

THE EFFECTS OF THE 2004 HURRICANE SEASON ON GREENHOUSE VEGETABLE PRODUCTION IN FLORIDA

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Abstract. The 2004 hurricane season proved to be one of Florida's worst. The four hurricanes (Charley, Francis, Ivan and Jeanne) caused total agricultural losses at over \$2 billion. In response, the federal government appropriated \$13 billion of 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 surveyed suffered some type of damage as a result of the hurricanes. Of these, 50% had crop damage and 75% suffered structural damages. Estimated totals for damages incurred were 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 examined 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.

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. By the tropical storm season of 2004 the wind's were back, striking on four separate occasions and ravaging much of the state. Hurricane Charley hit through Punta Gorda on 13 Aug. 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, the Florida panhandle awaited its turn. A fierce category five hurricane, Ivan, approached the Gulf, but gradually weakened before making landfall on 16 Sept. near Pensacola, with 120 mile an hour winds. On 24 Sept., 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. Together, these four hurricanes killed 117 people, caused property losses estimated at \$25 billion and total agricultural losses at \$2.1 billion, according to the UF/IFAS hurricane recovery report (Cheek, 2005).

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 losses, 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 Agency's and other government 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 and specialty crops such as strawberry and edible flowers (Greer and Diver, 2000; Hochmuth, 2003). In the 1970s, there was an estimated 20 to 30 acres of greenhouse vegetables (Hochmuth, 2003), and this industry had grown by 2004 to encompass 74 acres (Tyson et al., 2004); more than 30 acres have been added 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 fresh vegetable producing state (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/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 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 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).

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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

Twenty growers located in 13 counties (Table 1) were identified through County Agricultural Extension Agents. A survey was designed by J. M. Mitchell and D. J. Cantliffe. A copy of the survey can be obtained from the UF-IFAS Protected Agriculture website <<http://www.hos.ufl.edu/protectedag/surveys.htm>>. 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, impacted their structures and how damages were paid. Other information collected from the survey included greenhouse type, size, crops grown, media used, hurricane damage incurred, insurance and marketing strategies.

Results and Discussion

Total greenhouse production acreage of the 20 greenhouse vegetable growers surveyed in 2004 prior to the hurricanes 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, Homestead, Fla.) have closed since Tyson's survey was conducted. The total area in production of the 20 growers from the survey today (2005-post-hurricanes) was 58.2 acres (Table 1). Greenhouse type (Table 2) varied; double-poly, fan-pad cooled houses totaled 30 acres (47% of total acreage and 50% of the growers using this type). 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-pad cooled and one acre was a single-poly, fan-pad cooled design.

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).

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

County	Producers (no.)	Total acreage (in production before hurricanes) 2004	Total acreage (in production after hurricanes) 2005	% Decrease
Brevard	2	2.90	1.40	52
Collier	3	21.70	20.00	10
Glades	1	0.20	0.20	0
Highlands	1	0.60	0.60	0
Hillsborough	2	3.00	3.00	0
Levy	1	0.03	0.03	0
Okeechobee	1	10.00	10.00	0
Orange/Osceola	1	2.00	2.00	0
Palm Beach	2	7.90	7.90	0
Seminole	1	0.30	0.30	0
St. Lucie	2	8.00	5.40	33
Suwannee	4	7.50	7.50	0
Total	21	64.10	58.20	10

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

Design	Acreage (no.)	Percent of total acreage	Producers ^z (%)
Double-poly, fan-pad cooled	30	47	50
Plastic, passive ventilated	26	41	25
Mesh	3	4	10
Plastic, fan-pad cooled	2	3	10
Single-poly, fan-pad cooled	1	2	10

^zNumber of producers surveyed = 20; Some producers have more than one type of greenhouse.

The primary crops grown were colored pepper (*Capsicum annum* L.) at 25.2 acres (43% of total acreage and 25% of the growers), cucumber (*Cucumis sativus* L.) (at 23 acres (39% of total acreage and 40% of the growers) and tomato (*Lycopersicon esculentum* L.) at 7 acres (11% of total acreage with 30% of the growers) (Table 2). Other crops (lettuce (*Lactuca sativa* L.), strawberry (*Fragaria ananassa* L.), herbs (*Ocimum basilicum*), bean (*Phaseolus vulgaris* L.), eggplant (*Solanum melongena* L.) and carrot (*Daucus carota* L.) 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 other media had minimal usage (Table 4). 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).

