

A SUCCESSFUL INJECTION AND UNDERPLANTING PROGRAM TO COMBAT LETHAL YELLOWING OF PALMS

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Abstract. The reappearance of lethal yellowing in 'Jamaica Tall' coconut palms (*Cocos nucifera* L.) and other palm species prompted the town of Palm Beach, Florida to engage in an injection program in January, 1975. The entire population of 40,000 palms was injected 3 times per year from January, 1975 with oxytetracycline using high pressure equipment. This continued through June, 1981 when the town switched to the Mauget® injector method. Oxytetracycline continued to be injected but at a reduced rate from 2.0 g/tree/injection to 1.5 g/tree/injection. Palm mortality, using the high pressure injection method, had ranged from a low of 35 trees/month in 1978 to a high of 423 trees/month in 1980. The Mauget® method provided a dramatic reduction in palm mortality reducing the average loss from 280 trees/month from July, 1980-June, 1981 to 28 trees/month from July, 1982-April, 1983. An extensive underplanting program, with 'Malayan Dwarf' coconut palms, was carried out from 1976-1979. The program continues on all town-owned property with excellent results.

The rapid spread of lethal yellowing (LY) in many of the palms of South Florida during the mid 1970's (1) caused the town of Palm Beach, Florida to seek ways of preserving the tropical atmosphere of their landscape. The area was heavily populated with 40,000 palms, 29,000 being the LY susceptible 'Jamaica Tall'.

Extensive testing of injection techniques and methods of control were being conducted by the University of Florida (3). The town of Palm Beach followed these recommendations (2) in initiating a comprehensive control program.

Movement of the Disease

The disease was first noted at the south end of Palm Beach in 1975 in 'Jamaica Tall' coconut palms. Other susceptible palms in the town included *Pritchardia* spp., Christmas palm (*Veitchia merrillii* (Becc.) H. E. Moore), Senegal date (*Phoenix reclinata* Jacq.), date palm (*Phoenix dactylifera* L.), fishtail palm (*Caryota mitis* Lour.), spindle palm (*Hyophorbe verschaveltii* H. Wendl.) and Palmyra palm (*Borassus flabellifer* L.). As LY moved northward many of these palms died. By 1978, the disease moved 12 miles to the northern town boundary. During this time, 193 palms were lost to LY.

Development of Injection Program

The potential devastating impact of LY on the town of Palm Beach was recognized by the Civic Association. They conducted an educational program to inform residents and

the end result was the initiation of a preventative injection program for the 40,000 palms growing within the boundaries of Palm Beach on public and private property.

A commercial spray service was contracted to perform the injection program. Oxytetracycline was injected in the palms with the air pressure injection method of McCoy (3), at 4-month intervals. Each series of injections was completed within 45 days. The injection program has continued from 1975 through 1983 with 26 series of injections completed.

Modification of Injection Program

With the disease pressure continuing to increase over the years and increasing numbers of palms dying from LY, the dosage of chemical injected was increased from the recommended amount of 1 g per injection to 2 g in 1979. This was done in hopes that the added chemical would provide more protection.

In 1982, research workers at the Ft. Lauderdale Research and Education Center were consulted and the recommendation was to change from high air pressure injection of the antibiotic to the low pressure Mauget® injector. Uptake of the chemical, as detected in the fronds, was greater and less physical damage was done to the trunk of the tree with this injector (4). This change was to prove significant in the reduction of trees dying from LY.

The cost of the program using the Mauget® was more than that with the air pressure injection which had been \$204,000 per year. The injection program with the Mauget® was \$279,000 in 1982 or \$3.92/tree/injection.

The town of Palm Beach made the decision to reduce costs by doing their own injections. The program is done with town employees rather than by contractors. Injections are made at the rate of 325 trees/day/employee. The series is completed in 28 days vs. 45 days for the contractor. The costs have been reduced to \$1.56/tree/injection with an anticipated savings of \$120,000 per year.

The efficiency of the Mauget® in getting the chemical into the tree was a key in reducing the amount of chemical in each injection from 2.0 g to 1.5 g, also contributing to reduced cost.

Palm Mortality

Before the Mauget® program was initiated, palms were dying at an increasing rate even with an aggressive program. Even so, this was still at a much reduced rate when compared with areas that had no injection program. Fig. 1 indicates the loss of palms as a result of LY.

In 1974, a town ordinance was passed that required all dead or dying palms be removed within 5 days after notification by the town. It was hoped that the removal of these trees would reduce the source of inoculum. There were never over 35 diseased trees awaiting removal at any time.

To manage the control program, the town was divided into 41 zones. These zones were surveyed on a regular schedule to determine spread of LY. Trees were noted and removal notices sent to the property owners.

Starting with the initiation of the injection program, extensive records have been maintained on the number of palms that have died, cause of death and variety of palms affected.

