INFLUENCE OF SHADING ON FOREST SEEDLING QUALITY WITH POTENTIAL USE IN AGROECOLOGICAL PRACTICES

INFLUÊNCIA DO SOMBREAMENTO NA QUALIDADE DE MUDAS FLORESTAIS COM POTENCIAL USO EM PRÁTICAS AGROECOLÓGICAS

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ABSTRACT

The aim of this study was to evaluate the growth of seedlings of *Hymenaea stigonocarpa* and *Eugenia uniflora* under different conditions of sun exposure during rustification. The treatments established were: rustification in shading 50%, full sunlight and under shading in the period of the day of greatest light intensity, and full sunlight throughout the period. The experimental design was the completely randomized, with two repetitions of fifteen seedlings each. The parameters survival, plant height, stem diameter, height/stem diameter ratio and number of leaves were analyzed at 30 and 60 days. For the two species, the treatment full sunlight and under shading in the period of the day of greatest light intensity resulted in seedlings with higher quality for planting with 60 days of rustification. For *H. stigonocarpa*, it can also be considered rustification in full sun, without the need for shading.

Keywords: *Hymenaea stigonocarpa*. *Eugenia uniflora*. Rustification.

RESUMO

O objetivo deste trabalho foi avaliar o crescimento das mudas de jatobá (*Hymenaea stigonocarpa*) e pitangueira (*Eugenia uniflora*) sob diferentes condições de exposição ao sol durante a rustificação. Os tratamentos estabelecidos foram: rustificação em sombrite 50%, em pleno sol e sob

sombreamento no período do dia de maior intensidade luminosa, e em pleno sol todo o período. O delineamento foi o inteiramente casualizado, com duas repetições de quinze mudas por repetição. Os parâmetros sobrevivência, altura das plantas, diâmetro do colo, razão altura/diâmetro do colo (H/DC) e número de folhas foram analisados aos 30 e 60 dias. Tanto para o jatobá como para a pitangueira, o tratamento com sombreamento no período do dia de alta intensidade luminosa resultou em mudas com maior qualidade para o plantio com 60 dias de rustificação. Para o jatobá, pode ser considerada também a rustificação a pleno sol, sem a necessidade do sombreamento.

Palavras-chaves: *Hymenaea stigonocarpa*. *Eugenia uniflora*. Rustificação.

Is ascending the importance given to the deployment of sustainable agricultural systems including trees in association with agricultural crops and/or animal husbandry as land use option, by raising the income in relation to the agronomic aspects, social, economic and ecological (PALUDO and COSTABEBER, 2012). However, the use of native tree species in such systems has been hampered by the scarcity of studies (MARTINOTTO et al., 2011) and, according to Fonseca et al. (2002), the success of projects using native tree is conditioned, among other things, with the methods employed by nurserymen prioritizing the seedling production with quality and low cost.

As a strategy for the development of seedlings showing satisfactory quality for planting, commercial nurseries use the retractable cover as a way to optimize solar radiation and give continuity of production in any season of the year, making it easier to obtain quality seedlings in a timely manner and constant intervals. However, the cost is high in Brazil and there is also a lack of information about its positive effect on seedling growth (ATAIDE et al., 2011), and nurserymen, especially those who produce seedlings of native species, perform the relocation of seedlings to shade area to decrease seedling stress, which results in losses with the displacement.

Hymenaea stigonocarpa Mart. ex Hayne - Leguminosae) is a characteristic tree of savanna formations, with your fruit showing importance to rural populations as consumption *in natura*, or

for the marketing of by-products, such as jam, liqueur, and flour for cakes, breads and cookies. Also, in the production of firewood and charcoal of good quality (ÁVILA et al, 2011). The species presents potential for use in agroecological practices and agroforestry systems, as described by Da Silva Pereira et al. (2014) and Martinotto et al. (2011).

