valuable crop, would alter the total value of the garden considerably.

Labor requirements were three times greater for the smaller but more intensive garden than for the larger garden at Tallahassee (Tables 2, 4). However, the extra hours were not justified on an economic basis. Return per hour of labor was only $4.89 in the smaller garden compared with $13.63 per hour in the larger garden. Other rewards were provided, however, such as a greater array of vegetables and their dietary contributions.

Cost inputs were similar for all of the Florida gardens: Tallahassee, $71; Jacksonville, $83, and Homestead (5), $96 (Table 5). A breakdown of cost per garden in the U.S. of $19 is not shown in the survey (2). Since it is a survey figure, it may be that gardeners did not report all of the cost inputs when asked.

The statistic of most significance to gardeners is the net profit figure. Both gardens reported in this paper showed a net profit, with or without a charge for labor. The Jacksonville garden returned a profit of $333, or $52 per 100 sq. ft. The Tallahassee garden returned a net value of $314, or $23 per 100 square feet. These net values indicate that successful vegetable gardens in North Florida, like those in South Florida (5), are paying propositions.

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Proc. Fla. State Hort. Soc. 93:72-74. 1980.

EFFECT OF PRODUCTION SHADE AND FERTILIZATION LEVELS ON ESTABLISHMENT OF PALMS IN THE LANDSCAPE[1]

DEWAYNE L. INGRAM AND DENNIS B. MCCONNELL
University of Florida, IFAS,
Ornamental Horticulture Department,
1545 HS-PP Building,
Gainesville, FL 32611

Additional index words. Butia capitata, Livistona chinensis.

Abstract. Livistona chinensis **R. Br. and** Butia capitata **Becc. were grown in two gallon containers under combinations of three shade levels (80, 63 and 30% light exclusion) and three levels of Osmocote 18-6-12 (300, 600 and 900 lbs N/acre/yr; 340, 680 and 1020 kg N/ha/year). Production shade level had no effect on** Butia **visual rating or no. of new fronds after six months in the landscape. The lowest level of Osmocote during production resulted in a higher visual rating of** Butia **after 10 months in the landscape than the highest level, but neither level was different from the medium level.** Livistona **produced in 80 or 30% shade received a higher visual rating and had more new fronds after six months than those produced in 63% shade.**

Light and fertilization levels during production affect acclimatization of foliage plants to interior environments. Combinations of reduced light and/or lower fertilization than common in the industry have resulted in faster growth, higher quality and better adaptability to interior conditions of several plants including *Ficus benjamina* L. (1), *Dracaena angustifolia* Roxb. (2) and *Pittosporum spp.* (7). This increased adaptability has been linked to morphological changes in leaf structure, leaf distribution within the canopy (3), light compensation and carbohydrate storage (6).

Research is lacking on the effects of production light levels and fertilization rates on the adaptability of container grown woody ornamental plants to full sun landscape sites. It has been shown that some woody plants typically container grown in full sun have increased dry matter accumulation and quality in moderate shade during production (5). However, performance of shade grown woody plants transplanted into a sunny location has not been documented.

Jones (4) found 2000 lbs N/acre/year produced high quality specimens of several woody plants during production. However, plants receiving this high rate of production fertilization were stressed more when transplanted on a roadside site than plants receiving 500 lbs N/acre/year during production.

The purpose of this research was to evaluate growth of 2 palm species under combinations of light and fertilization levels while in production containers and to characterize the adaptability of these plants to a sunny landscape site.

Materials and Methods

Livistona chinensis R. Br. and *Butia capitata* Becc. were grown in two-gallon containers for 24 months (November, 1976 through October, 1978) in Gainesville, Florida. Plants were grown in three light levels, 80, 63 and 30 percent light exclusion. Osmocote 18-6-12 (18N-3P-10K) was surface applied every 3 months at rates of 300, 600, 900 lbs N/acre/year (340, 680 and 1020 kg N/ha/year). Factorial arrangement of shade and production treatments as replicated 6 times in a block design. No. of fronds and plant heights were recorded in October, 1978, before transplanting. Plant height was the distance from the lip of the container to the tip of the tallest leaf extended to a vertical position.

Four plants from each treatment combination were randomly selected and transplanted on November 3, 1978 in a randomized complete block design in a landscape site with full sun exposure. The Arrendondo fine sand of the landscape site was not amended at transplanting and 16-4-8 (16N-2P-6.7K) was surface applied every 3 months at the

[1]Florida Agricultural Experiment Stations Journal Series No. 2743.

rate of 800 lbs N/acre/year (907 kg N/ha/year). Plants were watered by overhead irrigation every 10 days if rainfall during that period was less than 1 inch (2.5 cm).

Visual ratings of 1 to 4 (1 = best, 4 = worst) were recorded for each plant in April and September, 1979. No. of new fronds was recorded in September, 1979 and plant height were recorded in May and October, 1980. Plant height was the distance from soil surface to the highest point of the unfurled frond.

