Acorbat Revista de Tecnología y Ciencia

Defoliation and leaf surgery for Sigatoka control in the subtropics

Carlos Henrique Nicoleite[1]; Luiz Augusto Martins Peruch[2]*; Márcio Sônego[3]; Gessina Zaniboni[4]

[1]Unibave, Orleans, SC, 88870-000, [2]Epagri/sede, Florianópolis, SC,88840-000, [3]Epagri/EEUr, Urussanga, SC, 88840-000, [4]Udesc, Florianópolis, SC, 88870-000

***Autor de Correspondencia:**
Luiz Augusto Martins Peruch
lamperuch@epagri.sc.gov.br

Contribución:
Tecnológica

Sección:
Fitosanidad

Recibido:
15 Diciembre, 2023
Aceptado:
15 Enero, 2024
Publicado:
16 Abril, 2024

Cita:
Nicoleite CH, Martins PLA, Sônego M and Zaniboni G. 2024. Defoliation and leaf surgery for Sigatoka control in the subtropics. *Acorbat Revista de Tecnología y Ciencia* 1(1): 23
https://doi.org/10.62498/ARTC.2423

RESUMEN

Este estudio tuvo como objetivo evaluar el efecto de la defoliación y la cirugía para el control de la Sigatoka in banana 'Prata Anã' (AAB). Los tratamientos ensayados fueron: DEF- Defoliación (remoción de hojas con >30% de severidad); SUR- Cirurgía (eliminación de partes de la enfermedad con <15 % de gravedad); DS- Defoliación y cirurgía; NT- Sin tratamientos. La enfermedad se cuantificó mediante la determinación de la suma bruta (GS), la hoja más joven manchada (YLS) y la severidad en la quinta hoja (5LS). Los tratamientos se repitieron a intervalos de 30 días en un área certificada orgánica en el sur de Brasil desde marzo/2016 hasta marzo/2017. Los datos se sometieron a análisis de varianza y prueba de Duncan (5% de error). Los tratamientos fueron más efectivos en primavera y verano. SUR, DEF y su combinación redujeron la suma bruta en un 40-69 % y 5 LS en un 87 % en la primavera en comparación con NT. En el verano se observaron diferencias significativas del 21, 45 y 73% para YLS, GS y 5LS, respectivamente. Teniendo en cuenta los resultados, independientemente del tipo de deshojado aplicado, la práctica es importante para el control de la enfermedad.

Palabras clave: *Pseudocercospora musicola*, defoliation, severidad, fitosanidad.

ABSTRACT

This study aimed to evaluate the effect of defoliation and leaf surgery for the Sigatoka disease control in 'Dwarf Prata' bananas (AAB). The treatments tested were: DEF. Defoliation (removal of leaves with >30% of severity); SUR. Surgery (removal of spotted parts with <15% severity); DS- Defoliation and surgery; NT- No treatments. The disease was quantified by the determination of gross sum (GS), Youngest leaf spotted (YLS) and severity in 5th leaf (5LS). Treatments were repeated at 30 days interval in an organic certified area in the South of Brazil from march/2016 to march/2017. Data were subjected to analysis of variance and Duncan test (5% error). Treatments were more effective in the spring and summer. SUR, DEF and their combination reduced gross sum by 40-69% and 5LS by 87% in the spring compared to NT. In summer significant differences of 21, 45 and 73% were observed for YLS, GS and 5LS, respectively. Considering the results, regardless the type of leaf removal applied the practice is important to control the Sigatoka disease in banana plants.

Keywords: *Pseudocercospora musicola*, defoliation, severity, phytosanity.

