English Version

Potential early development of *Aspidosperma polyneuron* Müll in rehabilitation projects of degraded area in southeastern Amazon

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Abstract

The definition and recommendation of the species for the different successional stages in areas under the recovery process are dependent on their behavior in environments under different light intensities. Thus, the present work aimed to define the successional stage in which plants of *Aspidosperma polyneuron* Müll Arg must be indicated for use in projects that aim to restore degraded areas according to the intensity of light. The experiment was conducted as a randomized block design with 15 replications. The treatments consisted of three levels of brightness (T1: Full sun, T2: 50% retention of light and T3: Natural Shadow). Data collection was performed at intervals of 21 days, until 145 days after emergence (DAE). Plants of *Aspidosperma poly*neuron Müll subjected to different levels of light intensity linearly as a function of time after planting. When grown in an environment with 50% sunlight they had a rate of growth in height and diameter higher than the plants under full sunlight. The greater weight of dry stem and root were also observed in environments of 50% light. All characteristics evaluated showed mass increases by increasing the light intensity.

Key words: *Aspidosperma polyneuron;* ecological succession; revegetation

Introduction

The dynamic of a tropical forest recovery is a combination of factors, in which groups of species with additional requirements, mainly regarding the necessity of light, are associated in a way that the species of early stages shade the species of final stages in the area of recovery. This phenomenon is known as secondary succession and is a base to distinguish the vegetal species that belong to each group: pioneers, early secondaries, late secondaries and climax (MARTINS, 2009).

Among the ecologic groups, pioneers and early secondaries species, are recommended to initiate the successional stages of the recovery process of degraded areas, since this recommendation is due to its adaptability to conditions of higher luminosity. Pioneer species are dependent of light, may not be found in understory, grow in clearings or in forest edges, and present a life cycle shorter than 10 years. By contrast, the early secondary species are more tolerant to shading, thus they occur in small clearings, large clearing edges, forest edges or understory not densely shaded, and they have a life cycle of 10 to 25 years (FERRETTI et al., 1995; CARVALHO, 2000).

In recovery projects it is planted from 50 to 60% of pioneer species, which are tolerant to adverse conditions and grow fast; from 30 to 40% of early and late secondaries, leaving approximately 10% of climax species. Hence, the greater capacity of adaptability of the species under the conditions of high insolation can assure the success of a degraded area recovery project.

Aspidosperma polyneuron Müll. Arg. is a native species of Semidesciduous Forest in submontane formation. Its wood has multiple uses, as building, rafters, beams, door stops and windows, furniture and car bodies (LORENZI, 2002). It is an endangered species (RIBAS, 2005) and it is listed for conservation on Brazil and Venezuela (CARVALHO, 1994). This makes this vegetal species prior as research object.

Among the forest species with high economic value, it should be emphasized since it can be used for landscaping and mixed reforestation destined to recover the permanent preservation degraded area (LORENZI, 2002). Due to lack of information on

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the behavior of the species in levels of shade and economical importance of the species it is justifiable to study its introduction in programs of degraded area recovery.

Characteristics as height, dry matter, root/shoot relation and diameter of root collar may be used to predict the tolerance degree of the species on environment with different intensity of light.

Thus, it aimed to define the successional stage in which *Aspidosperma polyneuron* Müll. Arg plants may be indicated to the use in projects which aim to recover degraded areas due to the light.

Material and Methods

The work was conducted in the experimental area of the Federal University of Tocantins (UFT), Gurupi University Campus, located on the South region of the state of Tocantins, with 280 m of altitude at the coordinates 11° 43' 45" S and 49° 04' 07" W. The regional climate is BwA'a' humid with moderate water deficit. The average annual temperature is 29.5 °C, with annual rainfall of 1804 mm (KÖPPEN, 1948).

