Effect of temperature on germination of golden grass seeds (*Syngonanthus nitens* (Bong.) Ruhland) originating from the region of Mateiros, Jalapão (Tocantins)

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ABSTRACT

Jalapão is a region rich in natural beauty and is in the east of Tocantins, the population practices handicrafts made with golden grass (*Syngonanthus nitens*) sewn with buriti "silk". Throughout the cerrado, fire is used as part of the management of existing species, for S. *nitens* popular knowledge states that with the proper use of fire its flowering is stimulated. The research was carried out to contribute to the definitions of management of the species. The germination of *S. nitens* seeds from the municipality of Mateiros, exposed naked and in capitula for 10 min at temperatures of 50, 100, 150 and 200 ºC, was evaluated. The viability of *S. nitens* seeds submitted in capitula and naked at 50°C for 10 minutes was higher when compared to the other temperatures. The exposure time of the bare seeds and in chapters at 150 and 200 ºC made them unviable.

Keywords: Golden grass, Germination, Temperature.

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INTRODUCTION

Jalapão is an area of 34,113 km2 to the east of Tocantins, which encompasses 15 municipalities and borders the states of Bahia, Maranhão and Piauí (SEPLAN, 2003). One of the main economic activities is family farming, with farmers and extractivists.

Syngonanthus nitens (Bong.) Ruhland, popularly known as golden grass, is an herb with a short stem, bearing leaves in a basal rosette from which 1 to 10 terminal scapes with capitulum-type inflorescences start. It is characterized by having golden scapes and cream and shiny involucral bracts (Giulietti *et al*. 1996). The species is from the Eriocaulacea family, represented by predominantly tropical species typical of the Cerrado biome, usually in open, swampy or periodically flooded places. They are known as "evergreens" because they maintain the original characteristics of their scapes and inflorescences unchanged after harvest (Giulietti *et al*., 1996).

The species is quite common in the mountains of the entire Espinhaço Chain with occurrences also in the high-altitude fields of the central portion of South America. The scapes of *S. nitens* are exploited especially in the states of Minas Gerais, Bahia and Goiás (Giulietti *et al*., 1996). In Tocantins, the "sempre-viva" is also exploited for the making of handicrafts, mainly in Jalapão, but it is also found in other regions of the state, such as the municipalities of Dianópolis, Tocantínia and Caseara.

The artisanal activity with golden grass (*Syngonanthus nitens*) sewn with buriti "silk" has been traditional in the region for about 90 years, but has become economically important since the early 2000s.

Sexual reproduction is of great importance to the population dynamics of the species, and about 40% of recruits may come from seeds (Schmidit *et al*., 2007). Pollination and seed dispersal can be carried out by wind (Schmidit, 2005; Giulietti & Hensold, 1990).

The seeds are oblong, weigh about 0.033 mg, are around 0.89 mm long and 0.32 mm wide, brown in color and have longitudinal streaks (Schmidit *et al*. 2007). The seed production per chapter is in large number, with a maximum of 237 seeds/chapter and on average it produces 60 seeds/chapter (Schmidit, 2005). Santos (2009) states that each golden grass inflorescence presents, on average, 161 seeds, suffering variation in the number of seeds considering its phenology and the average weight of each seed results in 0.0464mg.

S. nitens has been the target of studies on the development of techniques that indicate the best form of management and allow the sustainable use of the resource, thus avoiding damage to the biodiversity of adjacent paths and phytophysiognomies.

Fire in the Cerrado, as in most savannas, is characterized by being a superficial fire, which mainly consumes herbaceous plants (Miranda *et al*., 2002). The air temperature during a burn can range from 85°C to 840°C, while in the ground temperatures range from 29°C to 55°C at 1cm depth.

The variation in soil temperature below 5cm depth is almost nil, reaching a maximum of 3°C (Coutinho, 1978; Miranda *et al*., 1993).