INTRODUCTION

In the State of Santa Catarina, banana is the main cultivated fruit, occupying about 30,000 hectares and producing about 650,000 tons annually. In this region, yellow Sigatoka (*Pseudocercospora musicola*) and black Sigatoka (*P. fijiensis*) are present in banana plantations (Lichtemberg et al. 2010), causing considerable losses in fruit production. However, according to studies yellow Sigatoka still prevails in the subtropical conditions of the Santa Catarina State (Peruch et al., 2010; Peruch et al., 2022), but this situation is slowly changing. Studies report that the incidence of black Sigatoka is growing in the north of the state (Dos Santos et al., 2022). Fungicides sprays, management of weeds, resistant cultivars, and defoliation of diseased leaves are some of the control methods recommended for managing the Sigatoka complex diseases (Marin et al. 2003, Lapeyre de Bellaire et al. 2010).

The elimination of diseased leaves is a common practice for disease control in the banana production system (Ganry et al., 2012; Peruch et al., 2015). Defoliation is a practice largely adopted, but surgery is growing in importance in the last few years, but more information is necessary to quantify its effects (Peruch et al., 2015), specially in subtropical conditions. The defoliation frequency varies according to the year's season in subtropical climates. In Winter/autumn, defoliation is applied once a month, and in spring/summer, it is applied in 15-day intervals. The objective of this research was to evaluate the effect of defoliation and surgery for Sigatoka control in a banana production system in subtropical climate.

MATERIALS AND METHODS

The experiment was carried out in a certified commercial area of organic banana planted with cultivar Dwarf Prata (AAB) in subtropical conditions of the south of Brazil (28°45’20’’ S; 49°23’49’’ W) from March/2016 to March/2017. The region's climate is Humid Subtropical with Hot Summer (Cfa), according to the Koeppen classification. The average annual temperature is 19.4 °C, ranging from 14.6 °C in June to 24.1 °C in February. Total annual precipitation is 1,624 mm, with rainfall well distributed throughout the year and no defined dry season. The annual average relative humidity is 80%, ranging from 76% in December to 83% in June, with frequent dew formation, especially in autumn, winter and spring.

Banana plantation management in the experimental area was carried out according to technical recommendations for this crop in the organic system (Brazil,

2003). The banana mats were conducted in the mother-daughter-granddaughter system, with shoots being thinned when necessary. Fertilization was applied based on soil analysis with rock powder (3 t ha^{-1}.year) and poultry manure Niorg (1,8 t.ha^{-1}.year). Weed management was carried out by manual mowing during the experiment. No pesticides were applied in the culture management for control of diseases, insects or weeds.

In this experiment four treatments were tested: DEF- Defoliation (removal of leaves with >33% of severity); SUR- Surgery (removal of spotted parts in leaves with <15% severity); DS- Defoliation and surgery; NT- No treatments. Treatments were repeated in 30 days interval from March/2016 to March/2017. Disease was quantified in two marked plants per plot by the determination of three variables: gross sum (GS), youngest leaf spotted (YLS) and severity in 5th leaf (5LS). Gross sum was quantified by the evaluation of the disease in the youngest leaves (2, 3 and 4), considering the type of lesion and its density on the leaves (Bureau et al., 1992). The youngest leaf spotted (YLS) was evaluated as the first leaf that has 10 spots with gray centers (Carlier et al., 2003). Severity in 5th leaf (5LS) was the degree of the leaf affected by the disease, determinated using the Stover scale with different degrees of severity (0, 1, 5, 15, 33 and 50%). Bunch weight were also quantified in this study by the evaluation of two bunches per plot. Disease variables were evaluated in a 14 days interval to calculate a season mean value (autumn, winter, spring and summer) and bunch weight was evaluated in the final period of the experiment (summer).

The experiment adopted the randomized complete design with five repetitions. Each repetition consisted of 80 m^2 plot. Data were submitted to analysis of variance and to the mean separation test Duncan (5% error). The statistical analysis was performed by the R program version 3.5.1.

RESULTS AND DISCUSSION

The effect of leaf diseased removal showed marked differences in different seasons of the period evaluated. Treatments were more effective to control yellow Sigatoka in seasons with lower disease pressure, spring and summer (Figure 1A, 1C). No significant differences were observed for the treatments in the autumn and winter, except for treatment DS in the autumn (Figure 1B).

