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Research Article

Epidemics of dwarf cashew powdery mildew as affected by flowering periods, clones and chemical control[1]

Marlon Vagner Valentim Martins[2], Joilson Silva Lima[3],
Weverson Lima Fonseca[4], Luiz Augusto Lopes Serrano[2], Silvaldo Felipe da Silveira[5]

ABSTRACT

Epidemics of cashew powdery mildew are observed every year in most of the growing regions in Northeast Brazil. Currently, fungicide management is the main disease control strategy. This study aimed to compare powdery mildew epidemics according to the flowering periods in 2014 and 2019, in different dwarf cashew clones in 2018 and 2021, and with or without chemical control in 2016 and 2020. The disease severity data were used to calculate the variables area under the disease progress curve, final disease and onset of the epidemics, and the monomolecular linear model was used to calculate the initial disease incidence and disease progress rate. Regarding the flowering effect, it was found that, in 2014, the first flowering period stood out from the others for initial disease incidence, disease progress rate and area under the disease progress curve. In 2019, the third flowering period showed the lowest levels of initial disease incidence, area under the disease progress curve and final disease. As for the clones, 'BRS 226' stood out as the most resistant for most the disease variables in the two years of the study. The fungicide sprays had a significant effect and prevented the powdery mildew epidemics in the two years of the study. The powdery mildew epidemics showed to be more severe in the first flowering period and can be reduced by using chemical control and more resistant dwarf cashew clones.

KEYWORDS: *Anacardium occidentale*, *Erysiphe quercicola*, *Pseudoidium anacardii*.

RESUMO

Epidemias de oídio do cajueiro-anão em função dos períodos de floração, clones e controle químico

Epidemias de oídio do cajueiro são constatadas todos os anos na maioria das regiões de cultivo do Nordeste do Brasil. Atualmente, o manejo com fungicidas é a principal medida de controle da doença. Objetivou-se comparar epidemias de oídio conforme as épocas de florada em 2014 e 2019, em diferentes clones de cajueiro-anão em 2018 e 2021 e com ou sem controle químico em 2016 e 2020. A severidade da doença foi usada para calcular a área abaixo da curva de progresso da doença, doença final e início da epidemia, e o modelo linear monomolecular para calcular a doença inicial e a taxa de progresso. Quanto ao efeito das floradas, verificou-se que, em 2014, a primeira florada se destacou das demais para incidência inicial, taxa de progresso e área abaixo da curva de progresso da doença. Em 2019, a terceira florada apresentou os menores níveis de incidência inicial, área abaixo da curva de progresso e doença final. Quanto aos clones, o 'BRS 226' se destacou como o mais resistente para a maioria das variáveis nos dois anos de avaliação. As pulverizações com fungicidas apresentaram efeito significativo e contiveram as epidemias nos dois anos de estudo. As epidemias do oídio mostraram-se mais severas na primeira florada e podem ser reduzidas empregando-se o controle químico e clones de cajueiro-anão mais resistentes.

PALAVRAS-CHAVES: *Anacardium occidentale*, *Erysiphe quercicola*, *Pseudoidium anacardii*.

INTRODUCTION

Cashew (*Anacardium occidentale* L.) nut is the primary product exploited in Brazil and in the international market (Serrano & Pessoa 2016), and there is a great potential for value addition when the peduncle is better utilized. However, the cashew powdery mildew caused by the anamorphic state of *Erysiphe quercicola* [named *Pseudoidium anacardii* (Noack) U. Braun & R.T.A.Cook], formerly known as *Oidium anacardii* (Cardoso et al. 2017), occurs in all producing regions of Brazil and causes damage

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[2] Empresa Brasileira de Pesquisa Agropecuária (Embrapa Agroindústria Tropical), Fortaleza, CE, Brazil.
E-mail/ORCID: marlon.valentim@embrapa.br/0000-0003-2728-304X; luiz.serrano@embrapa.br/0000-0002-4596-2807.
[3] Instituto Federal de Educação, Ciência e Tecnologia, Sobral, CE, Brazil.
E-mail/ORCID: joilson.lima@ifce.edu.br/0000-0001-8312-0005.
[4] Universidade Federal do Piauí, Bom Jesus, PI, Brazil. *E-mail/ORCID*: weversonufpi@gmail.com/0000-0002-8984-0297.
[5] Universidade Estadual do Norte Fluminense Darcy Ribeiro, Campos dos Goytacazes, RJ, Brazil.
E-mail/ORCID: silvaldo@uenf.br/0000-0002-5020-5990.

to the cashew production. Being considered the most important disease for the crop, it should not be neglected, as it causes reductions of up to 100 % in the peduncle production and irreversible damage to the nut quality.

