







SCIENTIFIC ARTICLE

Foliar fertilization in Bermuda grass Discovery™

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Abstract

Bermuda grass Discovery™ is a new variety of ornamental and sports turfgrass with a unique color (bluish green), which has great potential to grow in Brazil. However, information regarding its development is still incipient, mainly related to the management of foliar fertilization. Thus, the aimed was to evaluate the development of Bermuda grass Discovery™ based on doses of foliar fertilizer. The experiment was carried out in the experimental area, in 2019 autumn; and the experimental design was completely randomized, with 4 treatments and 3 repetitions, totaling 12 experimental plots of 1.5 m² each. The treatments were: 0 mL L⁻¹ (Control), 50 mL L⁻¹, 75 mL L⁻¹ and 100 mL L⁻¹ of the foliar fertilizer: NPK (6-2-3 + 20% amino acids). The applications were carried out with costal spray, in the late afternoon (17h), to avoid losses by evapotranspiration, and the evaluations were daily over 15 days. The following were evaluated: chemical analysis of the soil, green color index, height of the lawn, dry mass of the clippings and analysis by digital image. It was observed that with the doses increasing, there was better development and coloring of the lawn, showing that foliar fertilization is an effective and quick response method for the turfgrass, with the need for regular applications in an interval of 7 days to maintain the quality desired aesthetics. However, this variety presents low vertical growth, consequently less need for maintenance of cut compared to the other Bermuda grass. The dose of 75 mL L⁻¹ is recommended for the management of the species.

Keywords: *Cynodon dactylon*, nutritional management, turfgrass.

Resumo**Adubação foliar em grama Bermuda Discovery™**

A grama Bermuda Discovery™ é uma nova variedade de gramado ornamental e esportivo de coloração única (verde azulada), e que tem grande potencial para crescer no Brasil. Entretanto informações referentes ao seu desenvolvimento ainda são incipientes, principalmente relacionados ao manejo da adubação foliar. Assim, objetivou-se avaliar o desenvolvimento de grama Bermuda Discovery™ em função de doses de fertilizante foliar. O experimento foi realizado na área experimental, no outono de 2019; e o delineamento experimental foi inteiramente casualizado, com 4 tratamentos e 3 repetições, totalizando 12 parcelas experimentais de 1,5 m² cada. Os tratamentos foram: 0 mL L⁻¹ (Testemunha), 50 mL L⁻¹, 75 mL L⁻¹ e 100 mL L⁻¹ do fertilizante foliar: NPK (6-2-3 + 20% de aminoácidos). As aplicações foram realizadas com pulverizados costal, ao final da tarde (17h), para evitar perdas por evapotranspiração, e as avaliações foram diárias ao longo de 15 dias. Foram avaliados: análise química do solo, índice de coloração verde, altura do gramado, massa seca das aparas e análise por imagem digital. Observou-se que com o aumento das doses houve melhor desenvolvimento e coloração do gramado, mostrando que a adubação foliar é um método eficaz e de rápida resposta para a grama, havendo a necessidade de aplicações regulares em um intervalo de 7 dias para manter a qualidade estética desejada, entretanto a variedade apresenta baixo crescimento vertical, conseqüentemente menor necessidade de manutenção de corte comparada as demais gramas Bermudas. Recomenda-se para manejo da espécie a dose de 75 ml L⁻¹.

Palavras-chave: *Cynodon dactylon*, manejo nutricional, gramado.

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Introduction

During the last few years, turfgrass have been cultivated for various purposes, be they landscape, recreational, sporting, ornamental and environmental (Santos *et al.*, 2016). The visual aspect (aesthetic) as the intense green color and density (closed lawn, without flaws), is of vital importance for the implantation and maintenance of species for ornamental and sporting purposes (Lima *et al.*, 2012).