Surgery, defoliation and their combination improved the disease control with a reduction of the gross sum by 40-69% and 5LS by 87% in the spring compared to NT.

Sigatoka was also reduced by the leaf removal treatments considering the YLS variable in the spring, because an improvement of 18-21% was observed in this variable. In the summer, all treatments of leaf removal improved disease control for GS and 5LS variables compared with NT. Differences between 21 and 73% were observed for GS and 5LS, respectively (Figure 1A, 1C).

On the other hand, treatments failed to improve disease control in seasons with higher disease pressure, except for DS that improved YLS by 22% compared to NT in the autumn. The other variables did not show significant differences in fall and winter periods.

The analysis did not reveal differences regarding the weight of the bunch in the different leaf removal treatments (Figure 2). Only small differences were observed between treatments in this study. Jimenez and Brioso (2018) determined that surgery to control black sigatoka can improve banana production by up to 300% in small producers. According to Ganry et al. (2012) leaf removal must be a regular practice in banana where black Sigatoka is presente, but taking into account that it could affect the production beyond certain level.

Leaf removal is a cultural control method usually recommended for Sigatoka disease (Marin et al., 2003; Peruch et al., 2015; Peruch et al., 2016). Surgery is a practice that can be as efficient as leaf removal, but more research is necessary to determine when its results out stand defoliation. According to Peruch et al. (2016) surgery performed better when applied to leaves with low severity of Sigatoka, especially in conditions of lower disease pressure. Another aspect that should be considered is the frequency of defoliation. Guzman & Villalta (2006) obtained satisfactory results with weekly defoliations, while Peruch et al. (2015) found no differences in treatments with monthly defoliation.

