RESULTS OF AN EVALUATION OF ENVIRONMENTALLY FRIENDLY PLANT PRODUCTION SYSTEMS FOR USE ADJACENT TO EVERGLADES NATIONAL PARK

Final Report, December 15, 2002

Jorge E. Peña
University of Florida, Tropical Research and Education Center
18905 S.W. 280th Street, Homestead, FL 33031
e-mail address: JEPE@MAIL.IFAS.UFL.EDU

Everglades National Park, encompasses more than 600,000 ha (1.5 million acres) and is the only subtropical wilderness in the continental United States. The Park is surrounded by areas dedicated to agricultural enterprises and urban dwellings. To maintain a balance between the economically important agricultural sector and environmentally sensitive areas that are found in the Park, technologies should be adopted that will benefit natural ecosystems, the general public and producers. There is an urgent need to transform agricultural pest control practices, so that agriculture can assist, rather than inhibit, the recovery of ecosystems in the Everglades. The development and implementation of a cost-competitive and sustainable farming system, that normally uses non-chemical pest control measures, could serve as a model for ecosystem restoration. Furthermore, such a system, if implemented, would demonstrate that agriculture and natural ecosystems can coexist without mutual detriment.

For more than 40 years, the University of Florida's Tropical Research and Education Center has developed wide knowledge of agricultural commodities that may be suitable to this effort. These commodities would use few chemical inputs and indigenous biological control agents to maintain pest problems under economic injury levels. For example, a complex of Florida native plants are field-grown commercially as ornamentals under ecological conditions that are similar to those found in Everglades National Park (i.e., marl soils which are flooded periodically); these include: buttonbush, silver leaf buttonwood, gumbo limbo, *Ilex krugiana*, coco-plum, *Quercus virginiana*, *Lysiloma bahamense*, *Pithecelobium guadeloupense*, *Swietenia mahagoni*, geiger tree and firebush. We hypothesize that native ornamentals could be grown in environmentally sensitive areas of South Florida by: (1) maintaining the area free of foreign pollutants, and (2) providing sound revenue for growers. The information generated through this study will help determine if

production of such commodities could be used as a model to demonstrate that agriculture and natural ecosystems can co-exist in South Florida.

2. General Objectives

1. Develop a sustainable, non-chemical pest management system to produce native plants of the Florida Everglades.
2. Evaluate macro and micro arthropod communities in both plant systems

Materials and Methods

This project was established in the Frog Pond, which is an area adjacent to the eastern boundaries of the Everglades National Park. An uncultivated area approximately of 2 ha of marl-rockdale soil located in a northwest flood prone area of the Frog Pond, was disked (Fig x) and 0.5 m raised beds produced at 4 m in between. Approximately, 900 oak, *Quercus laurifolia* , gumbo limbo, *Bursera simaruba* Sarg. (Burseracea), greenbutton wood, *Conocarpus erectus (*Combretaceae), and silverbutton wood, *Conocarpus erectus* var. *sericeae* (Combretaceae), sabal palmetto, *Sabal palmetto* (Palmaceae) grown in 3 gallon containers, were planted at a 3 m distance. These plants were selected because of their current popularity and because of the high prices that are obtaining in the market. Half of the planted area was designed as an "organic" or “biological” area, where use of agrichemicals is avoided, and half was designated as a "traditional" or “chemical” plot, where traditional agicultural practices are followed (i.e., application of agri-chemicals) (Fig xx). Field evaluations in the organic area were conducted in conjunction with minimum nutritional studies, cultural practices and biological pest controls which have the potential to produce and protect these trees economically. Weed control in the organic area was done by application of mulch (Fig xxx), whereas fertilization was done by a single application of organic compost. Chemical weed control and fertilization in the "traditional" area was done by application of 2.5 gallon /acre of Round- Up and 10-52-8 (N-P-K) at time of planting (1 gallon/tree) and 06-02-0 (N-P-K) at rate of 4 oz/tree.

Arthropod communities in biological and traditional sites were sampled by collecting 5 leaf flushes or palm fronds per plant [destructive sampling] and placing pitfall traps (n = 25 per plant system) around the area to determine the presence of soil dwelling arthropods. Once arthropod specimens were recorded, samples were processed in the laboratory and specimens are identified to family using taxonomic keys.

