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EFFECT OF BACKFILL COMPOSITION AND FERTILIZATION ON ESTABLISHMENT OF CONTAINER GROWN PLANTS IN THE LANDSCAPE[1]

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Abstract. **Root growth of** Pittosporum tobira **Thunb. 6 months after transplanting into the landscape was greater if the backfill was amended with peat than if amended with colloidal phosphate or unamended. Backfill influenced top growth response to fertilization treatments after 6 months, but did not affect top or root dry weight compared to controls after 12 months. Root and top dry weight of** Juniperus chinensis **L. 'Hetzii' was not affected by backfill or fertilization after 6 months. Backfill amendments increased juniper top dry weight after 12 months only if fertilization was not added.**

Amending the backfill when transplanting container grown plants into the landscape has been recently the subject of much research and controversy (1, 2, 4, 5). Some research suggested that benefits derived from amending the backfill were minimal, although container medium affected the degree of benefit derived from backfill amendments (3).

An experiment was initiated in Gainesville, Florida, in April 1978, to evaluate effects of backfill amendments and fertilization on the establishment of container grown *Pittosporum tobira* Thunb. and *Juniperus chinensis* L. 'Hetzii'.

Materials and Methods

Plants were grown for 1 year in 3 liter containers (17 cm x 15 cm) with a medium of equal volumes of pine bark, peat and sand, then transplanted into 1.2 m on-center hand-dug holes 46 cm in diameter and 30 cm deep in a field of native Arrendondo fine sand. Backfill treatments were unamended soil or amended with one-third by volume of Canadian peat or colloidal phosphate, a mixture of finely divided rock phosphate and clay washed from rock phosphate during mining. Fertilizer treatments were: 1. no fertilizer, 2. Perk[2] (1780 g/m^3), 3. Perk plus 11.3 g of 16N-2K-6P (16-4-8 commercial inorganic formulation) per plant every 3 months and (4) Perk plus 22.6 g of 16-4-8 per plant every 3 months. Perk and the first application of 16-4-8 were incorporated into the backfill and remaining 16-4-8 applications were distributed on the soil surface under the plant canopy. All treatments received overhead irrigation every 10 days when rainfall was below 2.5 cm.

Treatments for each of the 2 plant species were replicated 4 times in a randomized complete block design with a single plant as the experimental unit. Digging times were analyzed as separate experiments for each species. Pittosporum and junipers were dug by hand after 6 months and roots that had grown from the original root mass into the backfill and those extending into the undisturbed field soil were harvested, dried at 70°C and weighed. Only the pittosporum were dug after 12 months, because roots of adjacent juniper plants were intertwined after 12 months. Top dry weights were determined for both species.

Results and Discussion

Mean dry weight of pittosporum roots extending from the original container root mass into the peat amended backfill after 6 months was 20 g, which was significantly greater than the 11 g and 13 g mean root dry weights in colloidal phosphate amended and unamended backfills, respectively. Fertilization had no effect on root dry weight after 6 months. Top dry weight was not influenced by fertilization in an unamended backfill, but the peat amended backfill with Perk or Perk plus the 22.7 g rate of 16-4-8 yielded more top dry weight than peat amended backfill without fertilization (Table 1).

Twelve months after transplanting, backfill composition had not affected dry weight of pittosporum roots extending from the original root mass if no fertilizer or if Perk plus the 22.7 g rate of 16-4-8 had been added (Table 1). The peat amended backfill produced more root dry weight than unamended backfill with Perk or Perk plus the 11.3 g rate of 16-4-8. There was no effect of fertilization treatment on root dry weight at 12 months if the backfill was amended with colloidal phosphate. No treatment combination produced more root growth at 12 months than an unamended backfill with no fertilization. Sixty percent of roots harvested from plants in peat amended backfill were located in the undisturbed field soil. Only 53 and 43 percent of the roots were found in the undisturbed field soil when backfills were unamended or amended with colloidal phosphate, respectively. Top dry weight was not affected by backfill or fertilization after 12 months. The statistical model accounted for only 40 percent of the total variation in top dry weight after 12 months. Foliar tissue analysis revealed little effect of fertilization on tissue content of micronutrients at 12 months, although Perk increased Zn foliar content and 16-4-8 applications increased N content (Table 2). There was no interaction between fertilization and backfill composition on the level of any element in the tissue analysis. Peat amendments reduced phosphorus and increased manganese concentration in the leaves.

Backfill composition and fertilization treatments did not influence top or root dry weight of junipers 6 months after transplanting (Table 3). Twelve months after transplanting, top dry weight of junipers receiving no fertilization was greater if the backfill was amended with peat or

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[2]Perk, a micro-nutrient mix manufactured by Estech General Chemicals Corp., Winter Haven, Florida.

