



The Effects of the 2004 Hurricane Season on Greenhouse Vegetable Production in Florida¹

Jeanmarie M. Mitchell and Daniel J. Cantliffe²

The 2004 hurricane season proved to be one of Florida's worst. The four hurricanes (Charley, Francis, Ivan, and Jeanne) caused over \$2 billion in total agricultural loss. In response, the federal government appropriated \$13 billion for emergency assistance, of which Florida received a half billion dollars for agricultural disaster assistance. Many of Florida's producers were eligible for up to \$80,000 in aid. Among those who tried but failed to qualify for this aid were greenhouse vegetable producers.

Although the greenhouse vegetable industry in Florida is small, it is expanding and the present growers suffered millions of dollars in damages from the hurricanes in 2004. A survey was conducted in March, 2005 to assess both hurricane damages in 2004 and the present status of the greenhouse vegetable industry in Florida. Twenty growers were interviewed representing 64.1 acres or 86% of the greenhouse house vegetable industry as reported by Tyson et al. in 2004. Eighty-percent of the greenhouse vegetable producers that were surveyed suffered some type of damage as a result of the hurricanes; 50% had crop damage and 75% suffered structural damages. Estimated totals for damages incurred are predicted to be over \$4 million. Other information collected in the survey included

production area, greenhouse type, size, crops grown, media used, and marketing strategies. This research demonstrates the status of the greenhouse industry in Florida following the recent hurricanes, the increased importance of greenhouse production to Florida, and the need to lobby for government assistance following natural disasters.

Introduction

Before 2004 and despite numerous recent encounters with tropical storms of low intensity, Florida's most recent experience with hurricane devastation was 1992, when Andrew devastated the state's southern regions. During the tropical storm season of 2004, the winds were back and struck on four separate occasions, ravaging much of the state. Hurricane Charley hit Punta Gorda on August 13 with winds up to 149 miles an hour - a category four storm. Three weeks later a second hurricane struck, this time a category two. Hurricane Francis hit the east coast of Florida at Hutchinson Island with maximum sustained winds of 80 mph. Widespread heavy rains caused flooding over much of north and central Florida. While both the east and west coasts of Florida faced the aftermath of Frances, the Florida

1. This document is HS1021, one of a series of the Horticultural Sciences Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date August 8, 2005. Visit the EDIS Web Site at <http://edis.ifas.ufl.edu>.

2. Jeanmarie M. Mitchell, graduate student, and Daniel J. Cantliffe, professor and chair, Horticultural Sciences Department, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, 32611.

panhandle awaited its turn. A fierce category five hurricane, Ivan, approached the Gulf but gradually weakened before making landfall on September 16 near Pensacola, with 120-mile-an-hour winds. On September 24, Hutchinson Island and the east coast were revisited by another hurricane, Jeanne, also with 120-mile-an-hour winds. Jeanne gradually weakened to a tropical storm as it moved across central Florida with heavy rains and wind. Throughout the state, these hurricanes adversely affected homes, businesses, tourism, and agriculture. According to the UF/IFAS hurricane recovery report (Cheek, 2005), these four hurricanes together killed 117 people, caused property losses estimated at \$25 billion and caused total agricultural losses at \$2.1 billion.

In response, federal monetary support poured into the state, and the federal government appropriated a total of \$13.6 billion of assistance with the 2005 Emergency Hurricane Supplemental Appropriations Act. This act was designated for the eight southeastern states that suffered loss, of which Florida received \$0.5 billion dollars for agricultural disaster relief (FDACS, 2004). Money for agricultural losses was disbursed through the USDA's Farm Service Agencies and other governmental departments. Many of Florida's producers were eligible for up to \$80,000 dollars in aid.

Among the producers not eligible for assistance were greenhouse vegetable growers. The extent of the damage that vegetable greenhouse growers received from the recent hurricanes needs to be documented to help growers prepare for future storms.