The experiment was conducted in a randomized block design with 15 replications. The treatments consisted of three levels of brightness (T1: 100%, Full sun, T2: 50%, shading screen with 50% of light retention and T3: Natural Shadow). On the treatment with natural shadow, plants were placed in a remaining area of native cerrado vegetation *Stricto sensu*.

Seeds were collected in mother plants selected by plant health, after dispersion of at least 30% of the total volume. After the collection, the seeds were transported to the UFT/CAUG Seed Laboratory, where they underwent to a protocol of aseptically, and then submitted to a process of purge.

The seed germination occurred in beds with coarse washed sand, located in a nursery covered with shading screen which allows the passage of 50% of solar radiation. After germination and achievement of the stage of a pair of leafs, the seedlings were transported to polyethylene bags (0.28 m height and 0.15 m diameter), containing approximately 2 dm^3 of substrates on the proportion 2:1:1 namely 2: terra preta[1], 1: carbonized rice husk and 1: commercial substrate *Plant Florest I*®, and remained there for a period of 50 days.

After the period of formation, plants were submitted to a treatment on an acclimation period of 10 days, and subsequently it was initiated the evaluations. The data collection was executed on an interval of 21 days, until 145 days after the emergence (DAE). The characteristics evaluated were: plant height (AP), diameter of the seed collar (DC), leaf dry matter (MSF), stem dry matter (MSC), root dry matter (MSR), total dry matter (MST), relation height/diameter (A/D), ratio root/aerial part (R/PA) and dry matter partition (DEMS). Height was considered from the root collar to the apex of each plant, measure with a centimeter ruler (cm), and the root collar diameter measured with a millimeter caliper (mm), 1 cm from the soil.

To determine the dry matter plants were divided in leaves, stem and root. During removing the substrate bonded to the roots it was used soft water jets. This operation was executed over a fine-mesh sieve, aiming to avoid root losses (MORAES NETO et al., 2000). The obtainment of the weight was performed separately in an electronic scale analytic and stored in paper bags properly identified, which were placed in an oven with forced air circulation, at approximately 70 °C, for 72 hours.

With the results obtained in the plant height evaluation and collar diameter it was performed the regression analysis of time and to the other characteristics it was performed the variance analysis and subsequently compared the averages by Tukey test at 5% of probability.

Results and discussion

Aspidosperma polyneuron plants cultivated in an environment with 50% of luminosity show height growing rate (β_1: 0.3871) 33.2% higher than the plants under full sun (β_1 0.2585). This difference was bigger after the 103 days of evaluation comparing to the plants growing under full sun. Nonetheless, plants submitted to the condition of natural shading had

1 Epipedon plaggen – Soil Taxonomy (Estados Unidos, 1994)

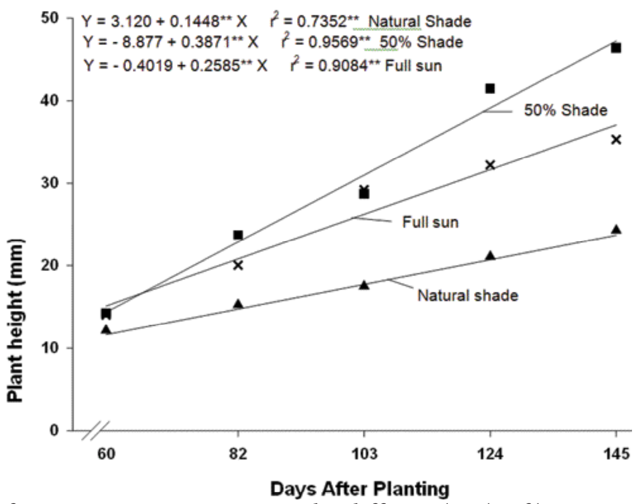

Figure 1. Plant height of *Aspidosperma polyneuron* under different levels of luminosity in relation to the time after sowing.

significant difference after 82 days (Figure 1).

