

# FACTORS AFFECTING THE SURVIVAL OF TRANSPLANTED SABAL PALMS

by Arthur C. Costonis

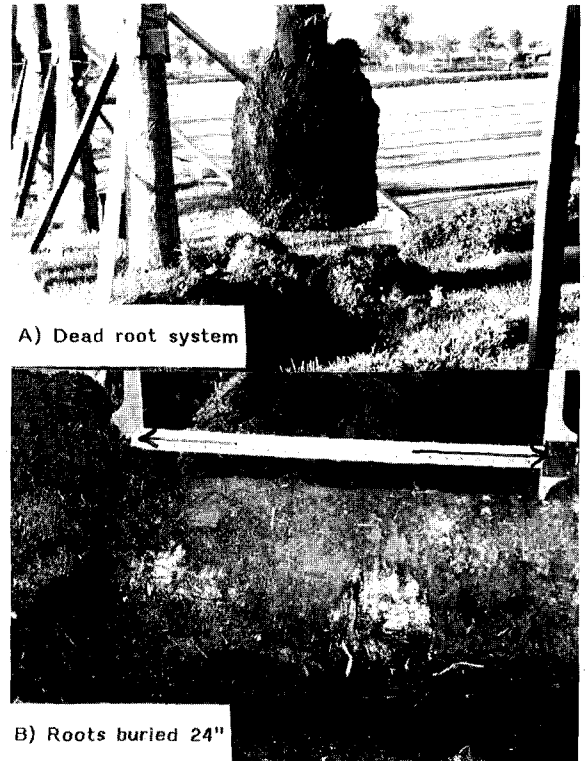
**Abstract.** The growth and vigor of sabal palms with their fronds removed before transplanting were statistically superior to those with fronds intact at time of transplanting. A root wrap treatment combined with planting the palms 4-6 inches above existing grade on a wet site statistically improved both the growth and the vigor of the palms whether the fronds were removed or intact. The loss rate in the study palms was 2.1% compared to the loss rate of 99% of the transplanting that employed conventional techniques.

Sabal palms (*Sabal palmetto*) are among the most widely transplanted palms in Florida. The majority are dug as mature specimens from natural stands since their slow growth rate makes nursery production uneconomical. Survival rates for transplanted palms are significantly lower than landscapers are willing to admit. The factors most responsible for this low survival rate are mainly cultural and can be corrected. Chief among these are the mechanical digging of the palm with dull blades that tear and rip roots; using a chain rather than a nylon strap to lift the palm from the ground; allowing the freshly dug palm to violently swing causing internal injury to the meristem bud tissue; cutting the root system almost even with the trunk; allowing the exposed root system to desiccate before planting; shipping palms with active fungus/insect pests; leaving approximately one to two thirds of the old fronds tied tightly around the bud to ostensibly provide support for the bud and continued photosynthetic activity for the palm.

Another major factor is planting the palm below the grade at which it grew in its natural state. If the planting site is wet, a high loss rate can be anticipated when the palm is planted below grade. The author was called onto just such a mall site to try to establish why a loss rate approaching 99% of approximately 3,000 transplanted sabal palms had occurred over a period of two growing seasons. Evaluation of the dead and dying sabal palms on site revealed two factors. One was that the palms

were planted from 10-52 inches below their natural root depth (Figure 1). The second was that the soil was primarily a silty muck and most planting pits were saturated with water. These soil conditions insured that the soil oxygen/carbon dioxide ratio would be out of balance to promote plant establishment.