Greenhouse vegetable production is becoming more important to Florida agriculture. Florida has been a leading producer of greenhouse-grown vegetables, which include herbs, specialty crops such as strawberries, and edible flowers (Hochmuth, 2003; Greer and Diver, 2000). In the 1970s, there were an estimated 20 to 30 acres of greenhouse vegetables in Florida (Hochmuth, 2003). By 2004, the industry grew to encompass 74 acres (Tyson et al., 2004), and another 30 acres have been added to production since that survey (D.J. Cantliffe, personal communication, 2005). The increase in acreage has made Florida a leading greenhouse vegetable producer, contributing

to Florida's status as the nation's number two state in fresh vegetable production (FDACS, 2003).

Greenhouse-grown vegetable crops have become more popular in recent years because of their higher yields, quality, and value (Anon., 2000). These increases parallel the rise in fresh vegetable consumption in the U.S. Since 1990, demand for fresh vegetables has increased 21% due to a more health-conscious population, year-round availability, and new and improved varieties (Wysocki and VanSickle, 2002).

With the current phase-out of methyl bromide due to the Montreal Protocol (an international agreement intended to protect the ozone layer), many vegetable producers could look to greenhouses as an alternative to field-grown vegetables. Growing vegetables in greenhouses on soilless media would not only give growers a superior product with higher yields, but would also avoid the problems associated with the use of methyl bromide (Cantliffe et al., 2003).

Some greenhouse products, such as tomatoes, are already becoming a mainstay in today's market. Compared to insignificant amounts of greenhouse-grown products in stores in the 1990s, today, greenhouse tomatoes account for 37% of all fresh tomatoes sold in retail stores and 17% of the total consumed in the U.S (Cook and Calvin, 2005).

A study of the effects of hurricanes on greenhouse production involves investigating an industry that is rapidly increasing. The study will prove important to the U.S. in the future by helping producers better cope with hurricane damage.

Materials and Methods

An assessment survey (available on the UF/IFAS Protected Agriculture website at <http://www.hos.ufl.edu/protectedag/surveys.htm>) was designed by J.M. Mitchell and D.J. Cantliffe. Twenty growers located in 13 counties (Table 1) were then identified through County Agricultural Extension Agents. The growers were interviewed by telephone from 18 Mar. through 7 Apr. 2005. The purpose was to assess how the 2004 hurricane season affected their production and impacted their structures, and how

damages were paid. Other information collected from the survey included greenhouse type and size, crops grown, media used, hurricane damage incurred, insurance, and marketing strategies.

Results

Greenhouse Vegetable Production Acreage and Greenhouse Design Types

Prior to the hurricanes, the total greenhouse production acreage of the 20 greenhouse vegetable growers surveyed in 2004 was 64.1 acres (Table 1). Tyson et al. (2004) reported 74 acres of greenhouse vegetables in Florida in the 2003-2004 growing season, but a few operations (such as Herbonics) have closed since that survey was conducted. The total area in production of the 20 growers from the survey today (post-hurricanes) is 58.2 acres (Table 1). Greenhouse types varied among those surveyed (Table 2); double-poly, fan- and pad-cooled houses totaled 30 acres (47% of total acreage and 50% of the growers using this type), while plastic, passive-ventilated greenhouses totaled 26 acres (41% of the total acreage and 25% of the growers). Three acres were mesh houses (4% of total acreage and 10% of the growers). Two acres were plastic, fan- and pad-cooled and one acre was a single-poly, fan- and pad-cooled design.

Employment Information

Seventy-five percent of the growers were in business throughout the year (12 months) with an average of ten full-time (min.= 1 person, max.= 40 people) and 4 part-time (min.= 0, max.= 35) employees (data not shown).