On the eastern side of the African continent, powdery mildew also causes economic losses. In the 1980s, in Tanzania, for example, the compulsory management of the disease was a measure taken by the government to reduce the impacts on nut production (Waller et al. 1992).

The fungus that causes cashew powdery mildew infects young shoots and sporulates abundantly on these organs, and the climate of the semi-arid region of Northeast Brazil (hot days and cold and humid nights) is very favorable to the disease (Cardoso et al. 2017). Epidemics of cashew powdery mildew begin mainly when the plant produces new shoots and increase with the appearance of panicles. Leaves and panicles are more easily infected and colonized, being the organs in which the disease is initially found, indicating how much the disease progresses in the crop over time (Cardoso et al. 2014). As it is a pathogen of secondary infection cycle, the increase of the disease in the field is conditioned on the inoculum produced and on the formation of new sites of infection, such as shoots and new healthy tissues of the plant (Martins et al. 2018). At the beginning of an epidemic, the first organs to be infected that deserve all the attention are flower buds and flowers.

All clones of dwarf cashew and common cashew (non-grafted) are affected by the disease to greater or lesser levels of severity. Dwarf cashew clones are classified as early, seasonal and late, according to the panicle emergence period (Melo et al. 2016). Early clones, such as the 'BRS 189' and 'CCP 76', are those that produce new sprouts soon after the end of the rainy season, coinciding with the months of May and June, in the three largest producing Brazilian states: Ceará, Piauí and Rio Grande do Norte. Seasonal clones are the ones that bloom in the normal flowering season, following the same behavior of the native common cashew trees, flowering in the months of July and especially in August, as is the case of 'BRS 226'. Late clones flower from September onwards and concentrate their production in a short period of time.

In addition to the flowering period, some clones, such as the 'CCP 76' and 'BRS 265', usually have two to three flowering flushes, depending on the rainfall throughout the year. During the first flowering period, which occurs after the rainy season (high relative humidity), severe epidemics of the disease usually occur in the three main producing states, whether in low- or high-altitude regions. However, in high-altitude regions, which have not only high relative humidity, but also cold winds and a greater temperature range (hot days and cold nights, with night temperatures reaching close to 18 ºC), the fungus becomes much more aggressive, triggering severe epidemics of the disease. Depending on the region and the clone cultivated, several flowering periods may occur between May and December, and there may be successive epidemics to a greater or lesser extent throughout the production cycle of the crop. Martins et al. (2018) consider that the first flowering period defines how the disease will progress in the field throughout the year and that the progress of the disease may be slower in the warmer months of the year or in the final production cycle of the plant. In this case, the rate of progress tends to be lower.

In the field, the panicles produced are exposed to fungal infection and, when they are not adequately protected with fungicides, the disease may reach very high levels in a short time. Shomari & Kennedy (1998) demonstrated in Africa a rapid growth of the disease in the panicles of cashew trees not protected by fungicides. The preventive use of fungicides impedes the evolution of the disease and delays the onset of epidemics (Martins et al. 2018).

Pinto et al. (2018) compared dwarf cashew clones based on the infection rate and the disease progress curves. Sijaona & Mansfield (1998) and Maddison et al. (1998), when describing the effect of clones and sanitization on the disease, demonstrated that different powdery mildew management strategies can alter the epidemics over time.

Although powdery mildew is strategically managed with the application of fungicides, their recommendations for dwarf cashew clones can reduce the progress of the disease in the field and the dependence of the crop on fungicides alone.

Epidemiological studies on cashew powdery mildew under commercial production conditions are important to rationalize the chemical control. Thus, this study aimed to assess the epidemics of dwarf cashew powdery mildew as a function of flowering period, cultivated clone and presence or absence of fungicide application.

MATERIAL AND METHODS

The data used in the present study come from six experiments set up to obtain epidemiological variables of powdery mildew in different flowering periods, dwarf cashew clones and fungicide management. All experiments were carried out at the experimental field of the Embrapa Agroindústria Tropical, in Pacajus, Ceará state, Brazil.

Four experiments were carried out in 2014, 2016, 2019 and 2020. In 2014 and 2019, different flowering periods were evaluated; in 2016 and 2020, strategies for the management of the disease with commercial calcium-sulfur solution (‘CS’), sulfur fungicide (‘K’) and systemic fungicide trifloxystrobin + tebuconazole (‘N’) were evaluated; and, in 2020, only the sulfur fungicide (‘K’) was applied in a fixed calendar scheme and compared with the disease threshold of 10 % (‘DT 0.1’). The clone ‘BRS 189’, with 13 years, was used in the experiments.