A great highlight on the national scene is the Bermuda grass (*Cynodon* spp.) (Santos *et al.*, 2019). They are species of hot season, originating in the African continent and naturalized in the Bermuda Islands, and have significant use in Brazil, due to their beauty, resistance to trampling, intense green and soft and thin leaves (Godoy *et al.*, 2012). Furthermore, the varieties that have been used show rapid growth and development, which is essential for use in high performance sports fields such as football (Mateus *et al.*, 2017). However, its use ends up being unfeasible for landscaping, since due to this characteristic, it increases the cost of maintaining turfgrass mowing (Santos and Castilho, 2018b).

Thus, as an alternative, it would be the use of a variety that has slow growth, to be used for ornamental purposes and in low traffic sports fields, such as golf fairway areas. And a species that corresponds to the desired characteristics is a new variety of Bermuda grass, known as Discovery™, or 'Barazur' (Khanal *et al.*, 2017). This new turfgrass has a unique color with shades of dark blue-green (Bruijn, 2012). Thus, having a differential in a esthetic quality, with low maintenance, due to its reduced vertical growth,

which makes it necessary to cut it only once a month, corresponding to 75% less pruning than the other varieties of the species (Qually Grama, 2019).

However, as it is a new variety recently launched in Brazil, information about the species is limited, with no information on maintenance fertilization. And lawn areas need all the nutrients in essential quantities to express their exuberance and complete their development (Santos and Castilho, 2018a). However, in São Paulo State, there is no official recommendation for fertilization for lawn maintenance, which ends up making the nutrition of turfgrass species with erroneous fertilizations much more difficult (Godoy *et al.*, 2012). Thus, foliar fertilization could be an alternative to try to mitigate this information, since the response time is fast, and absorption is efficient. However, it is essential to search for the ideal dose so that the lawn can at the same time improve its aesthetic quality and have an excellent development.

Thus, knowing that Discovery™ has great growth potential in Brazil and that information regarding its development is still incipient, the objective was to evaluate the response in the development of this variety according to different doses of leaf fertilizer.

Material and methods

The work was carried out in an experimental area of 45.5 m² Discovery™ Bermuda grass, 7 m long and 6.5 m wide, with sub-surface drip irrigation installed at a depth of 5 cm. The soil is characterized as Dystrophic Red Latosol (LVd), and the chemical characteristics are shown in Table 1.

Table 1. Soil chemical analysis of the experimental area.

pH	O.M.	P _{resin}	H+Al	K	Ca	Mg	BS	CEC	V%
CaCl ₂	g dm ⁻³	mg dm ⁻³		----- mg dm ⁻³ -----					
5.6	20	108	14	2.9	26	8	37	50	73

The climate in the region is called Cfa (humid subtropical climate with abundant precipitation and well distributed throughout the year), according to the Koppen climate classification. During the execution of the experiment, data on average temperature (20 °C), average relative humidity (70%) and accumulated rainfall (8 mm) were obtained through the Meteorological Station located next to the experimental area. The drip irrigation was performed daily by replacing the previous day's evapotranspired blade, so that the water factor would not interfere with the results.

The 45.5 m² area was divided into 12 plots of 1.5 m² (1 x 1.5 m) with 0.5 m borders. The experimental design adopted was completely randomized, with 4 treatments (doses of foliar fertilizer) and 3 repetitions, being: 0 mL L⁻¹ (Control-without foliar fertilization); 50 mL L⁻¹; 75 mL L⁻¹; 100 mL L⁻¹.

The foliar fertilizer used was a formulated one (6-2-3) composed by the fertilizers: urea, potassium sulfate and

monoammonium phosphate (MAP) with 20% more amino acids as a complexing agent.

The experiment was implemented in 2019 autumn, where the lawn was initially cut and maintained at a height of 15 mm. After cutting, the 1.5 m² plots were divided, with 0.5 m of border between them. The treatments were applied with a backpack sprayer, using a fan nozzle with an estimated flow rate of 350 L ha⁻¹, with the tank being washed after the application of each treatment. The sprayings were carried out in the late afternoon (17 h) to avoid loss by evaporation. The evaluations lasted 15 days being evaluated:

a) Green color index (GCI): Field Scout CM-1000 whose operating principle is based on light reflectance, making three readings in each plot, and their averages are calculated (0 to 999). Samples were obtained parallel to the surface of the turfgrass, at the same height (1.0 m). The results were obtained from the 1st to the 14th DAI (Days after the installation of the experiment).