Eugenia uniflora Linn - Myrtaceae is a trees found throughout the Brazilian territory and that has high economic potential in food and medicinal areas, being popularly used to reduce blood pressure, heartburn, bronchitis, cramps and stomach ailments. Its fruit is used for consumption, production of jellies, candies, soft drinks, ice cream and liqueurs, and in cosmetology. Is recommended for reforestation and as a cost effective alternative and agroecological activities, as in agroforestry systems, particularly for family farmers in the different regions of Brazil (LAMARCA et al., 2013).

This study aimed to compare the growth of seedlings of native forest species, pioneer and non-pioneer, testing different shading conditions during the rustification.

The experiment was accomplished in Viveiro Ribeirão Flora, located in Ribeirão Grande-SP, (24° 5′ 52″ Sul, 48° 22′ 17″ Oeste, and altitude of 684 m). Seedlings of *H. stigonocarpa*, non-pioneer species, and *E. uniflora*, pioneer, were subjected to three different processes of rustification: rustification in shading 50%, full sunlight and under shading in the period of the day of greatest light intensity (sun/shading), and full sunlight throughout the period. The seedlings were obtained through seeding and had your initial growth under shading 50% and of rustification were subjected to three light treatments. The conditions of irrigation, fertilization and location in the nursery were the same for all treatments. To make the shade on sunny days it was used a mobile structure built with shading 50%, acting as a cover, not being accomplished the relocation of the seedlings.

The experimental design was the completely randomized, with two repetitions of fifteen seedlings each treatment. The parameters survival, plant height, stem diameter, height/stem

diameter ratio and number of leaves were analyzed at 30 and 60 days. The results were submitted to analysis of variance and the averages were compared by the Tukey test at 5%.

Along the rustication there was no loss of seedlings of *H. stigonocarpa*, being observed at the end of the experiment the greater height growth when seedlings were maintained under the shading, while the stem diameter was greater when kept in full sunlight and under shading in the period of the day of greatest light intensity. Growth in diameter when grown in full sun is correlated with net assimilation rates of photosynthesis products (GONÇALVES et al., 2000)

According to Moraes Neto et al. (2000), the height of the plant is the most commonly used growth parameter to evaluate the responses of growth, however cannot be a criterion for qualifying for planting seedlings, but the correlation between height and the stem diameter, which must be between 5.4 and 8.1 to prevent lack of rigidity of stem. For *H. stigonocarp*a, height/diameter ideal was obtained in seedlings maintained in full sunlight and under shading in the period of the day of greatest light intensity, with 5.6, and when maintained throughout the period of rustification in full sunlight, with height/diameter 8.1. In both treatments the increase in the number of leaves over the 60 days was similar (table 1).

Table 1. The average height of the aerial part, base diameter, height/stem diameter ratio and number of leaves of seedlings of *Hymenaea stigonocarpa* grown under different levels of shading.

Day of data collection	Treatment	Height (cm)	Stem diameter (mm)	Height/Diameter	Number of leaves
0	Shading	35,1±2,5 g	3,8±0,4 d	9,21±1,3 bc	4,8±1,9 e
	Sun/Shading	35,6±5,0 f	3,2±0,4 e	11,12±1,7 a	4,4±1,1 e
	Full sun	34,9±1,8 g	3,6±0,5 d	9,60±1,6 b	6,4±1,5 d
30	Shading	39,8±1,8 b	4,2±0,4 c	9,57±1,2 b	7,6±1,9 c
	Sun/Shading	37,0±5,1 d	5,6±0,5 a	6,60±0,9 e	6,2±1,1 d
	Full sun	36,4±1,8 e	4,6±0,8 b	7,91±1,2 d	7,8±1,5 c
60	Shading	40,7±1,6 a	4,4±0,8 bc	9,46±1,4 b	10,6±3,2 a

Sun/Shading	38,3±4,7 c	5,6±0,5 a	6,85±0,8 e	8,6±0,9 b
Full sun	37,3±1,9 d	4,6±0,8 b	8,10±1,3 cd	10,4±0,9 a

In the column, medium followed by same letters do not differ by Tukey test (5%).