Examination of the root systems revealed that there was little to no ultimate or first and second order root growth as described by Tomlison (4). Since the developers were committed to replacing the sabal palms with sabal palms, the task was to



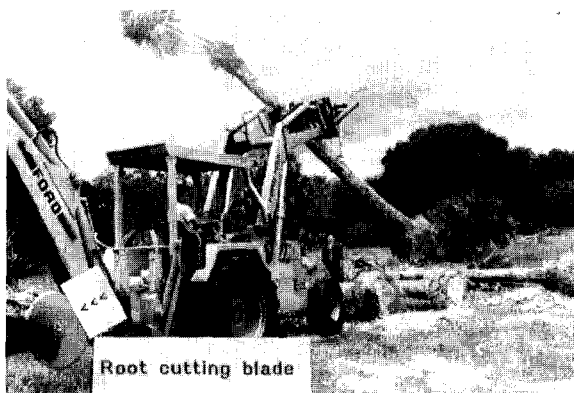
**Figure 1. (A) A suspended dead root system of a Sabal palm planted too deeply in a wet muck soil. (B) The palm was planted 24" below grade.**

develop a protocol to insure that sabal palms would grow on this site. Observations by the author and the research presented by Broschat (2) had revealed that the removal of all fronds of sabal palms before transplanting significantly increased their survival rate as well as their overall vigor.

The objectives of this study were to investigate the effects of transplanting sabal palms with and without fronds on a wet site. The effect of root ball size, planting depth, and the effects of a Gel-Tek Plus/Burlap Wrap treatment were also evaluated.

## Materials and Methods

**Palm selection and preparation.** All sabal palms (*Sabal palmetto*) were machine dug in the field in early summer with a modified backhoe to which a large round steel cutting blade was affixed (Figure 2). The palm was dug by making four cuts on all sides of the palm forming a root ball that was 24 inches square and approximately 20 inches deep. The palm was then lifted by means of a nylon strap wrapped around the trunk attached to the boom of the tractor. All cut roots were trimmed with sharp loppers to remove ripped root ends. All of the old frond bracts were removed beginning at the base of the trunk leaving those intact on the upper six feet of the trunk. There were 141 palms used in this study. The palms were transported 150 miles and planted 24 to 48 hours after digging. They were grouped and treated as follows (Fig. 3):



**Figure 2.** The equipment used to field dig Sabal palms. A back hoe has been modified to lift and transport the palms. A root ball cutter bar has been affixed to the rear of the backhoe.

Group 1 Fronds Intact (FI). This group contained 45 palms that had been pruned so that approximately 8 of the youngest fronds remained. These were tied together with hemp twine. The root systems remained exposed.

Group 2 Fronds Removed (FR) This group contained 47 palms that had all of the youngest fronds removed immediately after digging. The root systems remained exposed.