b) Green color index (GCI): Light reflectance meter, which consists of the use of a device called Field Scout TCM 500 Turf Color Meter, which measures the reflection of light by the turfgrass in the red, green and blue spectrum. The device was placed in contact with the lawn and pressed so that there is no light penetration, which generates a “grass index” (0 to 9.9) and RGB values (Green, Blue and Red respectively). The “grass index” data were obtained daily from the 1st to the 14th DAI, with the RGB components in the 7th and 14th DAI, and converted into values of Hue (H), saturation (S) and brightness (B) of the lawn and later obtaining Dark Green Color Index (DGCI) data (Karcher and Richardson, 2003).

c) Analysis of the visual aspect by digital image - Photographs of the area were taken with an 12Mp camera, fixed in a structure called “light box”, similar to that produced by Peterson et al. (2011). This structure is a completely sealed box with lamps connected to a battery, in order to standardize the brightness and the area photographed in all treatments. These images were transferred to a computer and placed on the side for better visualization of the treatments. This operation was performed on the 7th and 14th day after the installation of the experiment, obtaining one image per plot.

d) Turfgrass height - Data were collected daily from the 1st to the 14th day after the installation of the experiment, with the lawn height measuring instrument “Grass Height

Prism Gauge” being measured three times per plot, in order to minimize the influence on the result of irregular areas.

e) Dry matter mass - The cut was made using the GreenMaster 1000 Toro® machine leaving the lawn 15 mm high. Clippings were collected in order to evaluate the dry matter mass of the shoot of the lawn, after the samples were placed in an oven at 65 °C for 72 h, and weighed on a precision scale of 0.01.

Thus, the results were submitted through analysis of variance (ANAVA) and Tukey's test at the level of 5% probability for comparison of means, using the program “Statistix 10” for data analysis.

Results and Discussions

The results obtained for GCI with the Field Scout CM1000 (Table 2) shows the evolution over time of this variable. It was observed that on the 1st day after the installation of the experiment, there was no statistically difference, possibly due to the leaf fertilizer that had not yet been fully absorbed by the leaves. As of the 2nd day, 75 and 100 mL L⁻¹ showed the best results, and these are the highest doses used respectively. Over the days, linearity in the values was maintained, where mentioned treatments, obtained the best GCI in general. However, after the 9th day, a decrease in the results of 50, 75 and 100 mL L⁻¹ was observed.

Table 2. Green color index (GCI) obtained with the Field Scout CM1000 Chlorophyll Meter throughout the experiment.

Treatment	Days after installing the experiment													
	1		2		3		4		5		6		7	
	----- Scout CM1000 -----													
0 mL L ⁻¹	191	a	193	b	195	c	184	c	182	c	185	c	186	c
50 mL L ⁻¹	199	a	206	ab	235	b	279	b	305	b	302	b	304	b
75 mL L ⁻¹	199	a	229	a	292	a	305	a	331	a	330	a	325	a
100 mL L ⁻¹	201	a	222	a	292	a	303	a	322	ab	322	a	325	a
CVC	14		27		19		20		25		18		15	
CV(%)	2.77		4.89		2.94		2.94		3.43		2.42		2.14	
F	2.09 ^{ns}		7.34*		121.19**		156.55**		152.28**		287.08**		359.35**	
Treatment	Days after installing the experiment													
	8		9		10		11		12		13		14	
	----- Scout CM1000 -----													
0 mL L ⁻¹	180	c	186	c	185	b	188	c	189	c	182	b	186	b
50 mL L ⁻¹	301	b	291	b	276	a	216	b	204	b	201	ab	202	ab
75 mL L ⁻¹	323	a	312	a	289	a	242	a	218	a	216	a	211	a
100 mL L ⁻¹	323	a	298	ab	279	a	240	a	213	ab	219	a	207	a
CVC	13		14		20		22		10		29		19	
CV(%)	1.83		1.94		3.03		3.81		1.81		5.51		3.58	
F	528.24**		364.7**		116.7**		27.16**		36.31**		6.77*		6.99*	

Averages followed by the same letter in the column, do not differ, by the Tukey test at the level of 5%. ** - significant at 1%. * - significant at 5%. ns - Not Significant.