Results and Discussion

There were no significant interaction of production shade and fertilization effects of *Butia* or *Livistona* before or after transplanting. Height of *Butia* plants during production increased with decreasing light, although the number of fronds were not different (Table 1). Fronds of plants grown in 80% shade appeared larger and less rigid than fronds of palms produced in higher light. Fertilizer level had no influence on height or no. of Butia fronds during production. Three-hundred lbs N/acre/year was just as effective as 900 lbs N/acre/year. Visual color ratings were not affected by treatments.

Table 1. Effects of light and fertilizer level on height and no. of fronds of *Butia capitata* Becc. and *Livistona chinensis* R. Br. grown in containers.

	Light Level (% light exclusion)	Fertilizer Level (lbs N/ acre/yr)	Height (inches)	No. of Fronds
Butia capitata	30		26 c[z]	13.8 a
	63		33 b	12.8 a
	80		45 a	12.0 a
		300	35 a[z]	12.9 a
		600	34 a	14.1 a
		900	34 a	12.6 a
Livistona chinensis	30		18 b[z]	7.3 b
	63		16 b	10.6 a
	80		29 a	7.9 ab
		300	20 a[z]	6.8 a
		600	22 a	10.1 a
		900	20 a	7.0 a

[z]Means with same letter are not different by Duncan's multiple range test, 5% level.

Fertilizer level did not influence the height or no. of fronds of *Livistona* (Table 1). Height of *Livistona* was greater for plants grown in 80% light reduction than those grown in 63% or 30%. No. of *Livistona* fronds in September, 1979 was greater if produced in 63% shade than if produced in 30% shade. Effect of 80% shade on no. of fronds was not different from either the 30 or 63% production shade level.

Visual ratings in April and September 1979, no. of new fronds in September, 1979 and plant height in May and October, 1980 showed no effect of production light level on the establishment of *Butia* into the landscape (Table 2). Although there was no effect of production fertilizer level on visual ratings of *Butia* in April, September ratings revealed a production fertilizer level of 300 lbs N/acre/year was superior to 900 lbs N/acre/year. Milks, et. al. reported that carbohydrate levels increased in *Ficus benjamina* roots with increasing production fertilization (6). If this is true with *Butia*, the long term effect of production fertization could be related to carbohydrate reserves in roots. There was no effect of production fertilizer level on the no. of new fronds 10 months after transplanting.

All *Livistona* fronds were severely cold damaged the first winter (Table 3). Production light level did affect the recovery of *Livistona* from winter injury. Most plants produced new fronds the next summer, but palms produced in 63% shade received the poorest rating in September, 1979, and had fewer new fronds than palms produced in lower or higher light.

Table 3. Effects of production light and fertilizer levels on the establishment of *Livistona chinensis* R. Br. in the landscape.

Light Level (% exclusion)	Fertilization Level (lbs N/ acre/yr)	Visual Rating[z] April, 1979	Visual Rating[z] Sept., 1979	No. of Fronds Sept., 1979
30		4.0 a[y]	2.5 b	4.5 a
63		4.0 a	4.0 a	3.0 b
90		4.0 a	2.6 b	4.3 a
	300	4.0 a[y]	2.8 a	3.9 a
	600	4.0 a	3.0 a	4.1 a
	900	3.1 a	3.1 a	3.9 a

[z]Visual ratings of 1 to 4; 1 = best and 4 = worst.
[y]Means with same letter are not different by Duncan's multiple range test, 5% level.

Larger and less rigid fronds of *Butia* produced in 80% shade showed no greater stress through the winter or during the first summer after transplanting than palms produced in 30% shade. Lower light conditions for optimum production of *Butia* did not influence their adaptability to a landscape site with full sun exposure.

Table 2. Influences of production light and fertilizer level on establishment of *Butia capitata* Becc. in the landscape.

Light Level (% exclusion)	Fertilizer Level[y] (lbs N/acre/yr)	Visual Rating[z] April, 1979	Visual Rating[z] Sept., 1979	No. New Fronds Sept., 1979	Height (inches) May, 1980	Height (inches) October, 1980
30		1.8 a[y]	2.0 a	8.5 a	33 a	56 a
63		2.0 a	2.4 a	8.9 a	33 a	54 a
80		1.9 a	2.0 a	7.7 a	33 a	63 a
	300	1.8 a[y]	1.8 b	8.5 a	33 a	62 a
	600	1.9 a	2.2 ab	8.2 a	33 a	60 a
	900	1.9 a	2.4 a	8.4 a	32 a	52 a

[z]Visual ratings of 1 to 4; 1 = best and 4 = worst.
[y]Means with same letter are not different by Duncan's multiple range test, 5% level.

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Proc. Fla. State Hort. Soc. 93:74-75. 1980.