Two adult orchards with high production, one with the clones ‘BRS 226’, ‘BRS 265’ and ‘Embrapa 51’, in 2018, and the other with the dwarf cashew clones ‘BRS 189’, ‘CCP 76’, ‘BRS 226’ and ‘BRS 265’, in 2021, were used to obtain the epidemics data.

In all the evaluation years, 10 panicles per plant were sampled around eight plants, from the beginning of the flower production until the end of the production cycle, which, in the region, comprises the period from May to December. The disease was evaluated weekly by observing the symptoms of powdery mildew in the panicles, assigning severity scores ranging from 0 to 4, based on the descriptive scale of Cardoso et al. (2012), according to which: 0 = absence of disease; 1 = up to 10 % of disease severity; 2 = between 11 and 25 % of disease severity; 3 = between 26 and 50 % of disease severity; and 4 = above 50 % of disease severity.

The severity data observed over time were used to obtain the following variables: area under the disease progress curve (AUDPC), final disease (*y*final) and onset of the epidemic (OE); and the monomolecular model {ln[1/(1 - y)]} was used to estimate the initial disease incidence (*y0*) and the disease progress rate (*r*) (Madden et al. 2007). The model was fitted through simple linear regression to severity values and evaluated for its fit to the disease data. The disease data (*y0*, *r*, AUDPC, *y*final and OE) of the treatments of each year were subjected to analysis of variance and the means compared by the Tukey test at 5 % of probability, using the R software (R Core Team 2021).

RESULTS AND DISCUSSION

In all the experiments and evaluation years, the powdery mildew symptoms were initially observed in the panicles. So, this part of the plant was selected to be always monitored after the emergence of the new shoot. During the reproductive cycles of the dwarf cashew clones, the epidemics of the disease lasted approximately up to 80 days, and this period can be considered as the main interval to monitor the disease, from the appearance of the first panicles.

The disease progress curves indicated the effect of the treatments on the epidemics, and the chemical control had a greater effect on limiting the growth of the disease, when compared to the flowering periods and the dwarf cashew clones (Figure 1).

Some management strategies, such as chemical control, limit cashew powdery mildew epidemics, but plant phenology (Martins et al. 2018) and dwarf cashew clones (Pinto et al. 2018) also interfere with the disease progress curves.

When analyzing the progress of the disease during the flowering periods of dwarf cashew in 2014 and 2019 (Figures 2A and 2B), it was found that there was a significant difference between the flowering periods, regarding initial inoculum (*y0*), progress rate (*r*), AUDPC and *y*final (Table 1). In 2014, there was a significant difference between the flowering periods for the variables *y0*, *r* and AUDPC. However, unlike in 2019, the first flowering period had the highest rate of the disease and the lowest *y0* and AUDPC. On the other hand, the averages of *y*final were similar between the flowering periods of 2014. It was possible to observe that the rate of disease progress decreased and there were significant increases in *y0* and AUDPC as new flowering periods occurred (Table 1). In 2019, the first flowering period was statistically equal to the other two flowering periods for *r*. For the other analyzed variables (*y0*, AUDPC and *y*final), the third flowering period was different from the others, with the lowest values (Table 1). In both flowering periods, the onset of the epidemic was similar and occurred at the beginning of the emergence of dwarf cashew panicles (Figures 1A and 1B).

The phenology of plants, such as flowering periods, can be included in the integrated management of the disease as a whole (Lima 2017, Martins et al.

