466+2.5823x- 0.0161x² | 0.99** |
| FHIA-18 | 52.70a | 42.36b | 48.10 a | - | $\hat{Y}$ = 121.63 – 2.0216x + 0.0129x$^2$ | 0.99** |
| BRS Platina | 50.29a | 42.49b | 51.83 a | - | $\hat{Y}$= 117.2533 – 2.0244x+ 0.0137x$^2$ | 0.99** |
| *Mean* | - | - | - | | | |
| CV (%) | 8.46 | | | | | |
| C* | | | | | | |
| Prata-Anã | - | - | - | 28.84 a | - | - |
| FHIA-18 | - | - | - | 29.46 a | - | - |
| BRS Platina | - | - | - | 28.57 a | - | - |
| *Mean* | 28.91 | 28.28 | 29.66 | | $\hat{Y}$= 28.95 | |
| CV (%) | 5.54 | | | | | |
| °Hue | | | | | | |
| Prata-Anã | 73.20 a | 75.47a | 68.10a | - | $\hat{Y}_{(mean)}$= 72.26 | - |
| FHIA-18 | 69.44 a | 58.20b | 71.06a | - | $\hat{Y}$= 169.0900-2.9247x+0.0192x$^2$ | 0.99** |
| BRS Platina | 71.15 a | 62.27b | 73.21a | - | $\hat{Y}$= 154.5867-2.4205x+0.0159x$^2$ | 0.99** |
| *Mean* | 70.79 | 65.31 | 71.26 | | | |
| CV (%) | 4.92 | | | | | |
| Soluble solids | | | | | | |
| Prata-Anã | - | - | - | 63.03 a | - | - |
| FHIA-18 | - | - | - | 63.66 a | - | - |
| BRS Platina | - | - | - | 63.13 a | - | - |
| *Mean* | 61.03 | 62.67 | 66.12 | 63.27 | $\hat{Y}$= 57.3322 + 0.0727x | 0.99* |
| CV (%) | 10.71 | | | | | |
| Titratable acidity | | | | | | |
| Prata-Anã | 0.91 ab | 0.63 a | 0.78 b | - | $\hat{Y}$= 2.3333 – 0.04786x + 0.00003x$^2$ | 0.99** |
| FHIA-18 | 1.13 a | 0.74 a | 0.91 a | - | $\hat{Y}$= 2.9200-0.0626x+0.0004x² | 0.99** |
| BRS Platina | 0.67 b | 0.63 a | 0.63 c | - | $\hat{Y}_{(mean)}$= 0.64 | - |
| *Mean* | - | - | - | | | |
| CV (%) | 10.95 | | | | | |

Average values within a column with different letters are significantly different according to Tukey's test (p<0.05)
* and ** (Indicates significant differences at p< 0.05 and p<0.01, respectively)

**Table 3.** Averages assigned by the tasters (100) in the acceptance of dried bananas (hedonic scale that ranged from 1= I totally disliked 9 = I totally liked).

| Genotypes | Irrigation Levels | | |
|---|---|---|---|
| | 50 | 75 | 100 |
| | Acceptance of general appearance | | |
| Prata-Anã | 5.87 Ba | 5.85 Ba | 6.63 Aa |
| FHIA-18 | 5.57 Ba | 6.31 Aa | 5.75 ABab |
| BRS Platina | 5.67 Ba | 6.39 Aa | 6.11 ABb |
| | Acceptance of color | | |
| Prata-Anã | 5.65 Ba | 5.75 Bb | 6.65 Aa |
| FHIA-18 | 5.56 Ba | 6.46 Aa | 5.96 ABb |
| BRS Platina | 5.95 Ba | 6.63 Aa | 6.22 Bab |
| | Acceptance of texture | | |
| Prata-Anã | 6.96 Aa | 6.15 Ba | 6.24 Ba |
| FHIA-18 | 5.02 Cb | 6.45 Aa | 5.74 Bab |
| BRS Platina | 5.35 Ab | 5.91 Aa | 5.62 Ab |
| | Acceptance of flavor | | |
| Prata-Anã | 6.92 Aa | 6.08 Ba | 6.44 ABa |
| FHIA-18 | 5.87 Bb | 6.61 Aa | 5.96 Ba |
| BRS Platina | 6.19 Ab | 6.39 Aa | 6.12 Aa |

Different capital letters in the same row and minuscule in column indicate significant differences (p<0.05).

Analyzing the dried bananas diameter in each irrigation level, it was observed that 'Prata-Anã' genotype presented the highest diameter values in all the studied irrigation levels (p<0.05). In the specific case of irrigation level at 50% of the ETc, the diameter values of dried bananas from 'Prata-Anã' and 'FHIA 18' genotypes were statistically equal (p<0.05).

