Effect of Age and Handling on Subsequent Growth and Development of Areca Palm, *Chrysalidocarpus lutescens*, Seedlings[1]

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Abstract

This study was initiated to determine the optimal stage to transplant Areca Palm, *Chrysalidocarpus lutescens* H. Wendl., seedlings and to determine their tolerance to adverse handling during transplanting. Best growth and less plant loss occurred when transplanting was done at an early developmental stage (spike or 1st-leaf stage compared to 2nd-leaf stage). Growth reduction and losses were minimized when minimum root disturbance and desiccation occurred.

Index words: Transplanting, Areca Palm, Butterfly Palm, Yellow-Palm

Introduction

The production of palms in Hawaii has increased over the past few years due to greater interest in them for the landscape and as potted foliage plants. This increase in production has generated a greater concern for the problems involved in the culture of the crop, one aspect is the handling of transplants once germination begins. This study was initiated to determine the effect of stage of growth at transplanting and technique of handling of transplants of Areca Palm, *Chrysalidocarpus lutescens,* seedlings on subsequent growth and development.

The Areca palm is commercially propagated by seeds in flats or beds then transplanted to containers for further growing. Vegetable transplant studies have shown that yield, size, overall growth and health are greatly influenced by the time of transplanting due to the physiological recovery of young plants (1,2,5,9). A general rule is to transplant seedlings with the appearance of the first true leaves (6,7). It has been suggested that palm seedlings should be transplanted when 1 to 2 mature leaves have developed (3,4,8). Failure to remove the plants at the appropriate stage can result in extensive damage to larger root systems, slow establishment, and poor growth (5).

Materials and Methods

Forty-day-old seedlings, germinated in a 1:1 peat: perlite (by vol) medium, were taken from community seedling flats at three stages: (1) when the first true leaf was elongated from the first plumular leaf (sheath) but not unfolded (spike leaf stage); (2) when the first true leaf was fully unfolded and matured; and (3) when the second true leaf was fully unfolded and mature. Seven treatments were installed in a split-plot over time design. Treatments were in a completely randomized arrangement, with 8 replicates (5 uniform seedlings per replicate) for each of the 3 stages.

Treatments were chosen to simulate possible conditions encountered during production in the nursery such as water stress, rough handling, and poor environmental conditions. The treatments consisted of: (1) seedlings grouped as they grew in the flat, carefully removed, leaving roots and germinating medium intact; (2) seedlings individually separated, medium removed, then planted immediately; (3) seedlings separated, medium removed, allowed to sit on the surface of the flat exposed for 30 minutes prior to planting; (4) seedlings separated, planted immediately but not watered until the next day; (5) seedlings separated, medium removed, placed under intermittent mist for 30 minutes then planted; (6) seedlings separated, planted immediately, then placed under intermittent mist for 1 day; and (7) seedlings separated, planted and immediately placed under 30% saran shading (7500 ft-c).

Seedlings of all three stages were transplanted into 10 cm (4 in) square plastic pots with 5 uniform seedlings per pot. The medium consisted of a 1:1 peat:perlite (by vol) mix with Micromax (Sierra Chemical Company) and dolomite added at the rate of 0.9 kg/m^3 (1.5 lbs/cu yd) and 4.8 kg/m^3 (8 lbs/cu yd), respectively. Plants were fertilized every 10 days with Grow More (National Research and Chemical Company) 20N-8.8P-16.6K (20-20-20) at manufacturer's suggested rate of 7 g/l (0.8 oz/gal).

Transplanted seedlings, with the exception of those in treatment #7, were placed under 73% saran shade (3138 ft-c), and watered immediately unless treatments dictated otherwise. Temperatures in the shadehouse ranged from 20° to 30°C (70° to 88°F) during the experimental period.

Data consisted of the overall increase in height (measured from the soil surface to the leaf tip and averaged for the 5 seedlings in a pot), and seedling mortality taken at 10 day intervals to 50 days and a final measurement at 150 days from the start of the experiment. Analysis of variance and Waller-Duncan multiple range test was conducted on the data. Due to the limitations of the experimental set-up, statistical analysis between stages of development in addition to treatment effects at a given stage was deemed inappropriate (Tables 4, 5).