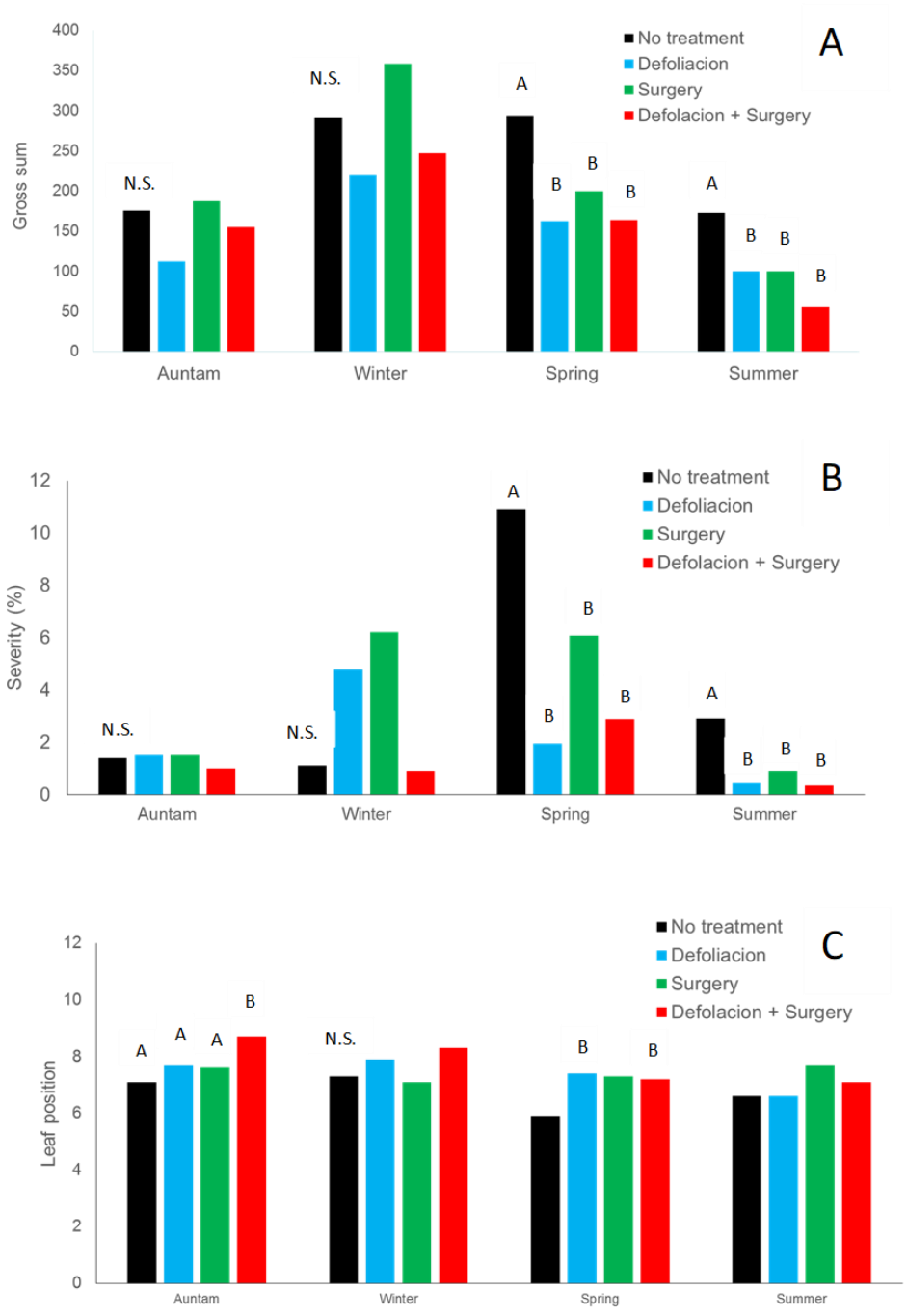

Figure 1. Gross sum-GS (A), severity in the fifth leaf- 5LS (B) and youngest leaf spotted-YLS (C) of yellow Sigatoka in banana plants submitted to leaf removal in the subtropical South of Brazil in the 2016-2017 period. Columns followed by different letters marks significantly differences by Duncan test (P <5% error).

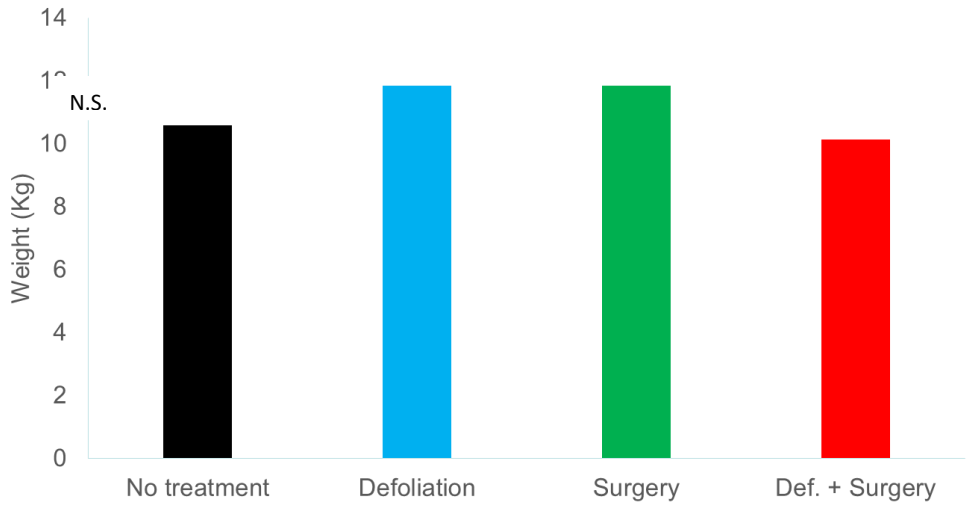

Figure 2. Bunch weight average of banana plants submitted to different treatments of leaf removal in organic commercial orchard in the subtropical region of Brazil in the 2016-2017 period. N.S. – Treatments are not significantly different by F test (P <5% error).