The dried bananas firmness derived from the variety BRS Platina was influenced by different amounts of water available during the plants cultivation (p<0.05), showing adjustment of the linear model, in which every 1% of increase in the level, there was loss of 0.0943 N. There was no influence of irrigation levels in dried bananas processed from Prata-Anã and FHIA-18 genotypes (p>0.05). Analyzing the genotypes in isolation, dried bananas derived from 'Prata-Anã' in irrigation levels of 75% of the ETc showed greater firmness than the other studied genotypes (p<0.05). In a study with *in natura* fruits, Pimentel et al. (2010) observed greater firmness in bananas 'Prata-Anã' in relation to the fruit of BRS Platina genotype in different maturation degrees.

### *Effect of water deficit on the color, soluble solids and acidity of dried bananas*

In Table 2, the results of color, soluble solids and titratable acidity are exhibited.

The irrigation levels effect was verified ($p<0.05$) under the dried bananas color, the luminosity (L*) and the angle of color (˚Hue). As for the luminosity, there was fit of the quadratic model ($p<0.05$), in which 'Prata-Anã' dried bananas derived from fruit irrigated with the level 75% were clearer (higher value of L*) unlike the 'FHIA-18' and 'Platina' dried bananas, which received less luminosity in this level, indicative of being darker. In some consumer markets, the dried bananas' darker color is synonymous of quality (Batista et al., 2014).

The dried bananas color intensity (C*) was not significantly different ($p>0.05$) among the products processed from different levels, with means of 28.84 ('Prata-Anã'), 29.46 ('FHIA-18') and 28.57 ('BRS Platina').

As to the color tone (ºHue), the model that best fits to the FHIA-18 and BRS Platina genotypes was the square ($p<0.05$), with lower values of ºHue in the intermediary level. Prata-Anã presented no adjustment of model ($p>0.05$). It is observed that, as occurred with the luminosity, the ºHue in dried bananas obtained from the drying of 'Prata-Anã' bananas irrigated with the level 75% were significantly higher than 'FHIA-18'. Neves et al. (2012) reported that, after the bananas dehydration, lower values of L* and ºHue express higher pulp darkening, indicative of , therefore ´Prata-Anã'dried bananas with golder and darker coloring in the ones processed from 'FHIA-18'.

The soluble solids content of the dried bananas was not influenced by the irrigation levels and the genotypes ($p<0.05$), with averages of 63.03° Brix, 63.66° Brix and 63.13° Brix in the dried bananas derived from Prata-Anã, FHIA-18 and BRS Platina genotypes, respectively. Some authors, however report that irrigation may reduce the solube solids content due to the dillution effect in the juice such as in citrus (Zanini et al.,1998), or the sugars accumulation promoted by the deficit in the first days of defficiency, in order to increase its osmotic potential, allowing the increase of turgescence, aiming at a osmoprotection through the stabilization of the sub-cellular structures. (Fillipou, 2011). According to Santos et al. (2011) the soluble solids are one of the most relevant characteristics from the point of view of the processing industries, because it measures indirectly the sugar content of the same. Thus, for this variable, it is possible to choose the smallest irrigation level, since there was no influence of different quantities of water offered to plants during their cultivation, not even difference among the genotypes ($p<0.05$).

The titratable acidity in dried bananas was influenced by different irrigation levels ($p<0.05$), in which the dried bananas from Prata-Anã and FHIA-18 genotypes exhibited fit of quadratic equation, with less content of malic acid in the intermediary level. The dried bananas acidity obtained from fruits of 'BRS Platina' banana was not influenced by the different availability of water for irrigation ($p>0.05$), with an average of 0.64 g malic acid. Mota (2005) working with dried bananas from different varieties, acidity of 1.70% in the Prata cultivar was found, superior value than the present study.