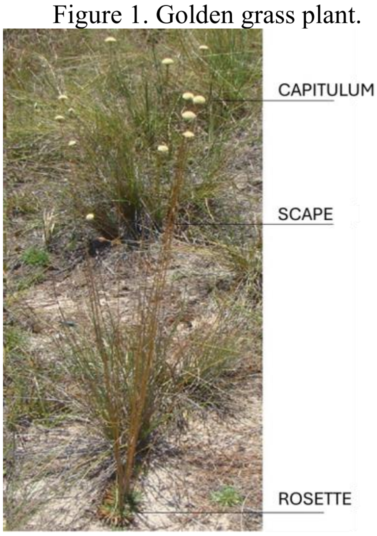
In the region of Jalapão (Tocantins), fire is an important management tool in humid fields, where golden grass occurs. Although traditional knowledge indicates that fire stimulates the flowering of *S. nitens*, little information is available on the effects of temperature on the survival and germination of seeds of this species.

Thus, the present study aimed to evaluate the influence of temperatures 50, 100, 150 and 200°C on the germination of *Syngonanthus nitens*, originating from the municipalities of Mateiros, in the State of Tocantins.

MATERIAL AND METHODS

The golden grass plant (*S. nitens*) is composed of a capitulum, scape and rosette (Figure 1).

Figure 1. Golden grass plant.



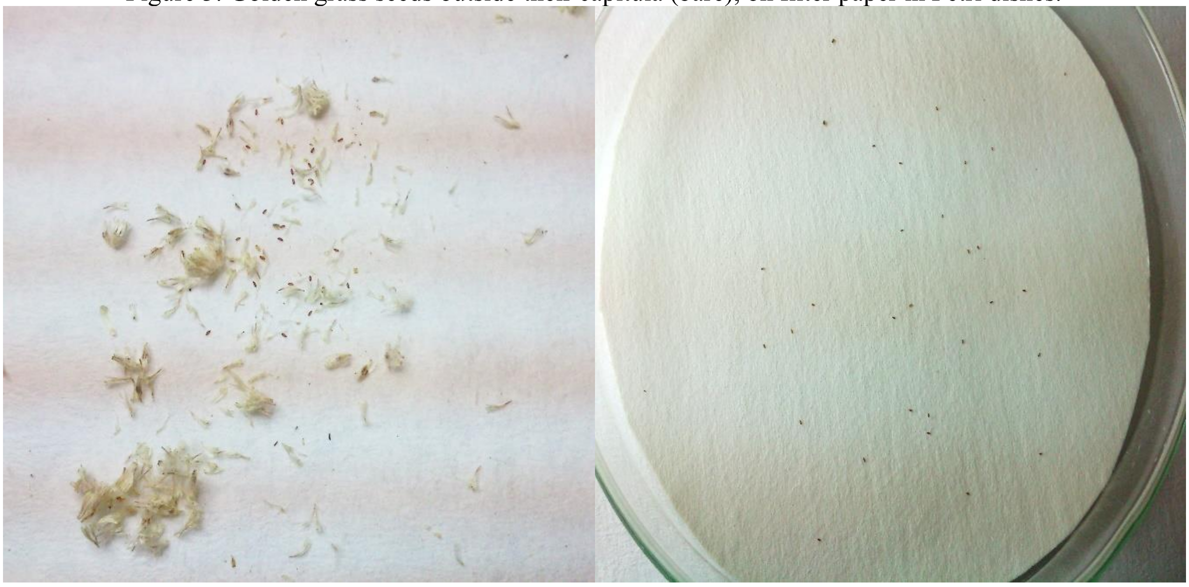
A total of 100 golden grass scapes were collected in October 2012, in a humid field (vereda), located in the municipality of Mateiros (geographic coordinate 23 L 0287374), State of Tocantins (Figure 2). This location was chosen because it is a region where there are native populations of golden grass and who use it as raw material in the making of handicrafts.

Figure 2. Collection of golden grass scapes, in the region of Mateiros.

The capitula and scapes after harvest were stored in high-density polyethylene packages because it allows low impermeability to water vapor, in order to maintain the original characteristics until the beginning of the laboratory analyses. For better packaging of the study material, after transporting the paths to the laboratory, the scapes were kept in glass containers.