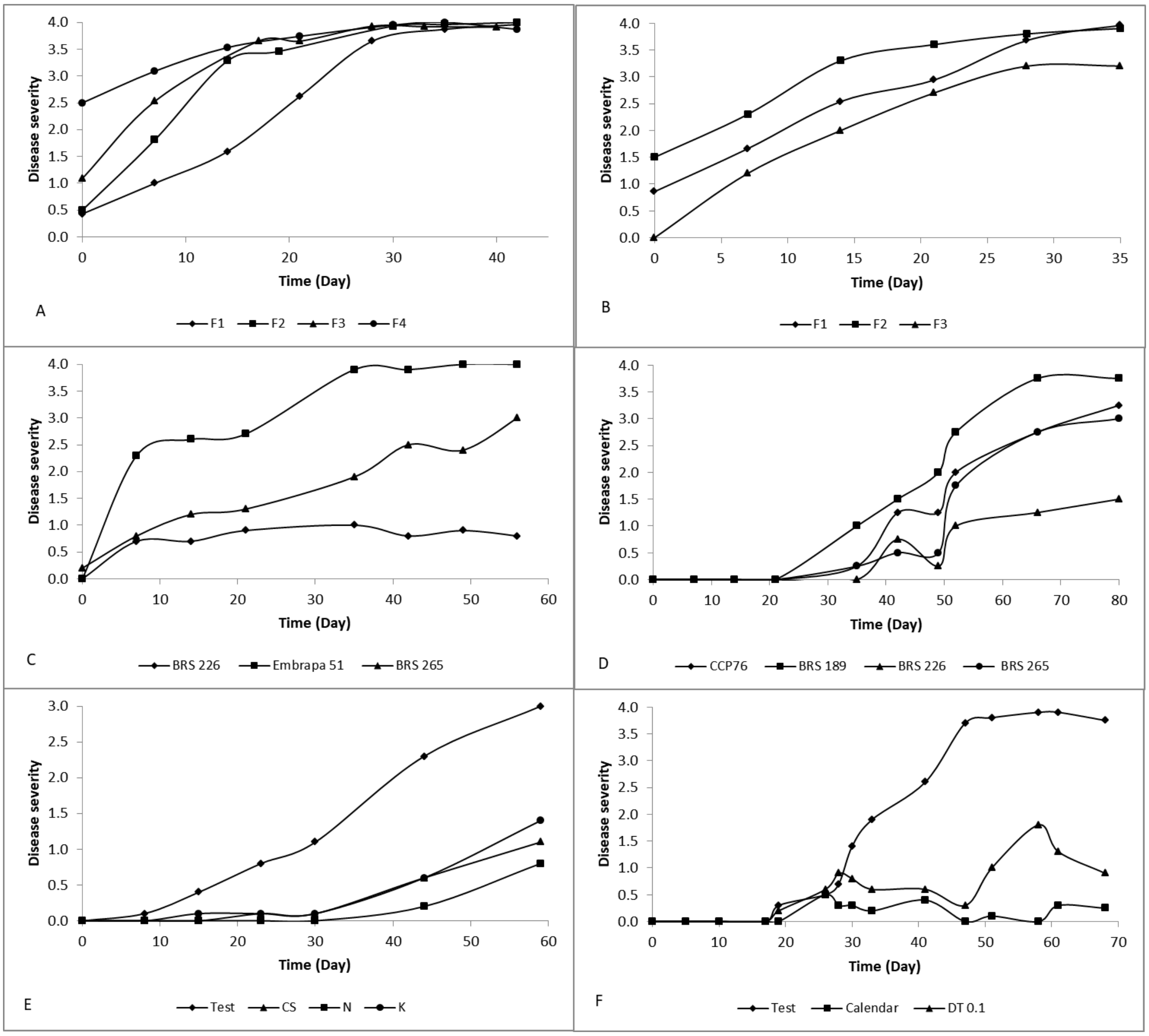

Figure 1. Progress curves of cashew powdery mildew in six experiments conducted between 2014 and 2021. The curves were drawn considering the influence of the flowering periods [A (2014) and B (2019)], dwarf cashew clones [C (2018) and D (2021)] and chemical control of the disease [E (2016) and F (2020)]. 'F': flowering period; 'Test': control; 'CS': calcium-sulfur solution; 'N': trifloxystrobin + tebuconazole fungicide; 'K': sulfur fungicide; 'Calendar': fixed calendar scheme; 'DT 0.1': disease threshold of control (10 %).