Greenhouse Vegetable Crops and Production Media

The primary crops grown were colored peppers at 25.2 acres (43% of total acreage and 25% of the growers), cucumbers at 23 acres (39% of total acreage and 40% of the growers), and tomatoes at 7 acres (11% of total acreage with 30% of the growers) (Table 3). Other crops (lettuce, strawberry, herbs, greens, beans, eggplant, and carrot) had minimal production areas (Table 3). Half of the growers used Perlite as their production media, while 25%

preferred pine bark, 20% nutrient film technique (NFT), 15% coconut coir, 15% ebb and flow, 15% soil, and minimal usage of other types of media (Figure 1). It was impossible to determine acreage for each media because growers used multiple types in their production systems. In 2004, a total of 53 acres (83% of total acreage) of greenhouse vegetables were grown in soilless culture and 11 acres (17% of total acreage) were grown in the soil (data not shown).

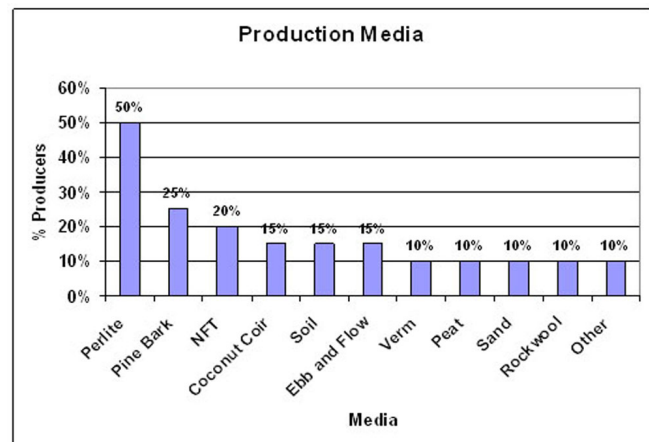


Figure 1. Summary of media used in Florida greenhouse vegetable production, 2004.

Marketing and Sales Information

The marketing results were as follows: 40% of the growers sell their produce as greenhouse-grown, totaling 21 acres (33% of total acreage); 30% sell as hydroponic, totaling 14 acres (21% of total acreage); 20% capitalize on a pesticide-free label (3 acres and 5% of total acreage); and 15% are certified organic (2 acres total, 3% of total acreage) (Table 4). Seventy percent of the growers sell produce through a wholesale distributor and 20% sell at restaurants/hotels and grocery stores. Fifteen-percent sell some of their produce at local farmers' markets, and all of the growers pack their own produce (Figure 2).

Hurricane Damage

Eighty percent of the greenhouse vegetable producers suffered some type of damage (crop, structural and/or secondary) as a result of the hurricanes (Table 5 and Figures 3, 4 and 5). Ten percent of the growers said the hurricanes did not hurt their crop but delayed their planting dates. Delayed

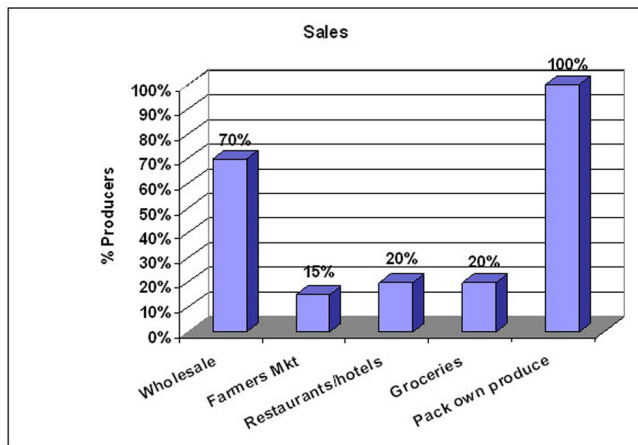


Figure 2. Summary of sales information, Florida greenhouse industry producers, 2004.

planting acreage totaled 10 acres (16% of total acreage). Fifty percent of the growers had crop damage, which hurt a total of 33 acres (53% of the total production acreage). Approximately 22 acres had a 100% crop loss (35% of the total production acreage affecting 25% of the growers). Crop loss of up to 75% was estimated on 4 acres (6% of the total production acreage affecting 10% of the growers). Loss of 50% or less of the crop totaled 7 acres (10% of the total production acreage affecting 15% of the growers) (Table 5). Total crop loss/damage to greenhouse vegetables was estimated to be over \$1.3 million, though many growers were not quite sure how much they lost. The absence of dollar figures for these growers' sustained loss might suggest that loss due to damaged crops may be considerably higher.