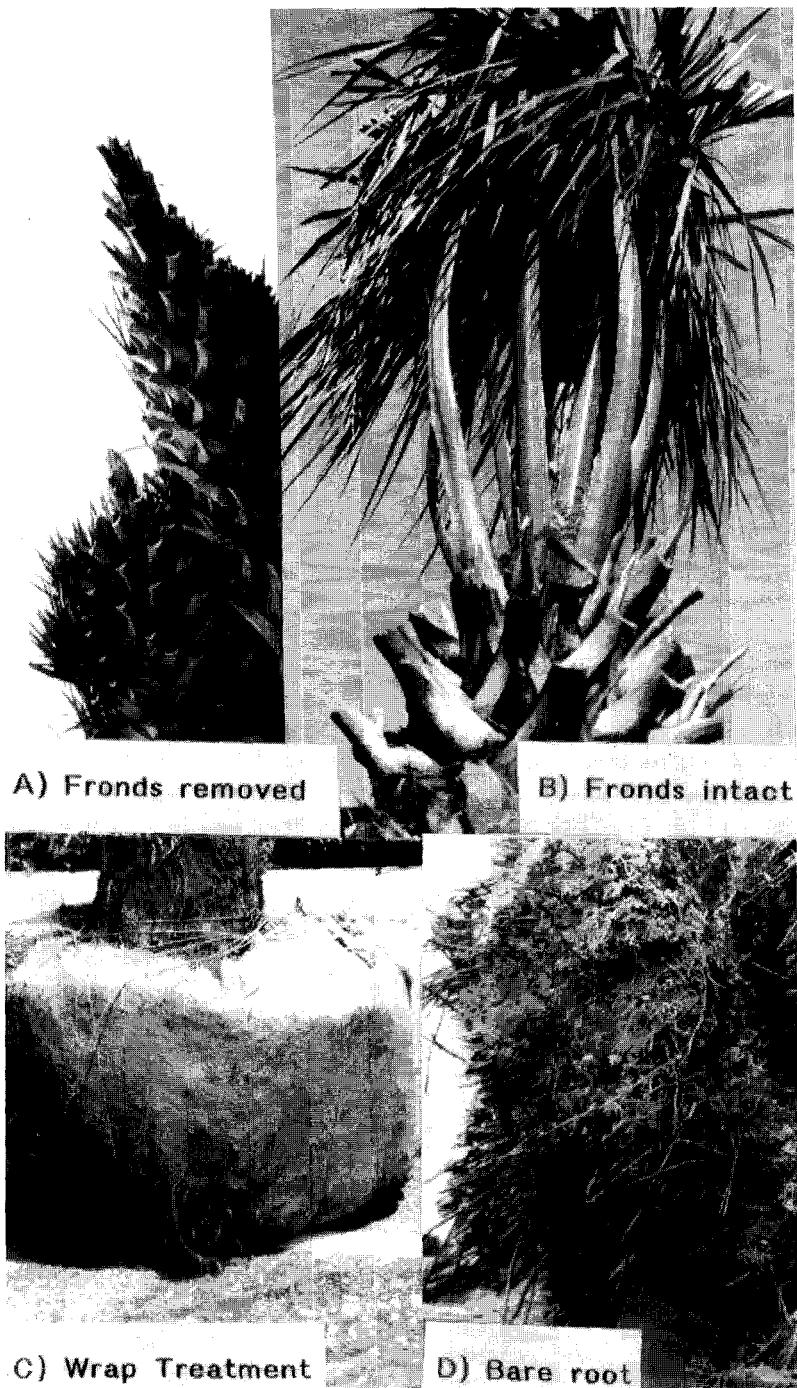
Group 3 (Wrap.FI). This group contained 18 palms that had been pruned so that approximately 8 of the youngest fronds remained. These were tied together with hemp twine. The root system was wrapped in burlap and tied with hemp twine. These were treated with the Gel-Tek Plus treatment at the time of planting.

Group 4 (Wrap/FR). This group contained 31 palms that had all of the old fronds removed immediately after digging and the root system was wrapped in burlap and tied with hemp twine. These were treated with Gel-Tek Plus at the time of planting.

A completely randomized block design was used. Approximately 23 palms from each of the above four groups were transplanted into six separate palm allees at the mall site.

All of the fronds of the palms were sprayed with a combination fertilizer-fungicide-insecticide before being shipped to the site for transplanting. The fertilizer was a 20-20-20 soluble fertilizer with micronutrients. The fungicide was Mancozeb. The insecticide was Dursban liquid. These chemicals were applied according to the manufacturer's label rates. All of the palms were again treated with this formulation 30 days after planting. Groups 3 and 4 received the Gel-Tek Plus treatment immediately after planting. Gel-Tek Plus is a liquid suspension formulation consisting of a polyacrylamide gel, a soluble fertilizer (10-10-20 with micronutrients) and a cytokinen extract. It is administered by means of a soil injection needle and injected into the rhizosphere at a depth of 4-6 inches at 150 psi at one quart of finished product per inch of tree diameter measured at 4 feet above the ground.