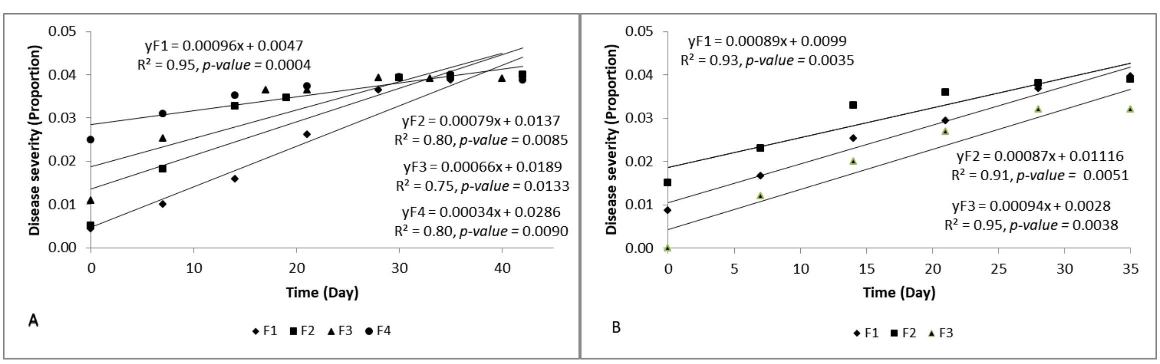

Figure 2. Data on the disease severity (proportion) of cashew powdery mildew observed and predicted in the first (F1: Aug. 04 - Oct. 06), second (F2: Aug. 20 - Oct. 15), third (F3: Sep. 05 - Nov. 05) and fourth (F4: Oct. 06 - Nov. 28) flowering periods in 2014 (A), and in the first (F1: Aug. 07 - Sep. 25), second (F2: Sep. 25 - Oct. 30) and third (F3: Oct. 09 - Nov. 13) flowering periods in 2019 (B), both for the dwarf cashew clone 'BRS 189'.

Table 1. Predicted data of the initial inoculum (*y0*) and disease rate (*r*), area under the disease progress curve (AUDPC), final disease (*y*final) and onset of the epidemic (OE), as a function of four and three flowering periods in 2014 and 2019, respectively; 'BRS265', 'BRS226' and 'Embrapa 51' in 2018 ; 'CCP76', 'BRS189', 'BRS265' and 'BRS226' in 2021; and chemical control of the disease in 2016 and 2020, for the dwarf cashew clone 'BRS 189'.

Treatments	*y0*	*r*	AUDPC	*y*final	OE (day)
			Phenology (2014)		
Flowering 1	0.0047 a[1]	0.00096 a	105 a	3.9 a	-*
Flowering 2	0.0137 b	0.00079 b	131 b	4.0 a	-
Flowering 3	0.0189 b	0.00066 c	131 b	3.8 a	-
Flowering 4	0.0286 c	0.00034 d	150 c	3.9 a	-
CV (%)	16.70	10.53	4.34	2.45	-
			Phenology (2019)		
Flowering 1	0.0099 a	0.00089 a	88 a	4.0 a	-
Flowering 2	0.0112 a	0.00087 a	92 a	4.0 a	-
Flowering 3	0.0029 b	0.00094 a	70 b	3.1 b	-
CV (%)	27.13	19.29	14.17	9.98	-
			Dwarf cashew clone (2018)		
'Embrapa51'	0.0087 a	0.0007 a	154 a	4.0 a	7 a
'BRS265'	0.0042 a	0.0005 b	92 b	3.3 a	5 a
'BRS226'	-	-	54 c	1.6 b	7 a
CV (%)	44.97	10.64	18.50	22.73	31.49
			Dwarf cashew clone (2021)		
'BRS189'	-0.0050 a	0.00050 a	159 a	3.7 a	37 a
'CCP76'	-0.0050 a	0.00039 a	114 ab	3.2 a	40 a
'BRS265'	-0.0057 a	0.00036 ab	95 ab	3.0 a	51 a
'BRS226'	-0.0024 a	0.00020 b	50 b	1.5 b	47 a
CV (%)	41.53	24.82	35.34	22.45	22.63
			Chemical control (2016)		
'Test'	-0.0036 a	0.0006 a	75.97 a	3.50 a	11 a
'K'	-0.0036 a	0.0003 b	18.30 b	1.75 b	35 bc
'CS'	-0.0022 a	0.0002 c	17.81 b	1.02 bc	28 ab
'N'	-	-	9.59 b	0.39 c	51 c
CV (%)	31.18	24.15	20.00	24.73	30.88
			Chemical control (2020)		
'Test'	-0.0075 a	0.0007 a	124 a	3.70 a	21 a
'DT 0.1'	-0.0008 b	0.0002 b	27 b	0.70 b	22 a
'Calendar'	-	-	13 b	0.06 c	24 a
CV (%)	34.26	12.41	16.33	9.62	32.43

[1] Different letters indicate a significant difference between the treatments (Tukey; $p \leq 0.05$). * Epidemic started in the first assessment. CV: coefficient of variation; 'Test': control; 'CS': calcium-sulfur solution; 'N': trifloxystrobin + tebuconazole fungicide; 'K': sulfur fungicide; 'calendar': fixed calendar scheme; 'DT 0.1': disease threshold of control (10 %).

2017), since the data obtained in several experiments indicated that, in the first flowering periods, the disease progress curves are more pronounced, especially when considering the AUDPC and final disease (Martins et al. 2018).