Some type of greenhouse structural damage was incurred by 75% of the growers (Figures 3 and 4). Fifty-percent had loss of roof materials, 30% had loss of side walls or curtains, and 25% of the growers suffered loss of the entire house. Total structural damage was estimated at over \$2.6 million, but again, this value is not definite.

The amount of equipment damage reported was less than in other areas of loss. Only 10% of growers lost tools such as media, pots, or drip line. Secondary damages affected 50% of the growers (Table 6). This was damage caused by disease (such as fusarium, gummy stem blight, angular leaf spot, and sclerotinia) which affected 20% of the growers. Insects (moths) affected 10% of the growers while other damages, including power loss, down time, and an unavailable market affected 20% of the growers.

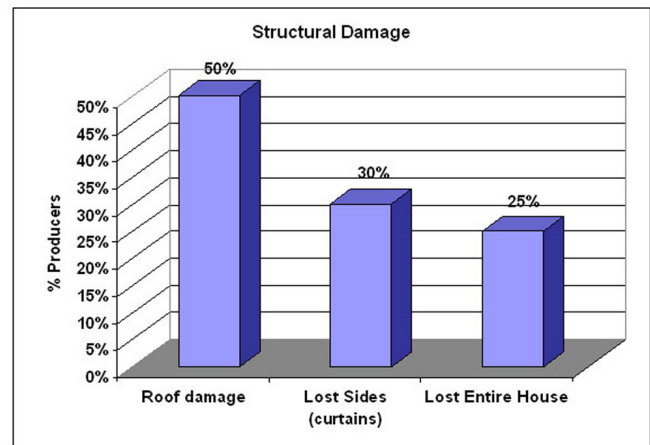


Figure 3. Summary of greenhouse (vegetable) structural damage from the hurricanes, 2004.

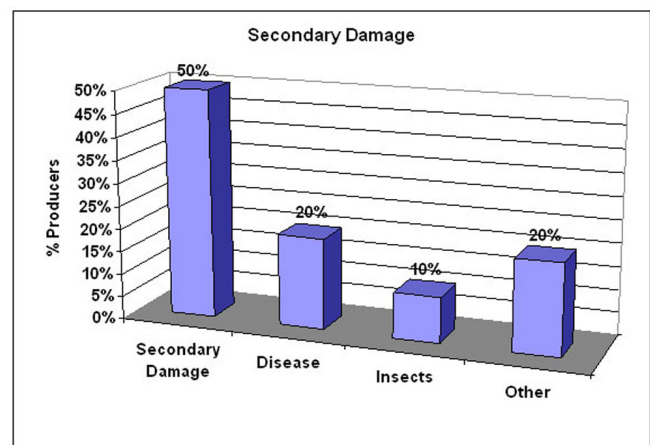


Figure 4. Summary of secondary damages to greenhouse vegetable growers as a result of hurricanes, 2004.