All laboratory activity was developed in the Seed Laboratory of the Lutheran University Center of Palmas - CEULP/ULBRA, located in the state capital, from January to April 2013. First, the seeds were separated with the aid of binocular sterioscopy magnifying glass and tweezers, as shown in Figure 3.

Figure 3. Golden grass seeds outside their capitula (bare), on filter paper in Petri dishes.



For the experiment, the seeds were placed on filter paper (previously sterilized in an oven at 105°C for 72 hours), in Petri dishes. The seeds were subjected to treatments inside and outside their chapters. Three replications were used, thus 27 plates with 25 seeds each, three for the control.

The seeds were placed in an oven with forced air circulation, with controlled temperature and exposure time. The temperatures used were 50 °C, 100 °C, 150 °C and 200 °C in an exposure time of 10 minutes.

After the treatments, the seeds were submitted to germination test still in Petri dishes, with filter paper soaked in distilled water. The seeds contained in chapters were separated after treatments.

The germination test was conducted in a germination chamber with photoperiod and thermoperiod control. The lighting in this case was by the use of fluorescent lamps with white and cold light, with a controlled light regime (12h/12h). The germination temperature was 28 °C, and the exposure time was 80 days.

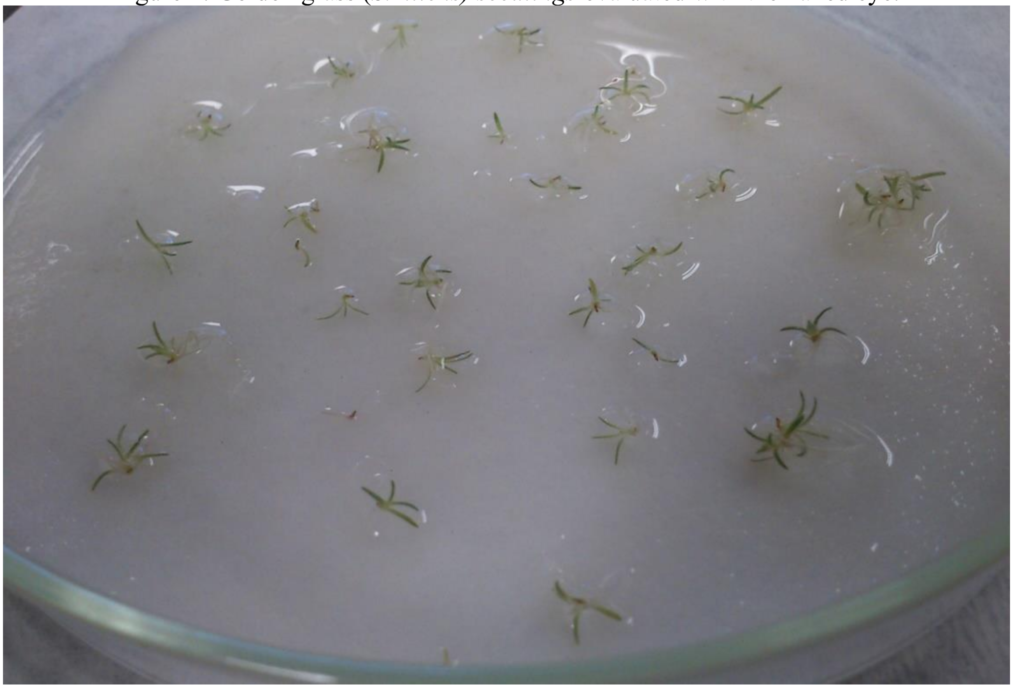
Observations were carried out daily to verify the number of germinated seeds. Considering germinated the seed with the emergence of the radicle or cotyledon. The experimental design was completely randomized, in a factorial scheme. The factors were: types of seeds (bare and in capitulums) and exposure temperatures (50, 100, 150 and 200 °C).

For the parameters analyzed, analyses of variance were performed and the means were compared by Tukey's test at 5% significance. The SANEST statistical package was used for the analyses.

RESULTS AND DISCUSSIONS

Figure 4 shows the seedlings of *Syngonanthus nitens*. The germination process began from the seventeenth day in the test chamber.

