1993) were confirmed by the results of this study. Avocado tree survival was high because most orchards consisted of mature trees with large diameter, massive trunks and major scaffold limbs and tree height of 25 ft or less. Preliminary observations indicated that nearly one half of the acreage planted to mangos was destroyed due to the hurricane. However, our survey found about one third of the mango trees were destroyed. Additional losses of mango trees were caused by sunburning of exposed trunks and limbs which was not accounted for in our survey.

Propagation method (i.e., grafting vs. air-layering) was the major factor in orchard survival for 'Tahiti' limes. The large percentage of grafted lime trees that survived the hurricane demonstrate the value of the more extensive root system of grafted trees compared to air-layered trees.

Many atemoya orchards survived the hurricane but most of the trees were toppled. Carambola orchards had the second highest percentage of standing trees after the storm and this may have been due to the reduced wind resistance of the flexible limb structure of the trees. Most mamey sapote orchards survived the hurricane and although older, larger trees lost many of their limbs, few were toppled and few were destroyed. Commercial guava orchards survived the storm well because they are kept topped at about seven to nine feet above the soil line.

In general, about 40% of the acreage planted to lychees was destroyed due to the hurricane. However, the percentage of 'Brewster' trees destroyed was far less than 'Mauritius' trees. Few lychee trees were toppled due to the storm. Most longan acreage survived the hurricane and a large percentage of the trees remained standing.

In conclusion, the type of commercial fruit tree destruction wrought by Hurricane Andrew varied among crops and was influenced by many factors including tree age and height. However, many other factors such as wood strength, limb angle attachment, root depth and extension, row orientation, and cultural practices may have influenced the damage due to the hurricane.

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# IS IT TIME TO DEVELOP A NEW SYSTEM FOR GROWING STRAWBERRIES IN FLORIDA?


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*Abstract.* **The raised bed, plasticulture system currently used to grow strawberries (*F.* × *ananassa* Duch.) in Florida has served the industry well, but its reliance on non-reusable polyethylene mulch, methyl bromide fumigant, and a large labor force to stoop and harvest fruit in the field will likely make it increasingly unworkable if environmental and labor regulations become more stringent.**

The cultural system used to grow strawberries in Florida is called the raised bed, 2-row, plasticulture system. It has been used by Florida strawberry growers for over 30 years (Brooks, 1960). In this paper, we will explain why this system has worked well, but why it might be time to start thinking about developing a new system.

### Current System

Tractor drawn bed presses create semi-confined areas (raised beds) in which to efficiently apply fumigant and fertilizer. Soil drainage within the bed is good because of the bed's elevation above the row middles. This drainage is especially important for strawberries, since large amounts of irrigation water are applied to the crop during the plant establishment period and during freeze events. Raised beds also make hand harvesting easier. The polyethylene mulch, which is used to cover the raised beds, provides excellent weed control and keeps the fruit cleaner than if it were lying directly on the soil surface.

The current system is dependent on a reasonably priced supply of polyethylene mulch and methyl bromide fumigant, and a large labor force willing to stoop and harvest fruit in the field. The future availability of these inputs, however, is uncertain. The use of polyethylene mulch creates a serious solid waste disposal problem. Currently, the mulch film is manually removed from fields at the end of the fruiting season and either burned at the edges of the field, or hauled to a landfill. Methyl bromide has recently been listed as a Class I ozone depleting chemical by the U.S. Environmental Protection Agency, and will probably be banned for soil fumigation uses by the year 2000 (Courter, 1993). And, finally, the labor force, which is made up mostly of migrant Hispanic men and women, could dwindle as this group becomes better educated and off-farm job opportunities become more available.

Lieten (1993) describes a peat bag system, currently popular in central Europe, that eliminates the need for soil fumigation, and is easy to establish and harvest. Efforts are being made in the U.S. to improve the present raised bed system (e.g., testing photodegradable mulches [Lamont, 1993] and alternatives to methyl bromide [Himelrick and Dozier, 1991]) but, concurrently, U.S. researchers may want to consider the feasibility of developing a totally new system.