### *Sensory analysis*

Regarding the purchase intention (Figure 1), based on appearance, it is observed that for the Prata-Anã genotype, 17%, 19% and 14% opted for not to buy the dried bananas in which the plants were irrigated with the levels 100%, 75% and 50%, respectively (Figure 1A). In contrast, 41%, 32% and 36% would buy these respective dried bananas, indicative of a greater rejection of the processed product with fruits whose plants were given the intermediary amount of water (75% ETc) in irrigation. The lowest rejection and indecision and greater acceptance was perceived in the dried bananas of the same genotype in the irrigation level of 100% ETc. For 'FHIA-18', 21%, 13% and 26% rejected the product processed from the fruits of this genotype irrigated with the respective levels 100, 75, and 50% of the ETc (Figure 1B). The opposite, 36%, 43% and 36% showed interest in buying products from such levels, showing better results in the intermediary irrigation level, as well as observed for 'Prata-Anã', with higher purchase intention and less rejection by the consumers. Concerning the purchase intention of dried bananas processed with fruits of 'BRS Platina' banana, 13%, 12% and 20% showed no interest in buying the product derived from the respective irrigation levels of 100, 75, and 50% of the ETc (Figure 1C). When they chose to buy, 36%, 42% and 30% of consumers responded that they would buy the dried bananas derived from the drying of fruits irrigated with the respective levels. In addition, as occurred with the dried bananas of FHIA-18 genotype, the least rejection and indecision and highest purchase interest was for the product with the intermediary level. In table 3 the following points are exhibited: results obtained in the sensory acceptance of the general appearance, color, texture, and flavor, with effect of the levels on these attributes ($p<0.05$).

About the acceptance of the general appearance ($p<0.05$), the dried bananas processed from the Prata-Anã genotype received an average grade of acceptance only in the irrigation level 100%, differing from the other level, that received average grades regarding the indecision. Consumers liked better the dried bananas from the fruits of 'FHIA-18' and 'BRS Platina' bananas irrigated with 75% of ETc, differing from the products t coming from the level 50% of ETc, which received lower average grade, denoting indecision on the part of consumers (grade 5.57 and 5.67, respectively). Among genotypes, there was a significant difference only in the level 100% ETc, in that consumers liked better dried bananas derived from fruits of 'Prata-Anã' banana than the 'BRS Platina' fruit.

When it comes to the dried bananas color, the product derived from the drying of fruits from Prata-Anã genotype cultivated with total water availability (100% ETc) was accepted by consumers, differing from the other levels ($p<0.05$), where consumers were undecided as to the liking of the color of the same. Whereas the best acceptance of dried bananas obtained from the fruits processing from FHIA-18 genotype occurred at the level 75%, differing from the average received from the level 50%. Similarly, consumers liked better the 'BRS Platina' dried bananas whose plants were irrigated with 75% ETc (grade 6.63), grade significantly higher ($p<0.05$) to those received by products of the levels 50% and 100% (5.95 and 6.22, respectively). Analyzing the acceptance among the genotypes, lower grades are noted attributed to dried bananas processed with 'Prata-Anã' bananas irrigated with the intermediary level (5.85). This result may be related to the ligher coloring of this product (higher values of L* and °Hue) (Table 2) not to be well accepted by study participants and, therefore, in accordance with Batista et al. (2014) who mentioned that in some consumer markets, the dried bananas darker color is synonymous of quality.

Regarding the acceptance of the firmness attribute, it is noted that, for the 'Prata-Anã' genotype, the dried bananas whose plants received less quantity of water, received the highest grade average ($p<0.05$), superior to other levels, indicating that consumers prefer one product with a softer firmness, since the final firmness of this product was the lowest among the levels (Table 1). The dried banana obtained from the fruits processing from FHIA-18 genotype gained higher grade with the intermediary level, differing from the other levels ($p<0.05$), and the firmness acceptance of the 'BRS Platina' dried bananas was similar for all three levels.

As for the attribute flavor, Prata-Anã genotype received the lowest average ($p<0.05$) in the dried bananas whose plants were irrigated with 75% ETc. Oppositely, consumers liked better the product derived from the drying of 'FHIA-18' fruits in this same level. For dried bananas derived from the BRS Platina genotype, there was no difference among flavor averages obtained at the acceptance test ($p>0.05$). Analyzing the consumer acceptance among the dried bananas of different genotypes, in isolation, there was a difference only for 'Prata-Anã'' in the level 50% ($p<0.05$), with greater acceptance for this product. When invited to describe what they liked the most in the product, 51% of consumers defined 'Prata-Anã' dried banana, which received the irrigation level of 50% of the ETc as delicious/sweet, against 45% for 'BRS Platina' 50% ETc and only 34% for 'FHIA-18' 50% ETc, which may explain the best acceptance by the product of the variety Prata-Anã irrigated with the lowest irrigation level.

## Material and Methods

### *Plant materials*

The banana plantation from which the fruits were harvested was implanted in 2014, in semi-arid region of Minas Gerais located in the Experimental Field of Gorutuba, belonging to Empresa de Pesquisa Agropecuária de Minas Gerais - Epamig, in Nova Porteirinha. The local altitude is 500 m, with latitude 15° 47' 29'' S, longitude 43° 17' 88'' E, and rainfall, annual average of 800 mm. The planting spacing used in this area was 2.0 x 2.5 m and irrigation performed through microsprinkler.