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Conclusions drawn are without statistical significance between stages.

Results and Discussion

Areca palm seedlings transplanted at the spike leaf stage showed little growth reduction due to the handling of the transplants (Table 1). Exposing the seedling to the air for 30 minutes prior to planting resulted in a slight reduction in height at 20 days after planting. After 30 days, however, these plants had recovered and were comparable in size to those in other treatments.

When the seedlings were transplanted after the first leaf was fully expanded and mature (Table 1), those that had their roots exposed to the air for 30 minutes were stunted, showing limited recovery after 50 days. Again the other treatments had no adverse effect on seedling growth.

Transplanting at the 2nd-leaf stage resulted in greater growth reduction of seedlings with their roots exposed for 30 minutes (Table 1). These plants were 64% shorter than seedlings that were barerooted but planted immediately when measured 50 days after transplanting. This compares to a 37% growth reduction for seedlings transplanted at the 1st-leaf stage. At 150 days, the difference between these treatments for the 2nd-leaf stage was 28%, indicating some recovery in growth but at the 1st-leaf stage there was only a 17% growth difference (Table 2).

At 150 days from the start of the experiment, seedlings transplanted at the 2nd-leaf stage were still shorter than those transplanted at the other two stages (Table 2). This suggests that transplanting injury increases with increasing age of the seedling. Total growth for the 150-day duration of the experiment for seedlings exposed for 30 minutes was also less with increasing age of seedlings at transplant (Table 2). Seedling growth was influenced by treatments to a greater extent at the 2nd-leaf stage than at the spike or 1st-leaf stages.

Seedlings grown under the 30% saran shading were shorter and more chlorotic regardless of transplant stage than comparable seedlings under 73% shade at 150 days (Table 2). This indicates that the 30% shading allows too much light for these plants at this young stage of development under the conditions of this study. Poole and Conover (6) reported that best palms were produced under 40% shade (6,000-7,000 ft-c) in Florida.

Seedling mortality was greatest when seedling roots were left exposed for 30 minutes prior to potting (Table 3). The mortality increased as the age of the seedling at transplanting increased with losses of 63% for seedlings transplanted at the 2nd-leaf stage compared to only 8% for those transplanted at the spike-leaf stage. Overall, there was a difference of 9% and 5% mortality from the 2nd-leaf and 1st-leaf stage, respectively, compared to the spike-leaf stage.

Table 1. Effect of transplant treatment on growth[z] of Areca palm, *Chrysalidocarpus lutescens,* seedlings transplanted at three developmental stages, after 50 days.

	Developmental Stage		
Treatment	spike-leaf	1st-leaf	2nd-leaf
Minimum disturbance	9.4 a[y]	8.5 a	10.1 a
Normally planted	9.7 a	8.4 a	9.4 a
Seedlings exposed to air	9.9 a	5.3 b	3.4 b
Planted, water withheld	9.6 a	8.7 a	8.3 a
Seedlings exposed to mist	9.9 a	7.9 a	8.6 a
Planted, exposed to mist	10.4 a	7.9 a	7.9 a
Planted, 30% shade	9.2 a	8.1 a	9.2 a
Average per stage	9.7	7.8	8.1

[z]Average growth increase after transplanting in cm.

[y]Means within columns followed by the same letter or letters are not significantly differant at the 5% level as determined by the Waller-Duncan Multiple Range Test.

Table 2. Effect of stage of seedling development on plant height[z] of of Areca palm, *Chrysalidocarpus lutescens,* 150 days after transplanting.

	Developmental stage		
Treatment	spike-leaf	1st-leaf	2nd-leaf
Minimum disturbance	33.6 b[y]	37.0 a	35.7 a
Normally planted	38.3 a	34.1 a	33.9 ab
Seedlings exposed to air	36.1 ab	28.4 b	24.3 e
Planted, water withheld	36.6 a	35.1 a	28.3 cd
Seedlings exposed to mist	36.9 a	36.0 a	30.4 bc
Planted, exposed to mist	36.1 ab	34.3 a	31.3 cd
Planted, 30% shade	25.0 c[x]	27.1 b	26.3 de
Mean growth of all treatments	37.7	33.1	30.1

[z]Average growth increase after transplanting in cm.