### Futuristic System

A system where plants are grown in long, window box type containers attached to mobile, triangular-shaped frames (Fig. 1) potentially has several advantages over the present system:

1. Polyethylene mulch would not be needed.
2. The growing medium could be moved through a steam sterilization facility (Fig. 2), eliminating the need for methyl bromide.
3. A mobile system would allow for the *movement of* plants and fruit through a climate-controlled building (Fig. 2) where workers could sit or stand to harvest fruit. Since harvesting fruit in this system would be less strenuous than in the current system, there should be more people willing and able to do the work.
4. Plants could be harvested during any kind of weather, and possibly even at night.
5. Fruit showing signs of rot could easily be removed from the plants and disposed of in a manner that would keep them from being a source of inoculum in the field. (In the current system, cull fruit is usually dropped in the row middles.)
6. A mobile system would also allow automatic pest control applications to be made indoors, eliminating

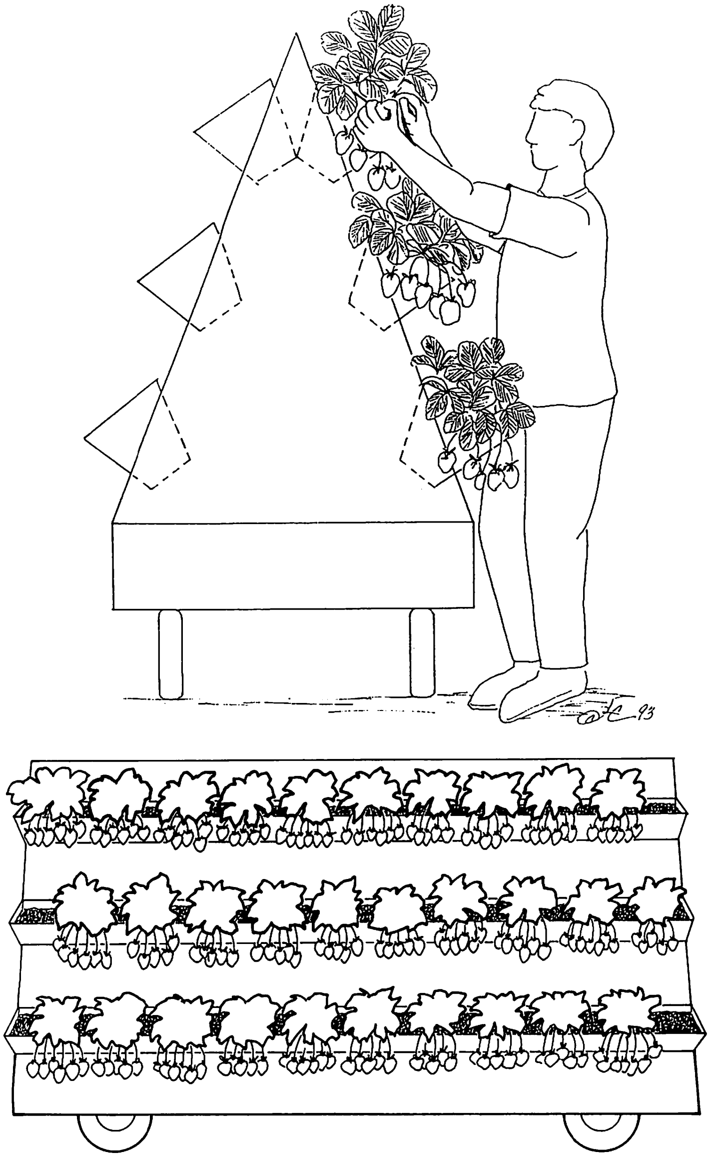

Fig. 1. End and side view of a proposed mobile strawberry growing unit.