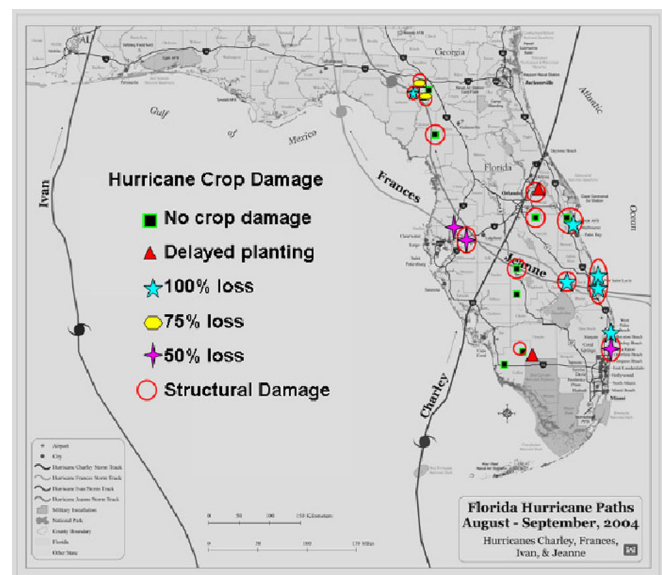


Figure 5. Florida map showing hurricane crop damage

Insurance Information

Only 35% of the growers had crop insurance (Table 6). Insured crop acreage totaled 11.5 acres (18 % of the total crop acreage), another 55% had insurance on their greenhouse structure which totaled 47.5 acres (74% of total greenhouse acreage), and 40% had insurance on their equipment. Four growers applied for some form of hurricane disaster compensation but none received any assistance. Thus, none of the growers received any assistance for crop damage either.

As of April 2005, 90% of the growers were back in production with a total of 58.2 acres. However, only 35% of the growers have fully recovered from the hurricane damages (data not shown). When asked what could be done to prepare better for hurricanes, most felt that better secured and fastened structures, along with back-up generators, extra plastic, and opened sides (curtains) would help decrease their damage risk.

Discussion

Damage totalled over \$4 million (crop and structural). About 80% of the greenhouse vegetable growers in 2004 were affected along with 33 acres of crops (51% of total acreage). The lack of government assistance awarded to greenhouse vegetable growers is in marked contrast to assistance provided to other producers and greenhouse ornamental growers in Florida. The Florida Nursery Growers' Association estimated nursery losses due to hurricanes to be approximately \$740 to \$813 million, and aid from the USDA to producers under this program was estimated at more than \$500 million. A representative from the Farm Service Agency was consulted (J.M. Mitchell, personal communication) about Federal aid eligibility for greenhouse vegetable growers. The representative stated that greenhouses are considered controlled environments and are not covered by disaster compensation money or under the Noninsured Crop Disaster Assistance Program (NAP). And nursery growers who use greenhouses? Are those greenhouses not also controlled environments? The Farm Service agent only recommended that Florida vegetable greenhouse growers should develop an association to lobby the

government for assistance, just as the nursery and citrus growers have done.

Conclusion

Being a small industry in a huge agricultural state, perhaps it would benefit greenhouse vegetable growers to form some type of association in order to have a stronger voice on various matters, including working with the federal government. Throughout the U.S. and Canada, there are many greenhouse grower associations designed to promote the greenhouse vegetable industry and improve production and marketing practices (North Carolina Greenhouse Vegetable Growers' Association, 2005). Another alternative for Florida greenhouse vegetable growers could be to join with the Florida Fruit and Vegetable Association (FFVA) to help lobby the government and receive funds specifically allocated to them.

Florida greenhouse vegetable producers must act fast because the National Oceanic and Atmospheric Administration (NOAA) has predicted yet another above-normal hurricane season expected for 2005. They estimate 12 to 15 tropical storms occurring, seven to nine becoming hurricanes, of which three to five could become major hurricanes (Lautenbacher, 2005).

But even with more hurricanes, the future looks bright for greenhouse production in Florida. Within the next year, approximately 50 more acres of greenhouses will be built, boosting Florida's total greenhouse vegetable production to over 100 acres. With greenhouse-grown vegetable produce already competing for shelf space in grocery stores, it is time for federal government insurance programs to recognize greenhouse vegetable growers as an equal to nurseries and other industries that use greenhouses for crop production.