On the condition of plain sun plants presented higher initial height until 65 days. After this period, plants showed inferior height comparing to the plants under the condition of 50% luminosity. Silva et al. (2007), evaluating the species *Theobroma grandiflorum* (Willd. Ex Spreng.) Schum also verified larger initial development when plants were exposed to the condition of 50% luminosity and plain sun. Similar results were observed with *Criptocaria aschersoniana* (ALMEIDA et a*l*., 2004) and *Maclura tinctoria* e *Senna macranthera* (ALMEIDA et al., 2005). However, it did not occur with *Hymenaea coubaril, Acacia mangium* (ALMEIDA et al., 2005) and *Cedrela fissilis* (SANTOS et al., 2006), when comparing them to plants maintained under plain sun. This shows the existence of a divergence between forest species considering the behavior in different environments.

This way, the definition of vegetal community to the introduction of the species on different successional stages in areas under recovery can be achieved according to the evaluation of its tolerance to the intensity of light, which is a selective factor. Thus, *Aspidosperma polyneuron* plants, due to the fact that they present high growth in the circumstances of plain sun until 65 days after the planting, may be used as pioneer provided that other species with higher initial growth rage are planted on the moment of the plant introduction. This happens since from 45 days these plants present higher growth on the condition of 50% of luminosity.

Plants submitted to different luminosity levels showed linear behavior in function of time after planting. However, the rage of plant collar development was higher when submitted to the environment with 50% of luminosity. Plants submitted to natural shading presented lower rages of plant collar development during the evaluation period, i.e. 65.21% (β_1: 0.0216) inferior than plants submitted to 50% luminosity (β_1: 0.0621). By contrast in plants under plain sun this difference was 26.73% (β_1: 0.0455), comparing to those submitted to 50% of luminosity.

Siebeneichler et al. (2008) evaluating *Tabebuia heptaphyilla* (Vell.) plants verified reduction on the plant collar diameter with the increase of shading. However, Almeida et al. (2005), working with *Maclura tinctoria* and *Hymenaea courbaril* and Silva et al. (2007) evaluating the species *Theobroma grandiflorum* (Willd. Ex Spreng.) Schum, did not verify differences on the development of the plant collar under 50% of shading comparing to plants grown under plain sun. In some species, higher luminosity allows a higher photosynthetic rate, and thus higher accumulation of assimilates on the plant stem (TAIZ e ZIEGER, 2002). The selection of forest species with these characteristics as *Aspidosperma polyneuron* enables its

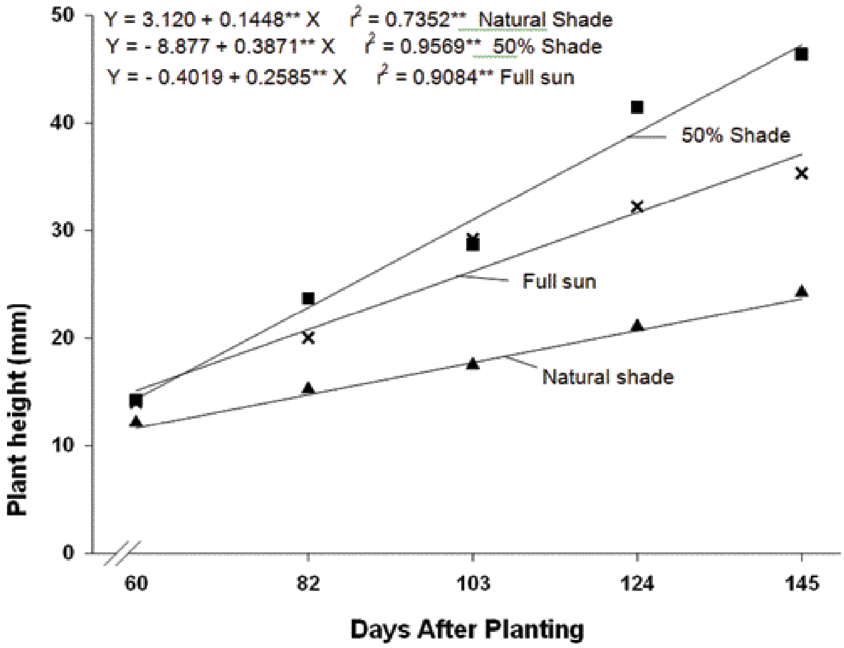

Figure 2. Plant collar diameter of *Aspidosperma polyneuron* submitted to different luminosity levels in function of time after planting.