When the N dose is high from a deficiency situation, there is an increase in the chlorophyll content, providing a linear response regarding the green color of the turfgrass (Gazola *et al.*, 2016). Also, according to Santos and Castilho (2015) the green color index, indirectly reflects the amount of chlorophyll in the leaves and the N foliar. Since the chlorophylls are magnesian porphyrins, with a central magnesium atom attached to 4 nitrogen atoms (Taiz *et al.*, 2017), and as the fertilizer used had 6% N, the highest doses provided greater amounts of this nutrient, which possibly explains the results found.

Decrease in the green coloration index can be explained due to the reduction of the N concentration in the leaf, once the maximum fertilizer absorption is reached, there is a dilution of the nutrient resided in the leaf with the growth of its mass (Lima *et al.*, 2012; Taiz *et al.*, 2017; Santos *et al.*, 2019). This clarifies the indexes found after the 9th day, in treatments 50, 75 and 100 mL L⁻¹, where the amount of N became insufficient to maintain the color that it had reached, due to the growth of the lawn. At 0 mL L⁻¹, the indexes remained statistically constant, possibly because the N concentration was naturally maintained.

Foliar fertilizers have a fast absorption and are efficient, the answers happen around 24 to 48 hours after application, as

reported by Coelho (2018). Exactly in the same period that the beginning of the increase in GCI and the statistical difference between treatments can be observed (1st to 2nd DAI).

Regular applications, with lower doses in a 7 to 14 day schedule, may be advised for maintenance, due to the drop in values observed in the present study, mainly from the 10th to the 12th day. However, at the end of the 14th day, there is still a response to the first fertilization, and there may be a greater residual effect.

Godoy *et al.* (2012) state that fertilization is vitally important to complete the amount of nutrients available in the soil, and thus supply the demand for turfgrass. And 75 and 100 mL L⁻¹ showed better performances (reaching 74% higher than control on the 7th day), however, such treatments did not differ statistically. This suggests that the demand for Discovery™ Bermuda grass has already been met with the dose of 75 mL L⁻¹, and there may be excess and, consequently, waste of fertilizer in 100 mL L⁻¹. Therefore, the recommendation for the application of 75 mL L⁻¹, provides greater savings, with the reduction of fertilizer applied, for the same result in the quality of the lawn.

The green color indices acquired with the Field Scout TCM 500 device (Table 3), corroborate the linearity of the data obtained in Table 2.

Table 3. Green color index obtained with the Field Scout TCM 500 Turf Color Meter throughout the experiment.

Treatment	Days after installing the experiment													
	1		2		3		4		5		6		7	
	----- Scout TCM 500 -----													
0 mL L ⁻¹	6.6	a	6.7	b	6.7	b	6.7	c	6.7	b	6.6	c	6.4	c
50 mL L ⁻¹	6.7	a	6.9	b	7.0	b	7.3	b	7.4	a	7.5	b	7.4	b
75 mL L ⁻¹	6.9	a	7.5	a	7.6	a	8.0	a	8.0	a	8.1	a	8.3	a
100 mL L ⁻¹	6.9	a	7.5	a	7.6	a	7.9	a	7.9	a	8.1	a	8.2	a
CVC	0.9		0.5		0.6		0.5		0.7		0.6		0.6	
CV(%)	4.85		2.55		3.11		2.75		3.59		2.97		3.24	
F	0.58 ^{ns}		15.83**		11.47*		25.23**		15.77**		30.36**		38.93**	
Treatment	Days after installing the experiment													
	8		9		10		11		12		13		14	
	----- Scout TCM 500 -----													
0 mL L ⁻¹	6.5	c	6.3	c	6.3	c	6.2	c	6.2	c	6.4	b	6.2	b
50 mL L ⁻¹	7.4	b	7.3	b	7.2	b	7.1	b	7.1	b	7.1	a	6.9	a
75 mL L ⁻¹	8.2	a	8.0	a	7.9	a	7.9	a	7.5	a	7.3	a	7.2	a
100 mL L ⁻¹	8.2	a	8.0	a	8.0	a	7.7	a	7.5	a	7.4	a	7.1	a
CVC	0.6		0.5		0.4		0.5		0.3		0.6		0.3	
CV(%)	3.01		2.50		2.09		2.59		1.82		3.20		1.88	
F	39.72**		59.15**		79.29**		47.68**		65.92**		11.56**		35.07**	