'MALAYAN DWARF' COCONUT PALM FERTILIZATION TESTS AND RECOMMENDATIONS[1]

HENRY M. DONSELMAN
University of Florida, IFAS,
Agricultural Research Center,
3205 S.W. 70 Ave., Ft. Lauderdale, FL 33314

Additional index words. 'Malayan Dwarf', foliar feeding, palm nutrient deficiencies, microelement deficiencies.

Abstract. **Florida has imported over a million 'Malayan Dwarf' seed coconuts from Jamaica and has several hundred thousand of these planted in the landscape. Of the three 'Malayan Dwarf' varieties (gold, yellow, and green), the golden variety is predominant. Because it requires more care than the lethal yellowing susceptible 'Jamaican Tall' coconut and, by nature, has a lighter green color and golden petioles, many people feel this palm is less desirable and some have even mistaken its normal coloration for lethal yellowing.**

To demonstrate the importance of nutrition in the growth of golden 'Malayan Dwarf' coconut palms, a test was set up in Crandon Park on Key Biscayne, Florida. Both foliar and granular fertilizers were formulated to provide the specific nutrient requirements of the 'Malayan Dwarf'. A program for establishing 'Malayan Dwarf' coconut palms was determined using foliar and granular fertilizer for the initial six months and granular fertilizer alone at 3-4 month intervals to maintain fertility. 'Malayan Dwarf' coconut palms respond dramatically to fertilization and, with proper care, are a valuable addition to the tropical look of south Florida.

The 'Malayan Dwarf' coconut palm (*Cocos nucifera* L. 'Malayan Dwarf') is known to require more care and fertilization than the 'Jamaican Tall' (Midcap 1975). Early introductions during the 1950's in Dade and Monroe County have survived lethal yellowing, but many of the palms appear to be nutrient deficient. Public acceptance of the 'Malayan Dwarf' coconut palm has been lower than anticipated because the horticultural requirements of the palm are different than the common 'Jamaican Tall'.

Of the three types of 'Malayan Dwarf' coconut palm (golden, yellow, and green) the green appears to be horticulturally the best adapted for south Florida. Early importations of 'Malayan Dwarfs' were predominately of the golden type. Although the golden 'Malayan Dwarf' grows well and is almost totally resistant to lethal yellowing its natural golden cast and lighter green color makes it appear to be "underfed". In the past few years the public's preference for green 'Malayan Dwarfs' and the Jamaican Coconut Industry Board's willingness to sort out and ship Florida seednuts of this type has made this green coconut very popular. With proper care all 'Malayan Dwarf' coconut palms will thrive in south Florida.

'Malayan Dwarf' coconut palms require the most care during their first few years. When young they may be a little less cold tolerant than the 'Jamaican Tall' and require a well drained soil, good nutrition, and adequate irrigation. The most critical step in determining the success of 'Malayan Dwarf' coconut palms in the landscape is during the establishment phase after transplanting. Good care during the first 6-12 months after the palm is planted will alleviate many of the problems that can occur later.

To determine the importance of nutrition in the growth of golden 'Malayan Dwarf' coconut palms a test was set up in Crandon Park on Key Biscayne, Florida.

Materials and Methods

Because of the special microelement needs of most palms and the unique requirements of south Florida's high pH soils, a special formulation of granular fertilizer was developed (Table 1). This high microelement mix is slow

Table 1. Analysis of 'Malayan Dwarf' Coconut Palm Granular Fertilizer.

Plant Nutrient		Percent
Total Nitrogen[z]		10.00
Nitrate Nitrogen	.00	
Ammoniacal Nitrogen	5.00	
Water Sol. Org. Nitrogen (and/or Urea Nitrogen)	1.03	
Water Insoluble Nitrogen	3.97	
Available Phosphoric Acid[z]		5.00
Soluble Potash[z]		5.00
Chlorine (not more than)		1.00
Secondary Plant Nutrients[y]		
Total Magnesium as Mg		2.41
Water Sol. Magnesium as Mg		2.41
Manganese as Mn		1.55
Boron as B		.06
Iron as Fe		1.39
Zinc as Zn		.04
Combined Sulfur as S		8.56

[z]Primary Plant Nutrient Sources: Potassium magnesium sulfate, Ammonium sulfate, Granular sludge, Ureaform, Potassium sulfate. Diammonium phosphate.
[y]Secondary Plant Nutrient Sources: Magnesium sulfate, Manganese oxide, borate, Iron sulfate, Zinc sulfate.

[1]The author wishes to express his gratitude to Mr. Howard Bardsley (F.E.C. Fertilizer, Homestead, FL) for providing the granular and foliar fertilizer used in this experiment and to Mr. Dick Jones (Dade County Parks and Recreation Dept.) for allowing this demonstration in Crandon Park. Additional thanks are made to Mr. Astor Goodison (Jamaica Coconut Industry Board), Mr. Harry Britt and Mr. Tony Bushell (Crandon Park), Mr. Jesse Durko (ARC, Ft. Lauderdale), and DeArmand Hull (Dade County Extension Service), for their assistance. Additional demonstrations were made at Oglesby Nursery & Gulfstream Country Club.