Epidemiological studies in these flowering periods were carried out in the same experimental area, with the same dwarf cashew clone ('BRS 189') and in two years (2014 and 2019). Despite that, considering that the epidemics of the disease may vary depending on climatic factors, the results of the trials in the present study suggest that the first flowering period is the one that has the greatest potential to generate the largest epidemic of powdery mildew in dwarf cashew. In the Northeast semi-arid regions, producers understand that the first flowering flush should not be neglected, as almost the entire crop can be lost to the disease, especially in the case of table cashew (fresh consumption).

In the case of late flowering periods, such as those verified in this study in 2014, the progress of the disease tends to be lower, mainly due to the plant phenology associated with higher temperatures and apparent decrease in fungal inoculum. In the 2014 experiment, for example, the data showed that powdery mildew progress rates were decreasing and lower in the months of October, November and December, considered the driest and hottest in the semi-arid region. In view of this information, a close relationship between the inoculum present, plant phenology (decrease of young panicles in the plant) and temperature elevation is inferred again.

Martins et al. (2020) reported that temperature increases above 23 ºC at any level of relative humidity negatively influences the conidia germination and formation of the germ tube and appressoria. All these steps are fundamental for *E. quercicola* infection, and it is likely that the increase in temperature and decrease in new shoots of the plant during the dwarf cashew production cycle will contribute to slowing down the progress of the disease. Maddison et al. (1998), in Tanzania, also found that the last flowering periods are those from which producers are able to obtain a higher nut yield, due to the lower disease pressure at this stage. Under Brazilian conditions, it has been observed that the epidemic decreases from October onwards, as verified by the decrease in the incidence and severity of the disease and by the low number of conidia collected in spore traps (unpublished data).

When the powdery mildew epidemics were analyzed as a function of dwarf cashew clones (Figures 3A and 3B), it was possible to observe significant differences among the clones in the two experiments carried out in 2018 and 2021. In 2018, 'BRS 226' was the clone with the lowest AUDPC and the lowest *y*final. The highest rate, AUDPC and *y*final were found for the 'Embrapa 51' clone. Although the *y0* and OE were similar among all the dwarf cashew clones, the other components of the epidemic showed differences among them (Table 1). In 2021, there were significant differences among the clones for progression rate, AUDPC and *y*final, with 'BRS 189' and 'BRS 226' showing the highest and lowest rates, AUDPC and *y*final, respectively. However, there was no difference among the clones for *y0* and OE (Table 1).

In addition to the phenology of dwarf cashew having an effect on powdery mildew epidemics, there is evidence of dwarf cashew clones interfering in the behavior of the disease progress curves. Pinto et al. (2018) found different reactions to powdery mildew among dwarf cashew clones and indicated that the most susceptible clones were those with the highest values of infection rate and AUDPC. In this case, the 'BRS 189' dwarf cashew clone, among those analyzed, had the highest absolute values of *r*, AUDPC and *y*final (Table 1).

In Tanzania, Sijaona & Mansfield (1998) and Sijaona et al. (2001), when describing the logistic model in obtaining the disease progress rate, were able to observe differences in epidemics under the effect of cashew clones with different levels of resistance to powdery mildew. These authors found that the epidemic rate was reduced in some resistant cashew clones, even though the fungus had completed its cycle.

Sijaona & Mansfield (1998) also used the disease progression rate in the comparison of genotypes and concluded that there were differences