This study determinate that both practices, defoliation and surgery, are important for disease control. There were no differences among the practices (defoliation and surgery) and their combination did not improve yellow sigatoka control. It was also clear that better results were achieved in lower disease pressure (spring and summer) in subtropical conditions. Wielermaker (2018), for example, considers defoliation as the main disease control method for black Sigatoka in organic production in Ecuador under tropical conditions.

CONCLUSIONS

Considering the results, the practice of defoliation is important to Sigatoka disease control in banana plants, regardless of the type of leaf removal applied. Leaf removal improved disease control in periods of lower disease pressure.

Acknowledgments: the article was supported by Acafruta, SC, Brazil

REFERENCIAS

1. Bureau E, Marin D, Guzman, JA. 1992. El sistema de preaviso para el combate de la sigatoka negra en banana y plátano. Panamá: UPEB. 40p.
2. Brazil. Ministry of Agriculture, Livestock and Supply. Law No. 10831, of December 23, 2003. Published in the Official Gazette of the Union, Brasilia, 2003, Section 1, Page 8.
3. Carlier J., Waele D DE, Escalant JV. 2003. Global evaluation of *Musa* germplasm for resistance to *Fusarium* wilt, *Mycosphaerella* leaf spot diseases and nematodes. The International Network for the Improvement of Banana and Plantain, Montpellier, France. 57p. (INIBAP Technical Guidelines, 6).
4. Dos Santos F, Miola A, Cardoso FK, Mees A, Peruch LAM, Mojolla GS. 2022. Avaliação temporal da ocorrência da sigatoka-negra em Santa Catarina. Memoirs of the XXII Congresso brasileiro de fruticultura. Florianópolis, Brasil. p. 262.
5. Ganry J, Fouré E, Bellaire ll, Lescot T. 2012. An integrated approach to control the black leaf streak disease (BLSD) of bananas, while reducing fungicide use and environmental impact. In: Dharumadurai D, Thajuddin N, Panneerselvam, A. (Org.). Fungicides for plant and animal diseases. Rijeka: InTech, p.193-226, 2012
6. Guzman M, Villalta R. 2006. Aporte de la deshoja sanitária y praticas adicionales em El control de la sigatoka negra em banano (*Musa* AAA). In: Manejo de la sigatoka negra em banano y plátano en America Latina y El Caribe. Resumenes. San Jose: Corbana-Inibap-Musalac. p.21
7. Jimenez JLS, Brioso PST. 2018. Surgery or surgical defolation in 'Grand Naine' banana in the control of black Sigatoka in the state of Rio de Janeiro. Rev. Bras. Frutic. 40: e-144.
8. Lichtemberg LA, Peruch LAM, Hinz RH, Pereira AM, Gasparotto L, Ferrari JT, Moraes WS. 2010. Black sigatoka dissemination in Brazil. Memoirs of the XX ACORBAT International Meeting. Medellin, Colombia. p.538-551.
9. Marín DH, Romero AR, Guzman M, Suton TB. 2003. Black sigatoka: an increasing threat to banana cultivation. Plant Disease, 87:3, p.208-222.
10. Peruch LAM, Medeiros AM; Albuquerque Junior CL de. 2015. Biomassa cítrica e fungicidas combinados com desfolha no controle da Sigatoka Amarela em banana "Prata". Revista de Ciências Agroveterinárias, 14: 234-239. Doi: 10.5965/223811711432015234.
11. Peruch LAM, Sônego M, Ferreira JV, Macarini D, Silva FP. 2010. Situação da sigatoka negra no sul de Santa Catarina e norte do Rio Grande do Sul. Annals of the I Simpósio sobre a cultura da bananeira nos subtrópicos do cone sul. Joinville, Santa Catarina p.165-172.
12. Peruch LAM, Rodrigues JAV, Silva, FA, Sônego M. 2016. Bases for application of defoliation or surgery on the yellow sigatoka control. Memoirs of the XXIII ACORBAT International Meeting. Miami, Florida. p.25
13. Wielermaker F. 2018. Organic banana cultivation and sustainability. Burleygh Dodds. pp.317-347.