Averages followed by the same letter in the column, do not differ, by the Tukey test at the level of 5%. ** - significant at 1%. * - significant at 5%. ns - Not Significant.

There was no response from the application after the 1st day, possibly due to the total non-absorption of the fertilizer, which happened after the 2nd day, where there was an increase in the rates. The drop in results also occurred from the 9th day after application, as a result of the growth of the lawn, but reaching the 14th with differentiation of the witness. 75 and 100 mL L⁻¹ obtained the best results, still not differing statistically, reinforcing the dose of 75 mL L⁻¹ as the best option in the application.

Thus, regardless of the reflectance device used, the green color index is efficient for analyzing the development of the turfgrass, especially with regard to N foliar. Lima et al. (2012) also found a correlation between the different

green color indices used in the present study for indirect determination of N in Bermuda grass. Santos et al. (2019) found that photosynthetic pigments indirectly show the nutrition of Bermuda grass for the nutrients of N and Mg, and consequently provide the most intense green when in greater quantities. Oliveira et al. (2018) confirmed the same correlation between GCI and Nitrogen in Emerald grass (*Zoysia japonica*).

The GCI values obtained, therefore, must be related to the values of the components of green color, hue, saturation, brightness and dark green color index, thus also having linearity in the data, as shown by the results obtained for these parameters (Table 4).

Table 4. Analysis of the component of green (G), Hue (H), Saturation (S), Brightness (B) and Dark Green Color Index (DGCI) at 7 and 14 days after installation of the experiment.

Treatment	7 days after installing the experiment									
	Green (G)		Hue (H)		Saturation (S)		Brightness (B)		Dark Green (DGCI)	
	---		degrees (°)		%		%		---	
0 mL L ⁻¹	98	b	72	b	40	ab	40	b	0.47	b
50 mL L ⁻¹	124	a	86	a	51	a	44	a	0.49	b
75 mL L ⁻¹	131	a	92	a	39	b	42	ab	0.58	a
100 mL L ⁻¹	131	a	93	a	40	ab	42	ab	0.57	a
CVC	10		7		11		3		0.05	
CV(%)	2.96		3.15		9.63		2.64		3.27	
F	58.38**		36.27**		5.39*		6.98*		30.88**	
Treatment	14 days after installing the experiment									
	Green (G)		Hue (H)		Saturation (S)		Brightness (B)		Dark Green (DGCI)	
	---		degrees (°)		%		%		---	
0 mL L ⁻¹	88	c	47	b	17	b	36	b	0.42	a
50 mL L ⁻¹	109	b	58	ab	25	ab	37	ab	0.45	a
75 mL L ⁻¹	118	a	64	a	32	a	38	a	0.46	a
100 mL L ⁻¹	119	a	68	a	33	a	38	a	0.47	a
CVC	5		15		10		2		0.09	
CV(%)	1.91		9.70		15.09		1.68		7.36	
F	140.17**		7.61**		9.61*		8.08**		1.63 ^{ns}	

Averages followed by the same letter in the column, do not differ, by the Tukey test at the level of 5%. ** - significant at 1%. * - significant at 5%. ns - Not Significant.