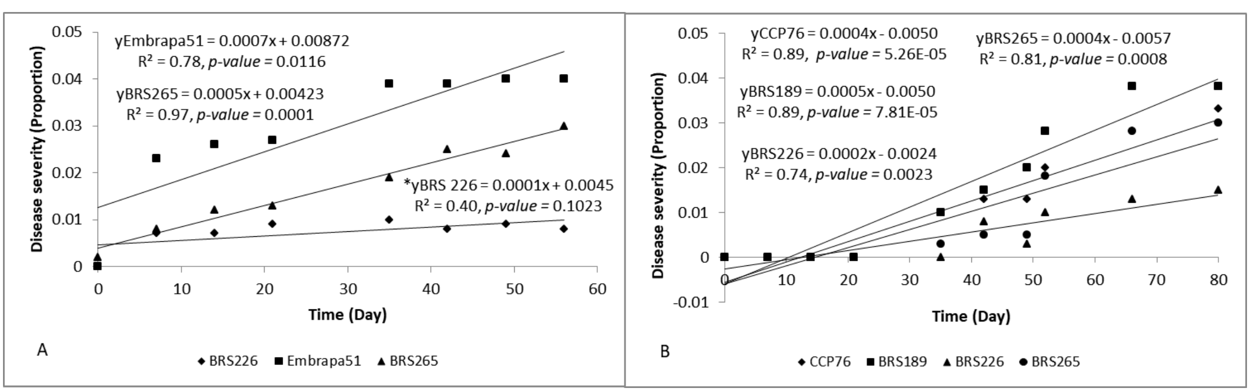

Figure 3. Data on the disease severity (proportion) of cashew powdery mildew observed and predicted for the dwarf cashew clones 'BRS226', 'Embrapa 51' and 'BRS 265' in 2018 (A), and 'CCP76', 'BRS189', 'BRS265' and 'BRS226' in 2021 (B). * Not significant.

among them, in terms of rapid and slow increase of the disease over time. Sijaona (1997) also considered clones with the capacity to maintain new healthy panicles, even under conditions of high inoculum potential, to be resistant.

For the results presented here, in addition to the *r* values as used by the aforementioned authors to differentiate cashew clones, and the *r* and AUDPC values proposed by Pinto et al. (2018), the final severity (*y*final) of the disease was also used for the same purpose. Dwarf cashew clones with lower levels of disease observed in the field can be used for integrated management, as they limit the evolution of powdery mildew epidemics. Although the epidemic of the disease has a direct link to the emergence of new cashew shoots, the ‘BRS 226’ clone, which constantly produces new panicles when the rainy season really ends, was the one that had the lowest rates of disease during the epidemic periods and under strong disease pressure. Other clones considered early, such as ‘BRS 189’ and ‘CCP 76’, mainly, produce flowers at only shorter intervals without rainfall and were those with the greatest powdery mildew epidemics.

The increase in the disease was described by the monomolecular model and the clones compared by the linearized progress curves and by the variables AUDPC, *y*final and OE. For the ‘CCP 76’ and ‘BRS 189’ clones, susceptible to powdery mildew (Pinto et al. 2018), the disease starts quickly in the presence of the inoculum of the fungus and in the flowering soon after the rainy season, or even after a dry spell. On the other hand, for the ‘BRS 226’ and ‘BRS 265’ clones, considered slightly later than the others, the epidemic of the disease took about 50 days for a rapid increase in its progress. It is worth pointing out that, despite the rapid beginning of the curve elevation, it was observed that the severity of the disease for the ‘BRS 226’ clone did not exceed the average of 5 % of diseased tissue. The rate of progress, in this case, was always lower during the cashew production cycle, demonstrating that this clone is the most resistant to the disease (Pinto et al. 2018, Brasil 2019). For the ‘BRS 265’ clone, the disease rate was higher due to the higher average severity of powdery mildew (37.5 %), and, as reported by Pinto et al. (2018), this clone is classified as intermediately susceptible.

When considering the chemical control on disease progression and its effect on the epidemic (Figures 4A and 4B), there were significant differences among the treatments. In the 2016 experiment, it was not possible to estimate the *y0* and *r* for the treatment ‘N’. However, it was the treatment that had the lowest absolute value for AUDPC, lowest *y*final and significant delay to the onset of the epidemic, which occurred at 51 days. For AUDPC, only the ‘Test’ was significantly different from the other treatments (‘CS’, ‘K’ and ‘N’). When analyzing the apparent rate of progress, ‘CS’ and ‘K’ were statistically different and with means significantly lower than that of the ‘Test’. There was no significant difference among the treatments regarding the initial inoculum. In the ‘Test’ treatment, the powdery mildew epidemic appeared on the 11th day after the beginning of the field evaluations (Table 1). In 2020, the ‘calendar’