Here we only present results from the destructive sampling method.

Preliminary Results

Destructive Sampling. A significant higher number of Phytoseiidae, Araneidae and Coccinellidae were collected from the biological system than from the traditional system(Fig 1). Among the Araneidae, groups of Orb, Hunting and space spiders were collected in higher numbers in the biological system than in the traditional one. Herbivores in the foliage were represented by the families Aphidae, Coccidae, Diaspididae (Homoptera), Tetranychidae, Tenuipalpidae, Tydeidae, Eriophyidae (Acari) and order Lepidoptera. No significant differences were observed in the two systems for the families Aphidae, Coccidae, Tenuipalpidae, but more Diaspididae, Eriophyidae and Lepidoptera were observed in the biological system than in the traditional system. More tetranychids were collected in the traditional system than in the biological system (Fig 2). Higher number of orb weaver spiders (Argiopidae, Epeiridae), hunting (Mimetidae, Gnaphosidae) and space spiders (families) were collected in all plants in the biological system than in the chemical system (P > F, 0.0068, 0.0001, 0.0001) respectively. Numbers of parasitized Aphididae and Coccidae were similar between the two systems (P > F 0.62, 0.17, respectively), but numbers of Phytoseiidae were higher in the biological system compared to the traditional system. The plant species with higher number of phytoseiid predators was *C. erectus* var., *sericeus*, representing 80% of the sample. At the same time, numbers of Tetranychidae were 50% higher in *C. erectus*, compared to the other plant species. The highest number of eriophyids was observed in *C. erectus* var *sericeus*, representing 99% of the sample. No difference in parasitism was observed for both systems on specimens of the family Aphididae.

In general, the mean abundance of arthropods at the biological system was significantly higher than at the chemically managed system. A significant interaction across the different plant species was also found which shows that some taxa are more abundant in some plant species grown under a biological system and others are more abundant in a chemically managed system. In general, higher numbers of carnivorous arthropods (predaceous spiders, mites, beetles) and herbivorous arthropods (mites, lepidopterans, aphids, scales) were observed on those plants grown under a biological system compared to those maintained under chemical treatments. Changes in these results for the remaining part of the study (2000-2001) are expected.

The preliminary data appears to indicate that arthropod communities in biological systems might differ in terms of overall density, community composition and trophic status. However, these differences could be attributed to the lack of certain nonaerial taxa or flightless taxa.

There were no major differences in growth for plants grown under both systems. The were no differences in plant height, which is used to determine the commercial value of the plants. However, there was slight difference in trunk diameter between plants grown under a traditional system than those grown under an environmentally friendly system.

Table 1. Mean ± SD numbers of arthropods in each plant species for biological and chemical systems in the Frog Pond

Role	Class/Order	Family	Plant Species	Biological System	Chemical System
Carnivorous					
	Arachnida		green button wood	18.50± 8.66	11.75±11.47
			Silver button wood	12.75±8.05	8.75±4.99
			Oak	9.25±5.56	8.75±4.34
			Gumbo limbo	7.00±8.36	5.75±3.50
			Sabal Palmetto	2.50±0.70	1.50±2.12
	Acarina	**Phytoseiidae**			
	Insecta	**Coccinellidae**			
		Chrysopidae	green button wood	0.75±1.50	0.50±0.57
		`	Silver button wood	7.75±12.97	3.50±4.35
			Oak	0.00±0.00	1.25±2.50
			Gumbo Limbo	0.00±0.00	0.50±0.57
			Sabal Palmetto	5.00±7.07	0.50±0.71
Herbivorous					
	Acarina	**(Tydeidae, Tetranychidae, Eriophyidae)**			
	Insecta	**(Aphididae, Coccidae, Lepidoptera)**	green button wood	81.25±122.20	43.00±74.09
			Silver button wood	791.00±1302	7.25 ± 10.87
			Oak	1.75 ± 3.50	12.25±16.13
			Gumbo Limbo	93.50±103.24	65.75±79.96
			Sabal Palmetto	2.00 ± 2.82	12.50±3.53