**Planting specifications.** All planting pits were dug 12 inches wider than the root ball and approximately 20 inches deep. Approximately six



**Figure 3.** The various treatments applied to the sabal palms before transplanting. (A) Fronds removed (FR); (B) Fronds intact (FI); (C) Wrap treatment; (D) Bare root ball.

inches of 2-3 inch diameter washed gravel were placed in the bottom of the pit. This procedure was done to insure that the palms would be planted from 4 to 6 inches above grade and to help promote drainage and soil air exchange. The planting mix consisted of 90% coarse sand and 10% existing muck top soil excavated on site. All palms were supported by three stakes. All palms were watered with a jet stick to remove air pockets. The wrap treatment was applied to palm Groups 3 and 4 to enhance the establishment of the palms.

**Data acquisition.** Palms were evaluated for vigor visually and by observing new frond growth. The vigor rating scale was numeric ranging from 1-5, where 1 = dead or dying; 2 = poor; 3 = fair; 4 = good; 5 = excellent. New frond growth was determined by averaging the exposed length of the fastest growing 3 fronds per palm. Measurements were taken at 30 day intervals for the first four months after planting during the first growing season. Subsequent measurements were taken 8 and 19 months, respectively, after planting.

The data were analyzed using an Analysis of Variance testing for main effects of frond removal, allee effect, wrap treatment for Fronds Intact and Fronds Removed, and a wrap treatment for interaction for growth and vigor at 120 days. The p values for the tests were determined.

## Results and Discussion

Sabal palms with fronds removed (FR) were compared to those with fronds intact (FI).

**Growth.** The FR groups began producing new growth between 6 and 10 days after planting while the FI groups didn't produce any new growth during that period. After 30 days, the growth of the new fronds produced on the FR group was more than three times that of the FI group (Table 1). After 60 days the growth of the FR group was about twice that of the FI group (Table 1). After 90 and 120 days the growth differences of the two groups narrowed although the groups with FR was still greater than those with FI. An analysis of variance test for the main effect of the improved growth of the FR group compared to the FI group was statistically significant ( $p = .0001$ ).

These results support those reported by

Broschat (1). They also complement the findings reported by Oyama and Mendoza (3) and Mendoza et al (2) who have demonstrated that when *Chamaedorea tepijilote* and *Astrocaryum mexicanum* were manually defoliated, their growth was greater than those with intact fronds.

**Vigor.** The initial vigor of the (FR) and (FI) were comparable at 4.4 (Good). After thirty days the FI group had a slight decline in vigor which continued for the next 30 days (Table 1). The vigor increased in the FI group for the next 60 days. By comparison the vigor of the FR groups was slightly higher than the FI group after 30 days growth and continued to remain higher or equal throughout the study (Table 1). An analysis of variance test for the main effect of the improved vigor of the FR group compared to the FI group was statistically significant ( $p = .009$ ). These results support those reported by Borschat (1).

**Wrap treatment.** Comparison of sabal palms with and without the wrap treatment with fronds intact (FI) or fronds removed (FR) showed the following: The growth and vigor of sabal palms with fronds removed and with the wrap treatment was superior to palms with fronds intact and without the wrap treatment (Table 2). An analysis of variance test for the improved growth and vigor of the wrap treated palms with FR compared to

**Table 1. Average <sup>a</sup> vigor and frond growth of sabal palms transplanted with fronds removed (FR) or fronds intact (FI).**

	Vigor <sup>b</sup>		Growth (cm)	
	FI	FR	FI	FR
<b>1991</b>				
7/17	4.2	4.3	9.0	33.6
8/03	4.0	4.5	29.3	57.5
9/05	4.0	4.5	53.5	76.0
10/11	4.3	4.5	69.8	85.5
<b>1992</b>				
1/08	4.0	4.3	75.0	93.0
12/09	4.3	4.4	91.3	103.3

a. Averages based on a total of 141 sabal palms (63 FI and 78 FR)

b. Visual vigor rating: 1 = dead or dying; 2 = poor; 3 = fair; 4 = good; 5 = excellent

**Table 2. Comparison of the average <sup>a</sup> vigor and frond growth of sabal palms with or without a wrap treatment <sup>b</sup> with fronds intact (FI) or fronds removed (FR) prior to transplanting.**