Not all loss of palms has been attributable to LY. Construction has taken a major toll with 9,000 palms being lost in this manner, 8,950 of these being coconut palms. Most

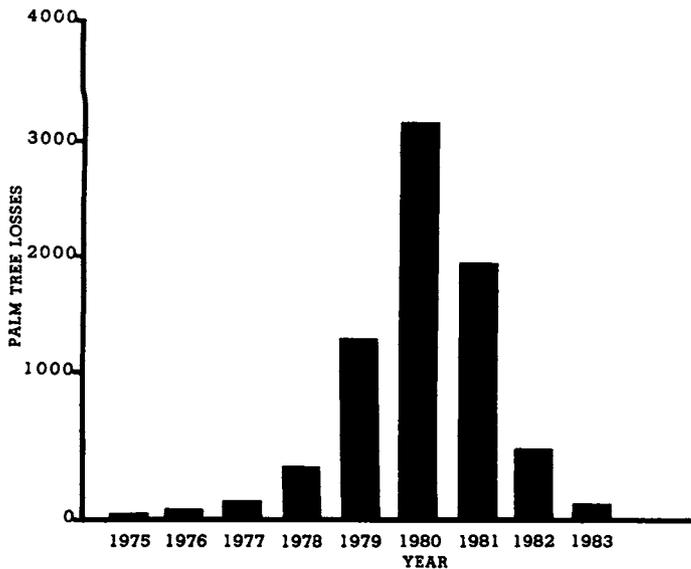


Fig. 1. Annual palm losses from lethal yellowing disease.

were on vacant lots. Other causes of palm loss are detailed in Table 1.

Decline in Mortality with Mauget® Injector

With the death of the first palms in Palm Beach in 1975 from LY, the mortality rate increased each year (Fig. 1). The peak year was 1980, with the loss of 3,425 palms.

In June, 1981, half way through the 20th series of injections, the Mauget® injections were started. The results were dramatic. With the incubation period of LY being 6 months, it was necessary to wait that period, at a minimum, before starting to evaluate the success of the changeover. Fig. 2 provides the evidence of the success. The number of trees dying dropped dramatically from 215/month for the first half of 1981 to 71/month in the first half of 1982. The figures for April-September, 1983 were only 7/month. This more than 20-fold difference in tree death is attributable to the change in injection methods because all other known factors are much the same as when the disease was at its peak in 1980.

The Underplanting Program

It was fully realized by all involved in the injection program that it was only "buying time" since the control was not 100%. Therefore, when the injection program was started, it was decided that an underplanting program of resistant varieties must be started. Research had shown the

Table 1. Causes of all palm losses in the town of Palm Beach, 1975-82.

Cause	Number of trees lost
Bud rot ^z	708
Construction	9,000 ^v
Lethal yellowing	9,024
Lightning	45

^zThis occurred as a result of freeze damage in the winters of 1981-82.

^vThis a close approximation.

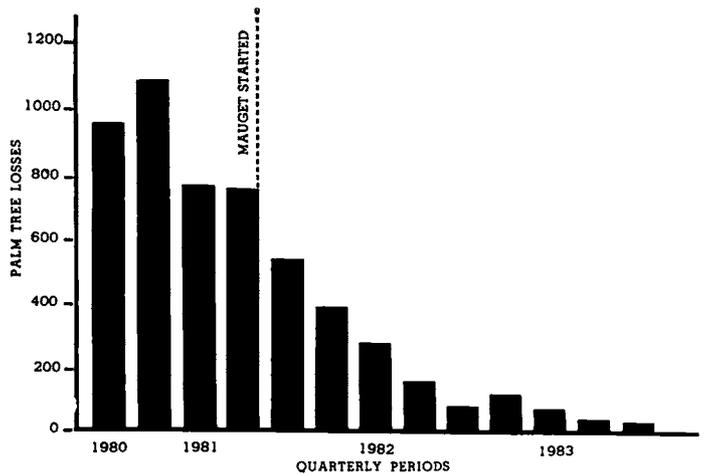


Fig. 2. Quarterly palm losses from lethal yellowing after the Mauget injections started.

'Malayan Dwarf' coconut to be about 96-99% resistant to LY so this was the cultivar selected for underplanting.

Seeds were imported from the Coconut Industry Board, Jamaica, West Indies. These included green, yellow, and golden 'Malayan Dwarfs.' Seed nuts were germinated at the town nursery and transplanted to town property after 2-3 yr. Since 'Malayan Dwarf' coconut palms require higher fertilization rates than the susceptible 'Jamaica Tall' a supplemental fertilization program was initiated (2). To date, nearly 2,000 have been used, underplanting all the 'Jamaica Tall' varieties. Out of these, only about 5% have died, which falls within the expected limits of resistance.

Resistant palms have been planted by town property owners but at a rate much lower than those on town property. Educational programs by the University of Florida Cooperative Extension Service and Palm Beach County are emphasizing the importance of palms in a subtropical landscape to increase the awareness of homeowners of the necessity to replant. A committee of interested citizens, County Extension personnel, town employees and University of Florida specialists meet quarterly to assess the program and determine new methods of repalming Palm Beach.

Conclusion

The injection and replant program in Palm Beach must be termed a success. This is especially true when compared with other South Florida skylines now devoid of the graceful coconut palm. While the program has been expensive, it has provided an example of what can be done to preserve trees valuable to a community. The approach has been thorough, with a specific goal, and the systematic keeping of records to evaluate progress.

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