At 7 DAI, it can be seen that the green and hue component showed positive responses to application in treatments 50, 75 and 100 mL L⁻¹, but did not differ statistically between them. With an increase in relation to the control for the green component of 26.53%, 33.67% and 33.67% and for the hue of 19.44%, 27.77% and 29.16% for 50, 75 and 100 mL L⁻¹ respectively. Saturation and brightness were contradictory to other results, presenting 50 mL L⁻¹ with a better performance. This may have occurred due to the characteristics of the variety in

question; Discovery™ Bermuda grass has a darker color than the standard in its ideal, being considered dark blue-green (Bruijn, 2012). As a result of this, the dark green component once again highlights the 75 and 100 mL L⁻¹ with better performances.

At the end of the experiment (14th DAI), 75 and 100 mL L⁻¹ returned to obtain the greatest results, differing from the other treatments, except in the dark green component, showing a lack of characterization in their visual aspect, possibly due to the decrease in chlorophyll concentrations.

The turfgrass GCI is important due to its aesthetic aspect, that is, it must have good density and intense green color (Lima *et al.*, 2012). And chlorophylls are responsible for this green hue in plants and, the higher the concentration in leaf contents, the more intense the color of a turfgrass (Oliveira *et al.*, 2018; Santos *et al.*, 2019). Thus, it is inferred that the results obtained show that at 7 DAI (Table 4), there was a higher concentration of chlorophylls in 75 and 100 mL L⁻¹.

These results are extremely important, since chlorophylls are responsible for converting light radiation into chemical energy, in the form of ATP and NADPH, and the higher the concentration of these

pigments, the greater the green tint, and the better the photosynthetic efficacy of the lawn (Taiz *et al.*, 2017; Santos *et al.*, 2019).

The visual aspect of each treatment at 7 (Figure 1) and 14 (Figure 2) days after the application of the foliar fertilizer, visually shows the aesthetics of the turfgrass, where with the increase of the doses, there was greater green coloring, corroborating with the data of GCI and DCGI previously obtained. According to Bruijn (2012) the Discovery™ coloring is different, darker than the standard (bluish green), being attractive to the ornamental sector, and on the 7th day this coloring reached its peak, becoming evident to the naked eye.

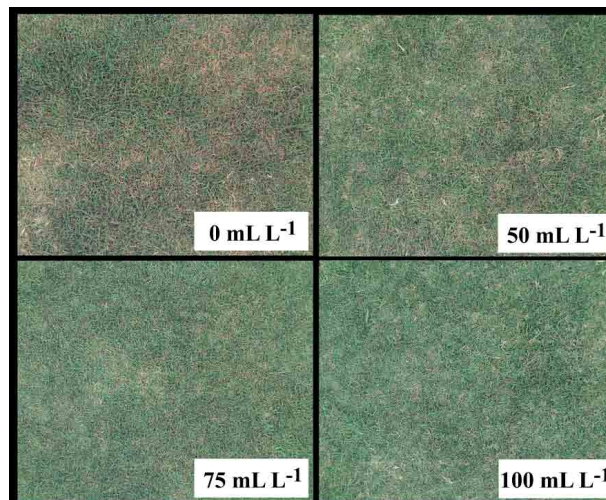


Figure 1. Visual aspect of the turfgrass 7 days after the installation of the experiment.

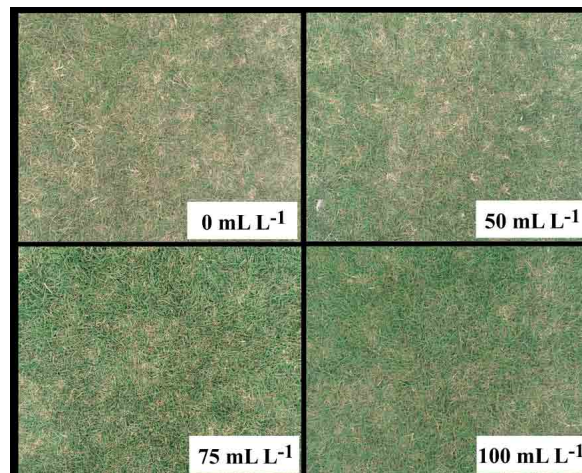


Figure 2. Visual aspect of the turfgrass 14 days after the installation of the experiment.