Table 1. Effects of backfill composition and fertilization on top and root dry weight of *Pittosporum tobira* 6 and 12 months after transplanting into the landscape.

Backfill	Fertilization	6 months Top Dry wt (g)	12 Months Root Dry wt (g)	12 Months Top Dry wt (g)
Unamended	None	132.8 cd[x]	85.8 ab	324.9 a
Unamended	Perk[z]	137.2 cd	37.6 d	165.3 a
Unamended	Perk + 11.3 g 16-4-8[y]	137.5 cd	45.8 cd	179.8 a
Unamended	Perk + 22.7 g 16-4-8	123.0 cd	60.4 bcd	255.0 a
Peat amended	None	158.8 bcd	62.4 bcd	173.8 a
Peat amended	Perk	257.2 a	98.0 a	263.9 a
Peat amended	Perk + 11.3 g 16-4-8	193.8 abc	97.7 a	278.5 a
Peat amended	Perk + 22.7 g 16-4-8	255.0 a	78.8 ab	182.1 a
Coll. phosphate amended	None	111.2 d	72.5 abc	249.3 a
Coll. phosphate amended	Perk	175.8 bcd	66.8 abcd	258.9 a
Coll. phosphate amended	Perk + 11.3 g 16-4-8	208.2 ab	57.9 bcd	284.1 a
Coll. phosphate amended	Perk + 22.7 g 16-4-8	150.2 bcd	70.6 abc	293.1 a

[z]Perk was incorporated into the backfill at a rate of 1780 g per m^3.
[y]16-4-8 fertilizer was applied quarterly at 11.3 g or 22.7 g per plant.
[x]Mean separation within columns by Duncan's multiple range test, 5% level.

Table 2. Foliar nutrient content of *Pittosporum tobira* as affected by backfill composition and fertilization 12 months after transplanting into the landscape.

Backfill	Fertilization	Percent of dry weight N	P	K	Ca	Mg	ppm Cu	Fe	Mn	Zn
Unamended		2.59 a[z]	.31 a	.82 a	1.22 a	.53 a	17.1 a	401.9 a	294.7 b	151.0 a
Peat amended		2.38 a	.27 b	.64 a	1.37 a	.50 ab	12.9 a	348.4 a	687.2 a	161.8 a
Coll. phosphate amended		2.58 a	.32 a	.89 a	1.48 a	.48 b	14.7 a	315.8 a	253.6 b	134.6 a
	None	2.38 b[z]	.34 a	.69 ab	1.54 a	.51 ab	19.5 a	359.3 a	309.7 a	100.6 b
	Perk[y]	2.19 b	.32 b	.43 b	1.91 a	.56 a	12.1 a	422.2 a	514.0 a	146.5 a
	Perk + 11.3 g 16-4-8[x]	2.73 a	.30 b	1.02 a	.98 b	.48 b	10.3 a	293.7 a	401.5 a	165.2 a
	Perk + 22.7 g 16-4-8	2.68 a	.25 c	.96 a	1.03 b	.47 b	17.0 a	351.6 a	439.0 a	188.0 a

[z]Mean separation within backfill and fertilization treatments by Duncan's new multiple range test, 5% level.
[y]Perk was incorporated into the backfill at 1780 g m^3.
[x]16-4-8 fertilizer was applied quarterly at 11.3 g or 22.7 g per plant.

Table 3. Effects of backfill composition and fertilization on top and root dry weight of *Juniperus chinensis* 'Hetzii' 6 and 12 months after being transplanted into the landscape.

Backfill	Fertilization	6 Months Root Dry wt (g)	6 Months Top Dry wt (g)	12 Months Top Dry wt (g)
Unamended	None	32.7 a[x]	178.0 a	251.6 c
Unamended	Perk[z]	26.6 a	184.0 a	282.1 bc
Unamended	Perk + 11.3 g 16-4-8[y]	23.3 a	192.5 a	425.0 a
Unamended	Perk + 22.7 g 16-4-8	27.9 a	171.0 a	369.5 abc
Peat amended	None	35.3 a	185.2 a	427.2 a
Peat amended	Perk	29.2 a	204.5 a	381.6 ab
Peat amended	Perk + 11.3 g 16-4-8	31.6 a	212.2 a	462.4 a
Peat amended	Perk + 22.7 g 16-4-8	31.0 a	213.8 a	442.0 a
Coll. phosphate amended	None	34.3 a	206.8 a	381.1 ab
Coll. phosphate amended	Perk	34.6 a	211.2 a	450.6 a
Coll. phosphate amended	Perk + 11.3 g 16-4-8	31.0 a	186.8 a	383.9 a
Coll. phosphate amended	Perk + 22.7 g 16-4-8	25.5 a	180.8 a	340.6 abc

[z]Perk was incorporated into the backfill at 1780 g per m^3.
[y]16-4-8 fertilizer was applied quarterly at 11.3 g or 22.7 g per plant.
[x]Mean separation within columns by Duncan's new multiple range test, 5% level.

colloidal phosphate than if unamended. Backfill composition did not affect top weight if Perk plus 16-4-8 was applied. Juniper top weight was greater for colloidal phosphate amended backfills compared to unamended backfills when only Perk was added.