Figure 4. Golden grass (*S. nitens) seedlings* evaluated with the naked eye.

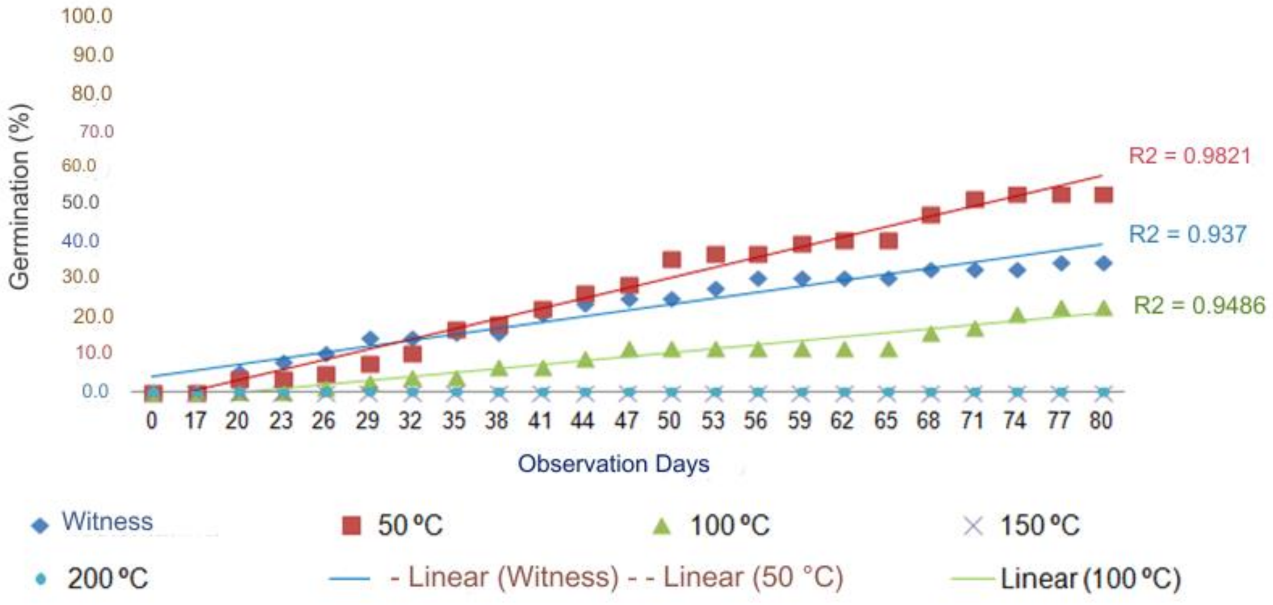


For the best observation, in an attempt to minimize uncertainties, during and close to the end of the test (79th day) all seeds were evaluated through a microscope, as can be seen in Figure 5.

Figure 5. Seed and seedling of golden grass (*S. nitens*).

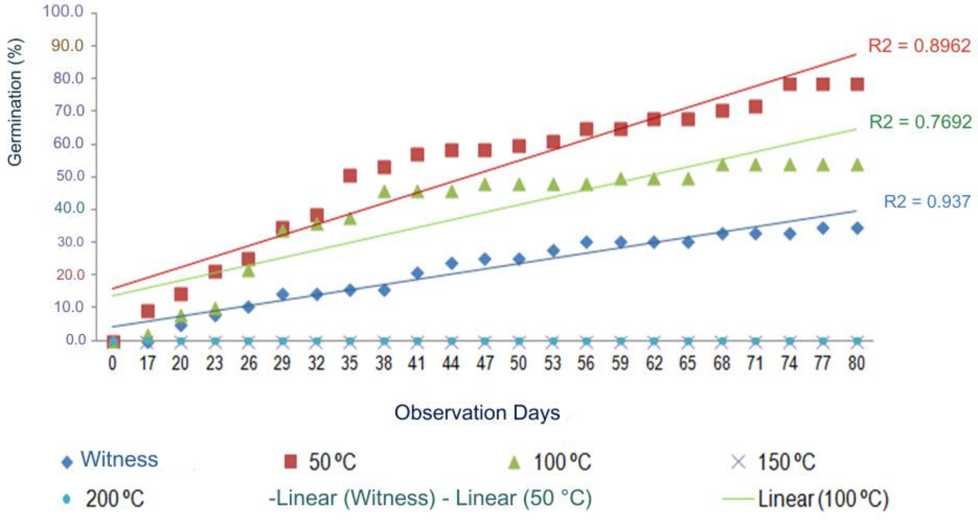
The seeds, when subjected bare to temperature shocks (Figure 6), showed germination difference between them from the twentieth day onwards, but the differentiation was significant after 50 days. These showed a median germination index below (G<85%). The highest germination index was demonstrated by the seeds submitted to 50°C (53.3 %) being higher than the control (34.7%). The temperatures of 150°C and 200°C made it impossible to germinate *S. Nitens* evaluated naked. The values of r² (Coefficient of determination), found for the seeds evaluated naked, were 0.98 for the control; 0.93 for 50ºC and 0.94 for 100ºC; and reveal a high degree of linear statistical relationship between the variables analyzed.