[y]Means within columns followed by the same letter or letters are not significantly different at the 5% level as determined by the Waller-Duncan Multiple Range Test.

[x]Growth of these seedlings was affected by a non-diagnosed foliar disease.

Table 3. Effect of stage of seedling development on Areca palm, *Chrysalidocarpus lutescens,* on percent survival[z] 50 days after transplanting.

	Developmental stage		
	spike-leaf	1st-leaf	2nd-leaf
Treatment	Percent survival		
Minimum disturbance	100 a[y]	100 a	100 a
Normally planted	100 a	100 a	100 a
Seedlings exposed to mist	92.5a	65 b	37.2 b
Planted, water withheld	100 a	92.5 a	92.5 a
Seedlings exposed to mist	100 a	97.5 a	92.5 a
Planted, exposed to mist	100 a	97.5 a	100 a
Planted, 30% shade	95 a[x]	97.5 a	100 a
Total percent that survived per development stage	98.2	92.9	89

[z]Percent of seedlings that survived per treatment.

[y]Means within columns followed by the same letter or letters are not significantly different at the 5% level as determined by the Waller-Duncan Multiple Range Test.

[x]Death of these seedlings caused by a non-diagnosed foliar disease.

The results of this trial suggest that Areca palm seedlings are highly tolerant of adverse conditions during transplanting. The most detrimental factor in this study was desiccation of roots at transplanting. Best results were obtained when the roots received minimum disturbance (when seedlings were removed from the medium, potted and watered immediately).

Plant losses can be further minimized by transplanting at an early stage, either at the spike-leaf or 1st-leaf stage rather than the recommended 2nd-leaf stage. Growth reduction and mortality of seedlings increased as seedling age at transplanting increased.

Significance to the Nursery Industry

Palms are considered slow growing plants which require considerable time to reach salable size. To reduce this time and maximize profits, growers should avoid situations which stress the plants during the production cycle. This study suggests that growth reductions and plant losses can be minimized when transplanting is done at the spike- or 1st-leaf stages, and when root disturbance and desiccation are minimized.

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Douglas Fir Seed Sources Tested for Christmas Trees in Connecticut[1]

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Abstract

Douglas fir, *Pseudotsuga Menziesii* (Mirb.) Franco, is a popular Christmas tree in the Northeast. In 1976 trees from 11 geographic sources ranging from British Columbia to southern Arizona and New Mexico were planted in a replicated design and managed as a commercial plantation. Information was also obtained on 10 seed sources grown on a commercial tree farm. All sources were hardy in the Connecticut plantings. In general, trees from southern Rocky Mountain sources were bluer, and grew faster than those from northern sources, but they were also more susceptible to attack by Cooley gall aphid, *Adelges cooleyi* (Gill), and rhabdocline needle cast fungus, *Rhabdocline pseudotsugae* (Syd.)

Index words: Douglas fir, *Pseudotsuga Menziesii,* Christmas trees, seed sources, *Rhabdocline pseudotsugae, Adelges cooleyi*

Introduction

Douglas fir has long been a staple of the timber industry in the West. It is native from Alaska to Mexico and found from sea level to 3300 m (10,000 ft). It is also an excellent Christmas tree and is widely grown in plantations in western and eastern United States. Genetic variation within the species is great, and is related to geographical source (1,2,3,4). For instance, rapid growth and bluish foliage have been reported to be characteristic of southern seed sources in contrast to the slower growing, more yellow green foliage of northern sources. Different seed sources might well respond differently when grown in widely separated geographic areas, on different soils, or even when managed differently. Data comparing several Douglas fir sources under southern New England growing conditions were not available. We report the results of a replicated trial of 11 sources of Douglas fir grown at two locations and a commercial planting of 10 sources at a third location, all in Connecticut.

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