Web Sites for Hurricane Preparedness Help

Hurricane Preparedness List for Nurseries:
<http://edis.ifas.ufl.edu/EP076>

Florida Nursery Growers Association (FNGLA)
Hurricane Tips:
<http://www.fnga.org/hurricane/default.asp>

Hurricane and Natural Disaster Brochures:
<http://www.aoml.noaa.gov/general/lib/hurricbro.html>

National Hurricane Center:
<http://www.nhc.noaa.gov/>

National Weather Service:
<http://www.nws.noaa.gov/>

Central Florida Hurricane Center:
<http://flhurricane.com/>

Florida Hurricane Reports:
<http://iwin.nws.noaa.gov/iwin/fl/hurricane.html>

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Table 1. Summary of greenhouse vegetable producers and production area by county.

County	Number of Producers	Total Acreage (in production before hurricanes) 2004	Total Acreage (in production after hurricanes) 2005	Decrease %
Brevard	2	2.9	1.4	52
Collier	3	21.7	20.0	10
Glades	1	0.2	0.2	0
Highlands	1	0.6	0.6	0
Hillsborough	2	3.0	3.0	0
Levy	1	0.03	0.03	0
Okeechobee	1	10.0	10.0	0
Orange/Osceola	1	2.0	2.0	0
Palm Beach	2	7.9	7.9	0
Seminole	1	0.3	0.3	0
St. Lucie	2	8.0	5.4	33
Suwannee	4	7.5	7.5	0
Total	21 ^z	=SUM(ABOVE) 64.1	58.2	10
^z Total producers surveyed = 20, one producer has two greenhouses located at different sites.				

Table 2. Greenhouse design-types of Florida greenhouse vegetable producers, 2004.

Design	Total Acreage	Percent of Total Acreage	Producers ^z %
Double-poly, fan- and pad-cooled	30	47	50
Plastic, passive ventilated	26	41	25
Mesh	3	4	10
Plastic, fan- and pad-cooled	2	3	10
Single-poly, fan- and pad-cooled	1	2	10
^z Number of producers surveyed = 20; Some producers have more than one type of greenhouse.			

Table 3. Summary of greenhouse vegetable crops grown in Florida, 2004.

Crop	Producers in Production ^z %	Area Produced (acres)	Total Greenhouse Acreage %
Colored Pepper	25	25.2	43.29
Euro. cucumber	25	18.9	32.48
Mini cucumber	15	3.6	6.18

Table 3. Summary of greenhouse vegetable crops grown in Florida, 2004.

Crop	Producers in Production^z %	Area Produced (acres)	Total Greenhouse Acreage %
Tomato	30	6.9	10.74
Lettuce	20	1.3	2.22
Strawberry	10	0.9	1.51
Other greens	10	0.8	1.39
Herbs	5	0.8	1.33
Arugula	15	0.3	0.51
Beans	20	0.3	0.43
Swiss chard	10	0.2	0.31
Radish	10	0.2	0.28
Mini carrot	10	0.1	0.24
Basil	5	0.03	0.06
Eggplant	5	0.01	0.02
^z Number of producers surveyed = 20; Some producers had more than one crop.			

Table 4. Summary of marketing information, Florida greenhouse vegetable producers, 2004.

Marketing Labels	Total Acreage	Total Acreage %	Number of Producers	Producers^z %
Organic	2	3	3	15
Pesticide-free	3	5	4	20
Greenhouse grown	21	33	8	40
Hydroponic	14	21	6	30
^z Number of producers surveyed = 20; Some producers had more than one label.				

Table 5. Summary of greenhouse vegetable crop damage from the hurricanes, 2004.

Damage	Total Acreage	Total Acreage %	Producers^z %
Delayed planting	10	16	10
100% crop loss	22	35	25
75% crop loss	4	6	10
50% crop loss	7	10	15
^z Number of producers surveyed = 20; Some producers did not have crop damage.			

Table 6. Summary of insurance information, Florida greenhouse vegetable producers, 2004.

Insured	Acres	Total Acreage %	Number of Producers	Producers^z %
Crop	11.5	18	7	35
Structure	47.5	74	11	55
Equipment	N/A	N/A	8	40
^z Number of producers surveyed = 20; Some producers had more than one type of insurance.				