A factorial design of 3 x 3 was used in a completely randomized design, being the treatments for the studied genotypes: Prata-Anã, FHIA-18 and BRS Platina and the irrigation levels applied to these genotypes for 50, 75 and 100% of crop evapotranspiration (ETc), with 3 replications, where each repetition was composed of 1 bunch of bananas with approximately 15 fruits.

At the time of harvest, regarding the sixth cycle of production, the fruits were exempt from physical damage (injuries), with the degree of maturity stage 1 (totally green peel). After the harvest, the fruits were brought to the Laboratory of Technology of Plant Origin Product Processing of Department of Agricultural Sciences of the State University of Montes Claros (Unimontes) for processing and ratings of dried bananas.

### *Dried bananas processing*

After the bananas reached the stage 6 of maturation, these were washed in running water, sanitized in sodium hypochlorite solution at a concentration of 100 mg $L^{-1}$ for 15 minutes, rinsed in clean water and peeled by hand. Then, the fruits were weighed and placed in trays and taken to be dried in the dryer trays with forced air circulation (brand Pardal, model PE14), under drying temperature of 65°C for 24 h. After this time, the dried bananas were removed, left to cool, packed in styrofoam trays, covered with PVC film and stored for physical, chemical and sensory evaluations.

### *Physical and chemical analyzes*

The moisture content was determined by the difference in the initial sample weight and the final weight after heating in an oven with air circulation at 105 °C to constant weight. The length and diameter of the dried-bananas were performed with the aid of a manual pachymeter, with unit of measure expressed in mm. The dried parts firmness was measured with the aid of a digital penetrometer, in the equatorial region of the product, with a unit of measure expressed in Newton (N).

The instrumental color of dried bananas occurred in terms of Luminosity (L*), chromaticity (C*) and angle of color (ºHue), through the Minolta Colorimeter, model Chroma meter CR 400, L C H., system L C H. The luminosity (L*) varied between 0 (darker) and 100 (lighter), for the chromaticity or color purity (C*), values relatively inferior represent impure colors (lower pigments saturation) and the superior, pure colors (greater pigments saturation). The hue angle or true color (ºHue), varies between 0º and 360º, being that the angle 0° corresponds to the red color 90 of the yellow color , 180º or - 90° the green color and 270° or -180° the blue color . For the evaluation of soluble solids and titratable acidity, dried bananas were triturated in water, at a ratio of 1:1, in order to obtain a homogeneous sample. After homogenization, the soluble solids evaluation was performed with reading on digital refractometer and result expressed in °Brix and titratable acidity, determined by titration and expressed in g malic acid 100 $g^{-1}$ pulp (Adolfo Lutz Institute, 1987).

### *Sensory analysis*

For the realization of the sensory analysis, one hundred participants, among them, employees, trainees and students from Unimontes and Epamig aged between 18 and 60 years, banana-dried consumers took place of the study. In the sensory analysis room of Unimontes, samples were presented monadically to the participants. Upon receiving the samples, consumers evaluated the dried bananas and were asked, based on overall appearance, if they would buy or not the product, using a scale of five points, which ranged between 1: Definitely would not buy up to 5: Definitely would buy.

In the product acceptance, the consumers were requested to observe the whole dried banana and expressed how much they liked the overall look and color and then tasted a piece of the sample, to express how much they liked the texture and flavor, by means of a hedonic scale of nine points, which ranged from 1: I totally disliked 9: I totally liked. The consumers still could describe, in a specific field, what they liked and disliked the most regarding the dried bananas. The samples were offered in plastic dishes, at room temperature. The tasters had water at their disposal to rinse mouth.

The participants read and signed an informed consent form, previously submitted and approved by the Human Research Ethics Committee of State University of Montes Claros, with approval number 1.349.848.

### *Statistical analysis*

For the physical and chemical data, analysis of variance was carried out in the data treatment, in which the irrigation levels effect, was determined by regression analysis at confidence level of 95% ($p<0.05$), according to Pimentel Gomes (1990) and the variety was compared by the Tukey test. In the sensory analysis, analysis of variance was applied in the treatment of hedonic scale data, considering sample and consumers as a source of variation. To investigate the irrigation effect and the differences among the genotypes, the Tukey test was applied at a confidence level of 95% ($p<0.05$).

## Conclusion

The different irrigation levels alter the physical and chemical attributes of dried bananas processed from Prata-Anã, FHIA-18 and BRS Platina genotypes. As for the attributes appearance, color, texture, and flavor, there is greater acceptance of consumers for the banana processed from 'Prata Anã' irrigated with the level related to 100% of ETc. The dried banana processed from 'BRS Platina' is the least accepted in the sensory tests.


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