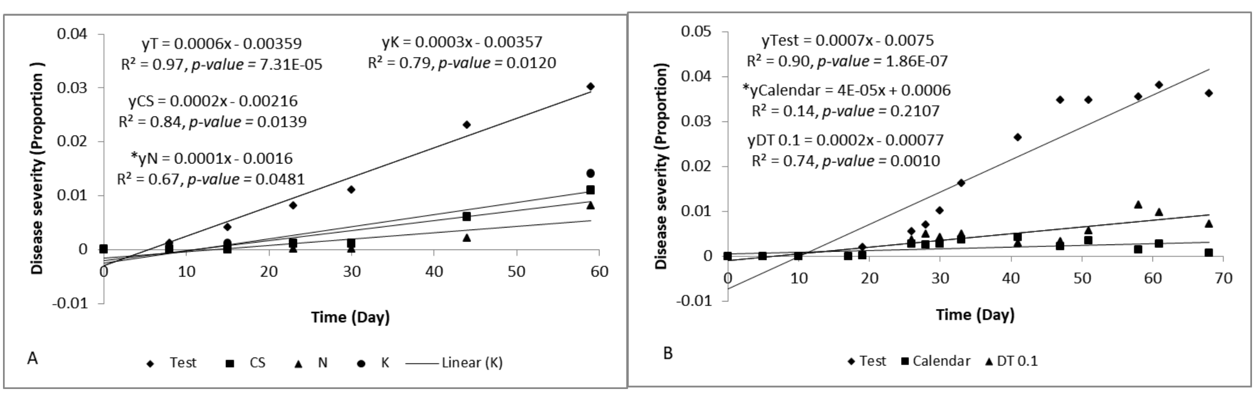

Figure 4. Data on the disease severity (proportion) of cashew powdery mildew observed and predicted, as a function of chemical management with calcium-sulfur solution (‘CS’), sulfur fungicide (‘K’) and trifloxystrobin + tebuconazole fungicide (‘N’) in 2016 (A), and ‘Calendar’ and ‘DT 0.1’ in 2020 (B). Both experiments were carried out with the dwarf cashew clone ‘BRS189’. * Not significant. ‘Test’: control; ‘Calendar’: fixed calendar scheme; ‘DT 0.1’: disease threshold of control (10 %).

treatment was significantly equal to ‘DT 0.1’ and different from the ‘Test’, which had higher means of AUDPC. Regarding *y0* and disease progression rate (*r*), the highest and lowest values were observed for the ‘Test’ and ‘DT 0.1’, respectively. On the other hand, for the final disease, the lowest value was found for the ‘calendar’, followed by ‘DT 0.1’. For the onset of the epidemic (OE), all treatments (‘Test’, ‘DT 0.1’ and ‘calendar’) were significantly equal (Table 1).

Also considering that the chemical control has the greatest power to limit the progress of the disease, if compared to the flowering periods and dwarf cashew clones, the data presented here indicate that the management strategy based on panicle protection with fungicides, whether contact or systemic, delays the emergence of epidemics and reduces the progress of the disease, regardless of the dwarf cashew clones used in the production system (Martins et al. 2022).

Martins et al. (2019, 2021) found, concerning chemical control studies, that the disease progress rate, AUDPC and *y*final were much lower than the values found in the control, even considering an average delay of 38 and 23 days in the emergence of epidemics due to the protection of panicles with calcium-sulfur solution, trifloxystrobin + tebuconazole and sulfur, and with sulfur protection from disease monitoring, respectively. These results are consistent with those reported by Martins et al. (2017), who found delays in the onset of cashew powdery mildew epidemics with the use of fungicides in the Ceará coastal region. Maddison et al. (1998), in turn, considered that sanitization with the elimination of new shoots within the plant, which are a repository of fungal inoculum, also had an effect on the disease progress curves, as it delayed the onset of the epidemics. However, Fonseca et al. (2022) pointed out the importance of external orchards and alternative hosts in nullifying the effect of orchard sanitization practices. In the present study, the results indicated that a greater control of powdery mildew was obtained with the use of fungicides and dwarf cashew clones that were more resistant to the disease.

When contact or systemic fungicides and/or clones of dwarf cashew exert a strong influence on the reduction of epidemics, as demonstrated by Topper et al. (1998a, 1998b) and Martins et al. (2022), low levels of disease severity in the field are observed, with a positive impact on the quality of the obtained cashew fruits. If there was no control, the disease could expand rapidly, resulting in low-quality cashews, especially when they were destined for the table market.

It is important to note that cashew powdery mildew epidemics start quickly due to climatic factors and from the emergence of new shoots (panicles) of dwarf cashew. This disease has a polycyclic characteristic, with exponential multiplication of inoculum occurring in successive cycles of infection within an epidemic. The continuous emergence of panicles and the constant production of inoculum in buds, flowers and nuts in the production cycle of dwarf cashew classifies powdery mildew as the main disease of the crop currently in the main producing regions of Brazil.

CONCLUSIONS

Management strategies act to reduce the initial inoculum, disease progress rate and epidemics. Chemical control, associated with the beginning of plant flowering (panicles in the bud stage), dwarf cashew phenology (clones with late flowering) and clones with genetic resistance, for example, are interventions that can contain or delay powdery mildew epidemics in dwarf cashew production fields in Northeast Brazil.

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