Figure 6. Germination of S. *nitens seeds* collected in the municipality of Mateiros, subjected to bare temperatures (0, 50, 100, 150 and 200°C).



As shown in Figure 7, the seeds collected in the municipality of Mateiros, when subjected to temperature shocks, presented a median germination index below (G<85%). The highest germination index was demonstrated by seeds submitted to 50°C (78.7%) followed by exposure to 100ºC (54.0%), being higher than the control (34.7%). The temperatures of 150°C and 200°C made it impossible to germinate *S. Nitens* evaluated in chapters.

Figure 7. Germination of S. *nitens seeds* collected in the municipality of Mateiros, submitted in capitula at temperatures (0, 50, 100, 150 and 200°C).



The samples submitted to a temperature of 50°C reacted better when exposed in their capitula, reaching the maximum germination index of the experiment (78.7%). This fact corresponds to a germination rate 25.4% higher than those exposed directly to the same temperature and 44% higher than the control. The viability of *Syngonanthus nitens seeds* submitted in capitulations at 50°C for 10 minutes was higher when compared to temperatures of 100, 150 and 200°C.

Samples subjected to 150 and 200 ºC for 10 minutes became unfeasible. The r^2 values found for the seeds submitted in the chapter were 0.89 for the control; 0.76 for 50°C and 0.93 for 100°C; and reveal a high degree of linear statistical relationship between the variables analyzed.

Hanley *et al*. (2003), observed the existence of a relationship between seed size and their resistance to high temperatures. According to these authors, species with small seeds, such as *S. nitens*, are more resistant to high temperatures than species with large seeds.

As small seeds, unlike large ones, remain close to or on the surface of the soil to germinate, their greater resistance to high temperatures, in regions periodically subjected to fire, constitutes an adaptation to this environmental factor. These results are useful and, through the use of this information for the development of management techniques consistent with the relationship of this species and the use of fire, can contribute to the development of recommendations for sustainable management of *S. nitens from* the humid fields of Jalapão and other regions of the Cerrado in which this species has economic importance.

The germination rates after the 100° treatments and the intolerance to temperatures of 150° and 200°C indicate that seeds of *S. nitens* may not survive and not germinate after the passage of the fire for a period of 10 minutes, considered long since experiments in humid fields of Jalapão indicate that the time in which the vegetation remains under high temperatures is short (< 60 seconds) and that, even during the passage of the fire, the temperatures of some places may not exceed 200°C (SCHMIDT, 2011).

CONCLUSIONS

The golden grass samples submitted to a temperature of 50°C reacted better when exposed in their capitulum, reaching the maximum germination index of the experiment (78.7%), which corresponds to a germination index 25.4% higher than those exposed directly to the same temperature and 44% higher than the control. The viability of *Syngonanthus nitens* seeds submitted in capitula and bare at 50°C for 10 minutes was higher when compared to temperatures of 100, 150 and 200°C. The exposure time of the bare seeds and in chapters at 150 and 200 ºC made them unviable.

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