use as secondary species in degraded areas under the process of recovery. The early secondary successional stage is composed by forest species that that occur in conditions of medium shade or luminosity not too intense, occurring in small gaps, edges of large clearings, forest edges or not densely shaded understory, which is the need for lighting required by *Aspidosperma polyneuron*, ie, a condition close to 50% brightness.

Plants submitted to environments with 50% of luminosity presented greater stem, root and total dry matter weight (Figure 3). All characteristics evaluated showed an increase on weight by the increase of light intensity. Probably plants increase photosynthesis

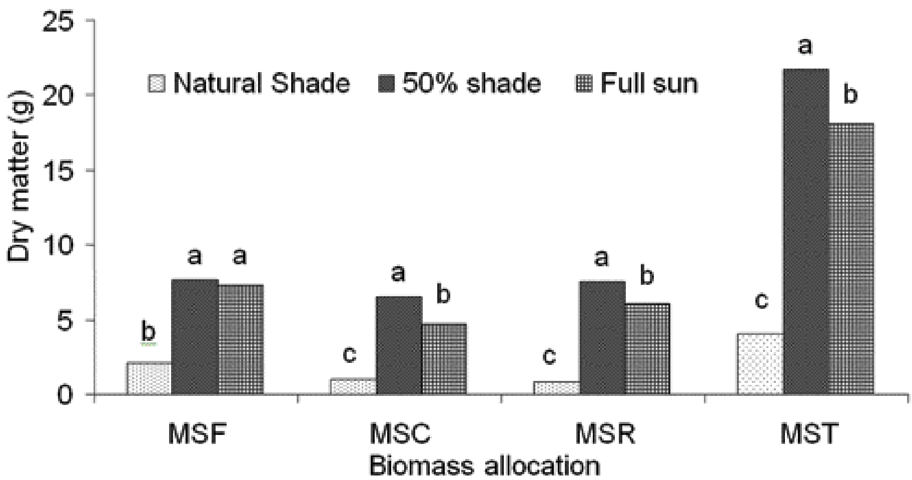

Figure 3. Leaf dry matter (MSF), stem dry matter (MSC), root dry matter (MSR), total dry matter (MST), of the plant parts of *Aspidosperma polyne* comparing to the levels of luminosity by 145 days.

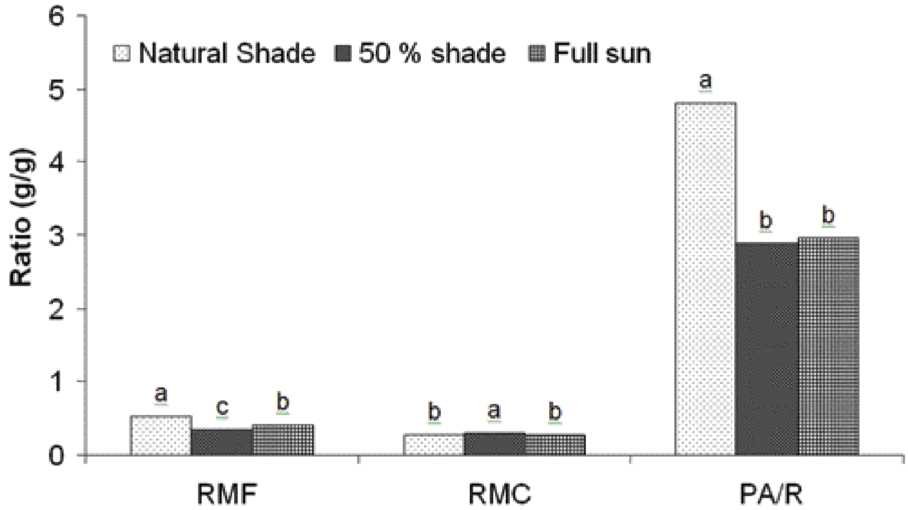

Figure 4. Leaf mass ratio (RMF), Stem mass ratio (RMC) and shoot/root ratio (PA/R) of *Aspidosperma polyneuron* plants based on the luminosity levels on the 145 days.