	Vigor <sup>c</sup>				Growth (cm)			
	FI		FR		FI		FR	
	No wrap	Wrap	No wrap	Wrap	No wrap	Wrap	No wrap	Wrap
<b>1991</b>								
7/17	4.1	4.5	4.3	4.5	6.6	16.3	24.5	31.3
8/03	3.9	4.3	4.2	4.6	25.4	41.9	47.0	55.3
9/05	3.8	4.7	4.2	4.6	48.3	70.4	61.3	81.3
10/11	4.1	4.6	4.4	4.8	61.5	78.7	71.0	91.5
<b>1992</b>								
1/08	3.8	4.5	4.0	4.5	72.9	87.4	80.5	100.5
12/09	4.3	4.8	4.5	4.5	91.9	99.1	95.3	109.5

a. Averages based on 92 palms with no wrap treatment and 49 with the wrap treatment

b. The wrap treatment consisted of wrapping the root balls in burlap and treating the palm at the time of planting with Gel-Tek Plus soil injection.

c. Visual vigor rating: 1 = dead or dying; 2 = poor; 3 = fair; 4 = good; 5 = excellent

those without the wrap treatment and FI was significant. The p values for growth and vigor were .004 and .002, respectively.

It is of interest to note that the vigor of the palms with the wrap treatment whether or not the fronds were removed was greater than those without the wrap treatment (Table 2). It is suggested that the burlap reduced the desiccation of the root system while the palms were in transit from the collection site to the planting site. The application of the Gel-Tek Plus formulation at the time of planting also aided the establishment of roots of these palms. Broschat and Donselman (2) make reference to the importance of the use of burlap to maintain the integrity of the root system as well as to keep the root system moist. The wrap treatment meets both of these requirements.

Only three of the 141 sabal palms in this study died. Those that died were in the group that were bare rooted, did not receive wrap treatment, and had intact fronds.

A total of 2,970 palms out of 3,000 (99%) previously planted on this site without regard for root depth, planting mix, or frond treatment died. The results obtained in this study demonstrated that when the palms were planted 4 to 6 inches above existing grade in a 90% coarse sand: 10% site top soil they grew quite well. It is clear from this

study that the high loss rates of transplanted Sabal palms that commonly occur can be significantly reduced by making modifications in planting procedures dictated by site conditions.

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**Résumé.** Le taux de croissance et la vigueur des choux palmistes dont les frondes avaient été coupées avant la transplantation étaient statistiquement supérieurs à ceux dont les frondes avaient été laissées intactes. Un traitement consistant à emballer de jute et à vaporiser de Gel-Tek le chou palmiste améliorait de façon significative, et le taux de croissance et la vigueur, peu importe que les frondes aient été coupées ou laissées intactes. Le taux de mortalité passait de 99 à 2.1% après avoir fait les corrections nécessaires concernant le degré d'humidité et la profondeur de plantation.

**Zusammenfassung.** Diese Studie bewertet die Verfahren zur Verbesserung der Überlebensrate von der Sabal palme (*Sabal palmetto*), die auf einen nassen Standort einer städtischen Promenade verpflanzt wurde. Die Palmen wurden 15 bis 20 cm tief in ein Pflanzgemisch aus 90% grobem Sand und 10% standörtlichem Mutterboden gepflanzt. Die Behandlungen verglichen Palmen mit entfernten und intakten alten Palmwedeln. Die Pflanztiefe und Wurzelballengröße wurden ebenfalls verglichen. Zusätzlich wurde ein bodeninjiziertes Wurzelstimulans, Gel-Tek®, bewertet. Die Wachstumsrate der Palmen mit entfernten Wedeln war deutlich besser ( $p = .0001$ ) als die derer mit intakten Wedeln. Das Wurzelstimulans verbesserte ebenfalls deutlich die Wachstumsrate ( $p = .001$ ).

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