There was an initial effect of backfill composition and fertilization on establishment of *Pittosporum tobira* in the landscape, but there were no differences in top dry weight after 12 months. *Juniperus chinensis* 'Hetzii' did not respond to treatments initially, however, at 12 months there was a significant interaction between backfill composition and fertilization. These results show that container grown woody plants respond differently to amendments and fertilization in the landscape. Therefore, it is difficult, if not impossible, to make broad recommendations for amending backfill.

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EVALUATION OF THE ADAPTATION OF COCOS NUCIFERA L. 'MAYPAN' TO THE FLORIDA LANDSCAPE

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Abstract. **'Maypan coconut palms have been tested in Florida on a limited scale since 1976. In 1979, Jamaica agreed to provide 'Maypans' to selected nurseries for commercial production. By 1981, over 5000 'Maypan' seednuts had been imported into Florida. 'Maypans' have been evaluated at the Ft. Lauderdale Agricultural Research and Education Center for 5 years. Limited plantings have been made throughout the coconut growing area of the state. Comparisons of growth rate, cold tolerance, soil adaptation, nutritional requirements, insect pests and disease are being made with the 'Maypan', 'Malayan Dwarf', 'Panama Tall', and 'Jamaican Tall'. Evaluations have also been made based on commercial nursery production.**

To date, the hybrid 'Maypan' has horticultural characteristics superior to the golden and yellow forms of 'Malayan Dwarf'. Only the lethal yellowing susceptible 'Jamaican Tall' coconut palm has grown as fast and adapted as well to Florida conditions. Thus, it appears that the 'Maypan' coconut palm can become a valuable part in the Florida landscape and help to replace the coconut palms lost to lethal yellowing.

South Florida has long been known for its tropical landscape. No other plant rivals the palm tree in providing this unique atmosphere. With the loss of the 'Jamaica Tall' coconut (*Cocos nucifera* L.) and several other ornamental palms to lethal yellowing (LY) much of this atmosphere has been destroyed. Compounding this problem has been a reluctance to replant with other palm species for fear they may also be affected by this disease. The vast majority of palm trees removed because of LY have been replaced with shade trees such as the live oak, black olive, or mahogany. As important as these trees might be they do not impart the tropical appeal of the coconut palm.

The devastation of south Florida's two most important ornamental palms, the coconut and Christmas palm (*Veitchia merrilli*) was enhanced by the narrow genetic base of these 2 palms in Florida. Of the 600 or more varieties of coconut palms in the world, south Florida essentially had only one type, the 'Jamaica Tall'. This variety, thought to have originated in India, became well established in Florida because of its vigor and cold tolerance. Unfortunately, it is also one of the most susceptible coconut palm varieties to lethal yellowing. The Christmas palm ("adonidia") was imported from the Philippines during the 1930's. All of Florida's Christmas palms probably descended from this single seed source. The reliance on a narrow genetic base greatly increases the chances of losing all the susceptible plants in an area where a disease is active. To insure that the devastation caused by a disease such as LY is never repeated, we need to diversify our plantings.

Research in LY Resistance

Past research in LY resistance of palm trees has been totally dependent on observations of the incidence of LY in established plantings. Early work in Jamaica established the resistance of coconut varieties, most notably the 'Malayan Dwarf' coconut palm. The economic dependence of Jamaica on copra production necessitated replanting the LY-devastated plantations with resistant palms. The vast majority of these replantings have been with 'Malayan Dwarfs'.

Breeding work by Jamaican scientists led to the developments of the recently introduced hybrid 'Maypan' coconut palm. This cross between the 'Malayan Dwarf' and 'Panama Tall' coconut palms exhibits hybrid vigor, giving the palm a more robust habit and anticipated better adaptation to a wider range of habitats. The 'Maypan' coconut palm grows very rapidly during the first 4-5 years, often surpassing 'Malayan Dwarfs' of the same age by several meters. Establishment after transplanting is also more rapid than the 'Malayan Dwarf'. 'Maypan' resistance to LY is high (86-96%) and the palms begin to bear coconuts after 5 years. As a landscape palm the 'Maypan' is more desirable than the golden and yellow form of the 'Malayan Dwarf' because of the faster growth rate, and expected tolerance to more adverse conditions. The weakness of the 'Maypan' is