To 60 days of growth, the increase in the number of leaves on seedlings of *H. stigonocarpa* was higher in shading treatments, however the numbers obtained in full sun with shade and full sun does not represent a problem for the survival of the changes in the field. Ramos et al. (2003), obtained similar results for the species, with higher growth in height and a greater production of leaves under shading, and the production of seedlings with conditions to be shipped when grown in full sun, which, according to the authors, represents species intolerance shaded environments.

For seedlings of *E. uniflora* survival was 70%, with higher growth in height and diameter of the seedlings grown in full sunlight and under shading in the period of the day of greatest light intensity, as well as the index of height/diameter to 7.75, ideal for the planting of plants. As the seedlings of *H. stigonocarpa*, the increase in the number of leaves was lower in this treatment, compared to those grown under shade throughout the period, but not compromising the survival in the field (table 2).

Table 2. The average height of the aerial part, stem base diameter, height/stem base diameter ratio and number of leaves of seedlings of *Eugenia uniflora*, seedlings grown under different levels of shading.

Day of data collection	Treatment	Height (cm)	Diâmetro (mm)	Height/Diameter	Number of leaves
0	Shading	18,6±1,1 d	1,96±0,1 c	9,50±0,8 cd	9,4±0,9 d
	Sun/Shading	18,8±3,5 d	1,98±0,04 c	9,51±1,2 cd	10,0±1,0 c
	Full sun	17,8±2,7 e	1,98±0,04 c	9,10±1,7 d	9,2±1,5 d
30	Shading	19,5±1,3 c	2,04±0,1 c	9,58±1,3 c	10,4±1,7 c
	Sun/Shading	20,8±3,3 b	2,04±0,1 c	10,30±0,9 a	11,0±1,0 b
	Full sun	18,3±2,7 de	2,04±0,1 c	9,10±1,2 d	7,0±2,0 e
60	Shading	20,5±1,4 b	2,10±0,2 b	9,85±1,7 b	12,6±1,7 a
	Sun/Shading	23,4±3,0 a	3,04±0,1 a	7,75±1,4 e	11,2±0,8 b

Full sun	18,8±4,6 d	3,04±0,1 a	6,22±0,9 f	7,0±3,3 e

In the column, medium followed by same letters do not differ by Tukey test (5%).

Although *E. uniflora* is a pioneer species and heliophyte (LORENZI, 2008), in this experiment the seedlings with rustication in full sunlight had low growth in height and loss of leaves, which undertook the survival of seedlings, with 30% mortality. De Almeida et al. (2005), found high rate of mortality of seedlings of *Jacaranda puberula*, also a heliophyte, when grown in full sunlight, and treatment with 30% of shading was ideal. The same was observed in species *Cariniana legalis*, heliophyte shading tolerant, in studies by Rego and Possamar (2006). For these authors, the reduction of the growth in full sun can be associated to the elevation of the temperature in the leaves, with consequent closure of the stomata for some species and, thus, the reduction of the carbon fixation necessary for the growth and survival of the plants.

There are few studies aiming to observe the action of exposure to the sun during the rustification in the quality of the seedlings. In the present work, treatment in full sun with the use of shading on sunny days favored the survival and ideal development of the seedlings of *H. stigonocarpa* and *E. uniflora*, with significant differences. For *Hymenaea parvifolia*, treatments in full sun, as well as 50% or 70% of shading were satisfactory (SILVA et al., 2007). *Caesalpinia ferrous*, presented better development under 50% of shading (LENHARD et al, 2013).

In none of the cited studies the growth was observed under shading conditions only on sunny days. Artificial shading is a technique used to obtain gains, in particular by reducing the damaging action of the sun's rays in periods with high energy availability (CARON et al., 2010).

With the results obtained, one can infer that the use of mobile structure built with shading 50%, without relocation of the seedlings before practiced and that resulted in losses, interfered in the growth and development of plants of *H. stigonocarpa* and *E. uniflora* for shipping of seedlings to the field with 60 days of rustification. For *H. stigonocarpa*, can be considered also the

rustification in full sunlight, without the need for shading, while for *E. uniflora*, direct exposure to the sun was harmful.

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