under greater light availability, which increases the carbohydrate content on leaves, stem and roots which influenced on the increase of the dry matter (LARCHER, 2000). However, the condition of 50% of luminosity probably provided less transpiration and consequently greater wet photosynthesis than the plain sun (TAIZ e ZEIGER, 2004).

Regarding to the leaf mass ratio (RMF), the environment of natural shading provided higher values. By contrast the environment with 50% of luminosity provided the greatest values of the stem mass ratio (RMC), differing from the data obtained a plain sun and in natural shading. However, the relation shoot/root in plants under high light intensity indicates larger allocation of assimilates to the root system. According to Carvalho et al. (2006), this is a strategy that allows the plant to achieve grater water and nutrient absorption to support high photosynthesis and transpiration rates under high light intensity. Plants with this strategy are a

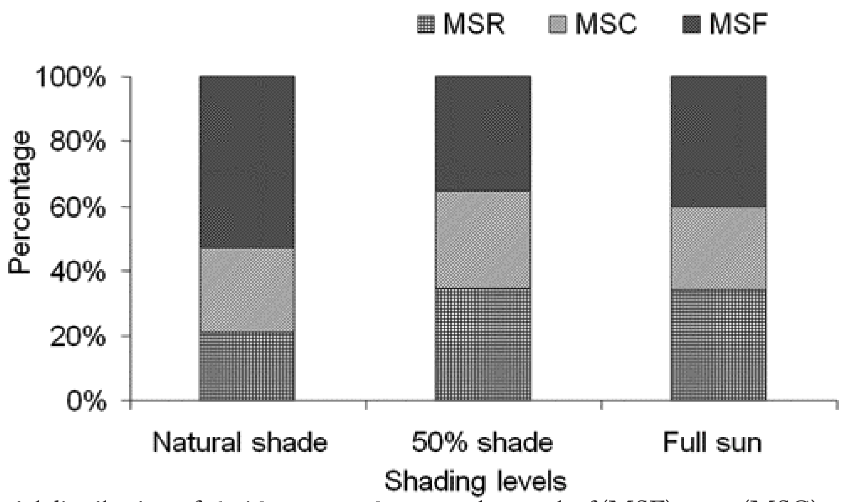

Figure 5. Spacial distribution of *Aspidosperma polyneuron* plant on leaf (MSF), stem (MSC) and root (MSR) dry matter for the shading levels

good suggestion to areas under process of recovery, once they may guarantee the initial development and condition the continuity of successional stages, which is the case of *Aspidosperma polyneuron* plants.

On the division of *Aspidosperma polyneuron* plants, it was verified an increase on the production of roots together with the light intensity, likewise a decrease on the production of stem and leaves, except for the condition of 50% of luminosity in which it was verified an increase on stem dry matter in relation to natural shade (Figure 5). Silva et al. (2007), studying the initial development of the *Hymenaea parvifolia* species, also verified a lower root production in function of the light intensity. Unlike the mentioned species, *Theobroma grandiflorum* presented higher root production under the condition of 50% of light intensity (SILVA et al., 2007). Lee et al. (1996), when cultivating plants with low light intensity, observed that these tend to invest more in biomass production of shoot than root.

Conclusions

Aspidosperma polyneuron plants have more potential of initial development when submitted to environments with 50% of luminosity.

Aspidosperma polyneuron plants should be introduced in areas with recovery process on the early secondary successional stage

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