The correlation between digital image, DCGI and N in Bermuda grass was verified in an experiment conducted by Catureglia *et al.* (2020), showing that photographs, in conjunction with other equipment can be an alternative for estimating turfgrass nutrition. Figure 1 shows the visual quality in the 75 and 100 mL L⁻¹, showing a better density and color, a consequence of the greater availability of the nutrient, followed by 0 and 50 mL L⁻¹, with low color

intensity, making it possible to visualize a yellowish aspect straw on the lawn.

However, as the days went by, the turfgrass lost its color, as already mentioned, reaching the 14 days with less shades, this caused the visual aspect to also be perceived (Figure 2), with a drop in the bluish-green when compared to 7 DAI (Figure 1). Thus, aesthetically, the turfgrass has become less dense and has less green color, which is not

desirable for ornamental lawns, thus inferring that the duration of foliar fertilization is a few days, and must be carried out periodically.

As the increase in doses provided higher levels of green color in the lawn, the height of the leaves also came to be influenced (Table 5), because when the doses of N are high, it causes greater growth of the turfgrass (Gazola et al., 2019). The height of the lawn began to differ statistically between treatments on the 4th day after fertilization, with 75 and 100 mL L⁻¹ growing faster than 50 and 0 mL L⁻¹, with up to 4.6% difference between 75 100 mL L⁻¹ and the control. However,

the very next day, the 5th after fertilization, 50 mL L⁻¹ differs from 0 mL L⁻¹, with a 2.6% increase in 50 mL L⁻¹. Thus it continues until the end of the experiment, ending with 75 and 100 mL L⁻¹ with the fastest growth than the others, due to the greater availability of applied nutrients. Even though 100 mL L⁻¹ received a greater source of N than 75 mL L⁻¹, its heights did not differ statistically, possibly due to the inability of the leaf to absorb more N than necessary. Still, it is essential to emphasize that the faster growth of the lawn results in a greater need for maintenance for the cut, and also causes a greater loss of nutrients by the clippings.

Table 5. Height of the turfgrass throughout the experiment.

Treatment	days after installing the experiment													
	1		2		3		4		5		6		7	
	----- mm -----													
0 mL L ⁻¹	15.1	a	15.1	a	15.4	a	15.2	b	15.3	c	15.5	b	15.6	c
50 mL L ⁻¹	15.4	a	15.5	a	15.1	a	15.4	b	15.7	b	15.9	b	16.2	b
75 mL L ⁻¹	15.2	a	15.2	a	15.2	a	15.9	a	16.1	a	16.4	a	16.7	a
100 mL L ⁻¹	14.8	a	15.2	a	15.2	a	15.8	a	16.1	a	16.5	a	16.7	a
CVC	0.9		1.0		0.6		0.3		0.3		0.4		0.5	
CV(%)	2.20		2.42		1.49		0.79		0.68		1.05		1.20	
F	1.75 ^{ns}		0.53 ^{ns}		0.83 ^{ns}		22.37**		36.62**		23.65**		21.59**	
Treatment	days after installing the experiment													
	8		9		10		11		12		13		14	
	----- mm -----													
0 mL L ⁻¹	15.7	c	16.0	c	16.3	c	16.7	c	17.1	c	17.3	c	17.8	c
50 mL L ⁻¹	16.5	b	16.7	b	16.9	b	17.4	b	18.3	b	18.5	b	19.2	b
75 mL L ⁻¹	17.2	a	17.5	a	18.3	a	18.6	a	19.0	ab	19.7	a	20.3	a
100 mL L ⁻¹	17.2	a	17.5	a	18.3	a	18.6	a	19.3	a	19.6	a	20.1	a
CVC	0.5		0.6		0.5		0.5		0.9		0.6		0.6	
CV(%)	1.20		1.31		1.12		1.12		1.82		1.21		1.2	
F	40.41**		33.01**		76.17**		67.50**		26.55**		71.07**		70.50**	

Averages followed by the same letter in the column, do not differ, by the Tukey test at the level of 5%. ** - significant at 1%. * - significant at 5%. ns - Not Significant.

