ABSTRACT: The research was carried out with the objective of evaluating the effect of different substrates based on grass roots, on air layering in lychee plants. The grass seedlings were planted in plastic pots with a capacity of 10 liters with a mixture of soil, sand and barnyard manure (3:1:1). The treatments were composed of Esfagno as a control and forage roots: Tifton, Jiggs, Mombaça and Tanzânia. Ninety days after planting, their roots were removed and placed to dry for later use in layering. After drying the roots, batches weighing 30 grams were made for all species and batches were separated for layering. Air layering was performed on adult lychee plants, in branches between 1 and 2 cm in diameter, with each treatment of five layering. Five plants of each treatment were collected for evaluation. The setting index, green mass and dry mass of the roots were evaluated. Grass roots can be used as a substitute for Esfagno in air layering in lychee trees. The substrates formed by roots of Mombaça and Tanzânia grass showed the best results in replacement of Esfagno in air layering in lychee trees and may be a solution for use in the production of seedlings of this fruit tree.

KEYWORDS: Lychee trees, Seedlings, Grass.
Roots as a Substrate in Layering in Lychee

MATERIALS AND METHODS

The research was conducted in the seedling production nursery and in the IFES region. The nursery is covered with a polyolefin screen with 50% shading, nursery sector of the Federal Institute of Espírito Santo (IFES-Campus Santa Teresa), district of São João de Petrópolis, Santa Teresa, ES, with geographic coordinates 19º56’12” S and 40º35’28”W, with an altitude of 155 m. The climate of the region is characterized as Cwa, mesothermic, with a dry season in the winter and heavy rainfall in the summer (Köppen classification) (ALVARES et al., 2013), with an average annual rainfall of 1,404.2 mm and an average annual temperature of 19.9°C, with a maximum of 32.8°C and a minimum of 10.6°C (INCAPER, 2011).

The experimental design was in randomized blocks (DBC) with 5 treatments and 4 replications, with each treatment composed of 10 air layering and each plant constituted a block. The grass seedlings were planted in plastic pots with a capacity of 10 liters with a mixture of soil, sand and barnyard manure (3:1:1). Irrigations were performed daily, using micro-sprinklers throughout the experiment, with three daily irrigations, lasting 15 minutes. The treatments were composed of Esfagno as a control and forage roots: Tifton, Jiggs, Mombaça and Tanzânia.

Ninety days after planting, when the development of the plants reached the cut-off point for use by animals, their roots were removed and placed to dry for later use in layering. After drying the roots, batches weighing 30 grams were made for all species and batches were separated for layering. Air layering was performed on adult lychee plants in the IFES region, in branches between 1 and 2 cm in diameter, with each treatment of five layering, totaling 100 layering. Five plants of each treatment were collected for evaluation.

The setting index, green mass and dry mass of the roots were evaluated. The experimental data were submitted to analysis of variance using the F test, meeting the model’s assumptions using the Shapiro-Wilk test to verify normality, and the treatment means were compared using the Tukey test at a 5% probability level.

RESULTS AND DISCUSSION

According to Table 1, it is observed that in the variable green mass and dry mass the layering containing Tanzânia grass, Mombaça and Esfagno did not differ statistically, and were statistically superior to the other treatments. Air layering containing Jiggs grass presented the worst result in these variables.

In terms of setting and callus production, there was no statistical difference in any of the treatments (Table 1). According to Hartmann et al. (2011), the wound made at the time of girdling contributes to callus formation, as cellular activity in the injured area is stimulated by an increase in respiratory rate and an increase in auxin, carbohydrate and ethylene levels, stimulating the formation of calluses and also of roots, being a precursor to the formation of adventitious roots.

Table 1. Average values of green matter, dry matter, setting index and callus index

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Green Matter (g)</th>
<th>Dry matter (g)</th>
<th>Handle Index (%)</th>
<th>Callus Index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jiggs</td>
<td>1.543 c</td>
<td>0.742 b</td>
<td>80 a</td>
<td>80 a</td>
</tr>
<tr>
<td>Tifton</td>
<td>1.761 bc</td>
<td>0.825 b</td>
<td>100 a</td>
<td>100 a</td>
</tr>
<tr>
<td>Tanzânia</td>
<td>2.665 a</td>
<td>1.155 a</td>
<td>100 a</td>
<td>100 a</td>
</tr>
<tr>
<td>Mombaça</td>
<td>2.669 a</td>
<td>1.178 a</td>
<td>100 a</td>
<td>100 a</td>
</tr>
<tr>
<td>Esfagno</td>
<td>2.852 a</td>
<td>1.331 a</td>
<td>100 a</td>
<td>100 a</td>
</tr>
<tr>
<td>CV(%)</td>
<td>23.55</td>
<td>20.81</td>
<td>19.64</td>
<td>19.64</td>
</tr>
</tbody>
</table>

Means followed by the same letter in the column, in the same column, do not differ from each other by the Tukey test, at a 5% probability level.

Esfagno presents itself as a material with greater water retention capacity, lightness, acid pH, easy handling and sterility, these points may have influenced the results presented. Esfagno has as main characteristics its lightness, acid pH, high water retention capacity, easy handling and sterility (BONETTI, 1992).

Hartmann et al., (2011) mention that before the formation of roots we have the formation of calluses in some species. However, Lins et al. (2015) in studies with Esfagno and coconut fiber in ‘Bengal’ lychees at different times of the year and found the lowest rooting rates in May and July, however, at this time they had the most developed callus mass. This fact indicates that the formation of roots in lychee layers does not depend on the formation of calluses, especially when it comes to substrates such as coconut fiber and seaweed (VIEIRA et al., 2019)
Mombaça grass and Tanzânia grass showed similar characteristics to commercial material (Esfagno), this fact may be due to the physiological characteristics of forages, in addition to these characteristics, they have a high content and capacity to store carbohydrates and proteins. Another important point presented by these grasses is, according to Herling et al. (2001), resist periods of water stress and compete for nutrients in the soil, promoting sufficient mass for propagation by layering.

Souza et al. (2015), studying the characteristics of Esfagno, found water retention capacity ($35.73 \text{ ml} \ 50 \text{ cm}^{-3}$), total porosity (82.40%), electrical conductivity ($194.80 \mu \text{s} \text{ cm}^{-1}$) and hydrogen potential in the aqueous extract of the substrate (5.0), resources that are considered ideal for the development of roots in layering.

Vieira et al. (2019), in studies with Tifton 85 grass, reported that this, as a substrate, presented easy handling and cultivation, in addition to good adaptation to Brazilian soil conditions. The observation is that Tifton, like the other substrates used in this research, may have conferred lightness, aeration and good moisture retention in the layering, a fact that suggested the results of this research, however, further characterization studies of these substrates are needed.

In addition to the characteristics, these grass species can also be used for grazing, as well as in hay and silage, with good acceptance by cattle, buffaloes, horses, sheep and goats (SANTOS et al., 2010). Vieira et al. (2019), cite the good result of Tifton 85 grass, the root system used as an alternative substrate to Esfagno due to the strong potential of lychee stratification, which can replace Esfagno as a substrate in air layering in lychees.

CONCLUSION
Grass roots can be used as a substitute for Esfagno in air layering in lychee trees. The substrates formed by roots of Mombaça and Tanzânia grass showed the best results in replacement of Esfagno in air layering in lychee trees and may be a solution for use in the production of seedlings of this fruit tree.

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