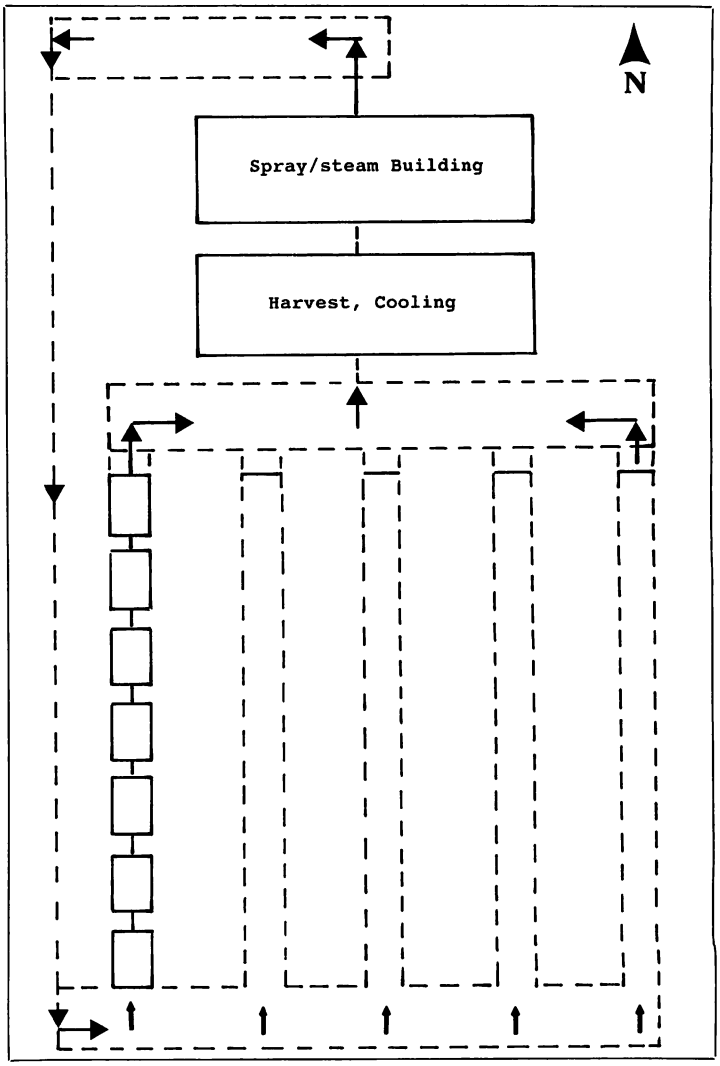


Fig. 2. Diagram of a proposed mobile strawberry production system, showing the position of the mobile units in the field and the direction of their movement, first through a harvest/cooling facility, and then through a spray/steam sterilization facility.

the current problems of application exposure and spray drift.

7. No large tractors would be needed for cultivation or spray application.

Despite these apparent advantages, there are some serious questions that will have to be addressed before such a system can become a commercial reality. For example, how much energy will it take to move the mobile units from the field through a packing/spray/steam sterilization facility, and how will plants be irrigated and freeze protected? Perhaps the most obvious and important question is what will the system cost and what is its potential productivity?

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# REOCCURRENCE OF PAPAYA MOSAIC POTEXVIRUS IN FLORIDA


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*Abstract.* **Papaya mosaic potexvirus was first reported from Florida in 1964. After that time papaya mosaic was not encountered again until 1991. This new occurrence was found in a 2-acre commercial papaya planting on Pine Island in Collier County, Fla. The infected bearing papaya plants exhibit a mottling of leaves. Papaya mosaic potexvirus was confirmed by SDS-immunodiffusion tests.**


Papaya has always had a place in south Florida agriculture, with an average of 400 acres per year and gross sales of over $2,000,000 (Anonymous, 1990). The greatest limiting factor in papaya production in Dade County has been papaya distortion ringspot (PRV) (Conover, 1964). However, another viral disease, papaya mild mosaic, caused by papaya mosaic potexvirus (PMV), was reported by Conover in 1964. The primary symptom of papaya mosaic is a mild green mottle of the foliage which is most easily seen in the young leaves. The young leaves develop a vein clearing, which is generally followed by rugosity of the laminae (Cook, 1975). The young leaves are slightly reduced in size and the trees are stunted. There is no evidence that the virus affects fruit quality or yield. The only method of transmission is mechanical, and vectors are unknown. Attempts to transmit the virus by aphids were not successful (Conover, 1964). Papaya mosaic was not observed during Florida surveys for papaya viruses in 1982 by Wan (Wan and Conover 1983). In 1991 papaya mosaic was found in a papaya grove on Pine Island in Charlotte County, Fla. This was the first sighting of this disease in 27 years, and it occurred 200 miles from the original sighting. In 1991 60% of the trees were showing typical symptoms of papaya mosaic.

The objective of this study was to confirm that this papaya disease was papaya mosaic potexvirus.


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### Materials and Methods

One leaf sample, from each of four papaya plants, was harvested and sent by overnight mail to Cornell University, New York State Agricultural Experiment Station, Geneva Campus, Department of Plant Pathology, Geneva, NY 14456-0462, for virus verification. Leaf samples were homogenized in 0.01M phosphate buffer (1:10) and used to inoculate the indicator host range of *Carica papaya* L., *Gomphrena globosa, Chenopodium quinoa, Nicotiana benthamiana, Nicotiana tabacum* L. variety 'Havana 423', *Cucumis metuliferus* and *Cucurbita pepo* L.

Symptom expression was monitored. Leaf samples were collected from infected tissue and used in SDS-immunodiffusion tests as described by Gonsalves and Ishii (1980). Two tests were conducted, one with antisera against the mild papaya ringspot virus (PRV) from Hawaii and the other with antisera against PMV which was kindly supplied by D. Purcifull. These tests were repeated several times with similar results.

### Results and Discussion

Symptom expression on the indicator hosts is summarized in Table 1. The typical PMV symptoms were expressed on *Gomphrena* which is the reported assay host of the virus (Purcifull and Hiebert, 1971). No symptoms were expressed on the PRV diagnostic species *Cucumis metuliferus* or squash, *Cucurbita pepo* (Purcifull et al., 1984). There were no serological reactions with the samples and antisera to PRV HA 5-1, attenuated form of papaya ringsport virus, but clear precipitin lines were observed with tissue infected with the mild PRV HA 5-1. This polyclonal antisera reacts with PRV