Discovery™ Bermuda grass presents a differential in aesthetic quality, with low maintenance, due to its reduced vertical growth (Qually Grama, 2019), and this fact is observed in the present work, as the maximum growth reaching after 14 days was 5.3 mm in 100 mL L⁻¹, which corresponds to a rate of 35.8% in relation to the 1st day evaluated. The Witness that did not undergo fertilization grew only 2.7 mm (17.9%). Amaral et al. (2016) working with Bermuda grass ‘Tifway 419’ observed that after 30 days, the growth of the lawn was accelerated, where the witness who did not undergo any type of handling reached 75 mm. For the ‘Tifdwarf’ Bermuda grass, used in golf course greens, growth is even more accelerated, undergoes excessive pruning

(Agnihotri et al., 2017). Corroborating the fact that the studied species has slow vertical growth.

Thus, the results found in the present study show the potential of Discovery™ Bermuda grass to be used for low maintenance turfgrass, due to its slow growth of the aerial part, even managed with NPK foliar fertilization. What is desirable for ornamental lawns, where due to this characteristic, the cost for cutting maintenance decreases (Santos and Castilho, 2018a).

As previously described, N is the nutrient that most stimulates turfgrass growth, due to the increase in chlorophyll content, which ends up reflecting on the dry mass produced, and this fact corroborates with the data from the present study (Table 6). After 15 days

of the application of leaf fertilizer, 75 and 100 mL L⁻¹ showed the highest dry mass of the clippings (4.6 and 4.7 g m⁻² respectively), and those doses presented the highest values of GCI (Tables 2 and 3), and the data

are thus correlated. This fact was also observed by Santos and Castilho (2016) in emerald grass, where the treatments with higher GCI showed greater dry mass of the leaves.

Table 6. Clippings dry mass of the Discovery™ bermuda grass.

Treatment	15 days after installing the experiment
	----- g m ⁻² -----
0 mL L ⁻¹	2.03 c
50 mL L ⁻¹	3.52 b
75 mL L ⁻¹	4.60 a
100 mL L ⁻¹	4.70 a
CVC	0.70
CV(%)	7.4
F	63.27**

Averages followed by the same letter in the column, do not differ, by the Tukey test at the level of 5%. ** - significant at 1%. * - significant at 5%. ns - Not Significant.

The treatments 75 and 100 mL L⁻¹ did not differ statistically, and with that, it can be concluded that the foliar fertilization in the dose used in 75 mL L⁻¹ would be enough for a quick response in the development of the lawn. However, it is noteworthy that there was a large difference in mass produced between treatments, where 100 mL L⁻¹ was 2.2 times greater than the control. However, the observed values are lower than the dry mass produced by other Bermuda grass varieties, such as those of ‘Celebration’ (Lima *et al.*, 2015), ‘Tifdwarf’ (Agnihotri *et al.*, 2017) and ‘Tifway 419’ (Amaral *et al.*, 2016; Mateus *et al.*, 2017; Santos and Castilho, 2018b), thus showing that the volume of mass produced correlates with the height of the lawn, showing that the species has a low maintenance need.

This result should be highlighted, since the maintenance of turfgrass has a significant cost and the choice of cultivar has a direct influence on this characteristic. These data corroborate what Qually Grama (2019) points out, which states that with this material it is possible to make only one cut per month, considerably reducing maintenance costs.

Conclusions

Foliar fertilization is an effective and quick response method for Discovery™ Bermuda grass, with the need for regular applications over an interval of 7 days to maintain the desired aesthetic quality, using the dose of 75 mL L⁻¹ of NPK (6-2-3). The variety presents low vertical growth, consequently less need for maintenance of cut compared to the other Bermuda grass.

Author contribution

JOS: Data collection and analysis, interpretation, preparation and writing of the article and critical review. **PLFS:** Idea of the experiment, field analysis, interpretation, preparation and writing of the article and critical review. **MVLN:** Field analysis, interpretation, preparation and writing of the article and critical review. **CANS:** Field analysis, interpretation, preparation and writing of the article and critical review. **JVC:** Field analysis, interpretation, preparation and writing of the article. **RLVB:** Critical review, approval of the final version, work advisor.

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