As far as marketing was concerned (Table 5), 40% of the growers sell their produce as 'greenhouse-grown,' totaling 21 acres (33% of total acreage), 30% sell as 'hydroponic,' with 14 acres (21% of total acreage) while 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). 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

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

Crop	% producers in production ^z	Area produced (acres)	% of total greenhouse acreage
Colored pepper	25	25.20	43.30
Euro. cucumber	25	18.90	32.50
Mini cucumber	15	3.60	6.20
Tomato	30	6.90	10.70
Lettuce	20	1.30	2.20
Strawberry	10	0.90	1.50
Other greens	10	0.80	1.40
Herbs	5	0.80	1.30
Arugula	15	0.30	0.50
Beans	20	0.30	0.40
Swiss chard	10	0.20	0.30
Radish	10	0.20	0.30
Mini carrot	10	0.10	0.20
Basil	5	0.03	0.10
Eggplant	5	0.01	0.02

^zNumber of producers surveyed = 20; Some producers had more than one crop.

Table 4. Summary of media used, 2004.

Production media	Producers (no.)	Producers ^z (%)
Pine bark	5	25
NFT	4	20
Soil	3	15
Perlite	10	50
Vermiculite	2	10
Peat	2	10
Coconut coir	3	15
Sand	2	10
Rockwool	2	10
Ebb and flow	3	15
Other	2	10

^zNumber of producers surveyed = 20; Some producers used more than one type of media.

farmers markets, and all of the growers pack their own produce (Table 6).

Eighty percent of the greenhouse vegetable producers suffered some type of damage (crop, structural and/or secondary) as a result of the hurricanes (Fig. 1 and Tables 7, 8, 9). Ten percent of the growers said the hurricanes did not hurt their crop, but delayed their planting dates. Delayed planting acreage totaled 10 acres (16% of total acreage). Fifty percent of the growers had crop damage which damaged a total of 33 acres (53% of the total production acreage). Approximately 22 acres suffered a 100% crop loss (35% of the total production acreage and affected 25% of the growers). Crop loss of 75% was estimated on 4 acres (6% of the total production acreage and affected 10% of the growers). Loss of 50% or less of the crop totaled 7 acres (10% of the total production acreage and affected 15% of the growers) (Table 7). Total crop losses/damages to greenhouse vegetables were 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 losses, might suggest that losses to damaged crops may be considerably higher.

Some type of greenhouse structural damage was incurred by 75% of the growers (Table 8 and Fig. 1). 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 exact.

There was a lesser amount of equipment damage reported. Only 10% of growers lost production materials (tools) such as media, pots or drip line. 'Secondary' damage affected 50% of the growers (Table 9). This was damage caused by disease (such as fusarium, gummy stem blight, angular leaf

Table 5. Summary of marketing information, Florida greenhouse vegetable producers, 2004.

Marketing labels	Total acres (no.)	% of total acreage	Producers (no.)	Producers ^z (%)
Organic	2	3	3	15
Pesticide-free	3	5	4	20
Greenhouse grown	21	33	8	40
Hydroponic	14	21	6	30

^zNumber of producers surveyed = 20; Some producers had more than one label.

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

Sales	Producers (no.)	Producers ^z (%)
Wholesale distributor	14	70
Restaurants/hotels	4	20
Grocery stores	4	20
Farmers markets	3	15
Pack produce on-farm	20	100

^zNumber of producers surveyed = 20; Some producers had more than one vendor.

spot or sclerotinia) which hurt 20% of the growers, insects (moths) affected 10% of the growers and other damages which included power loss, down time, and no market to sell produce affected 20% of the growers.

Only 35% of the growers had crop insurance (Table 10). Insured crop acreage totaled 11.5 acres (18% of the total crop acreage), 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 money, but none received any assistance. Thus, none of the greenhouse vegetable growers received any assistance for crop damage.

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, besides 'pray,' most felt that better securing and fastening of structures, having back-up generators, extra plastic and opened sides (curtains) would help decrease their damage risk.

There was over \$4 million dollars damage (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 complete 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 (2005) 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 neither covered by disaster compensation money, nor covered under the Noninsured Crop Disaster Assistance Program (NAP). What about the 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.

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

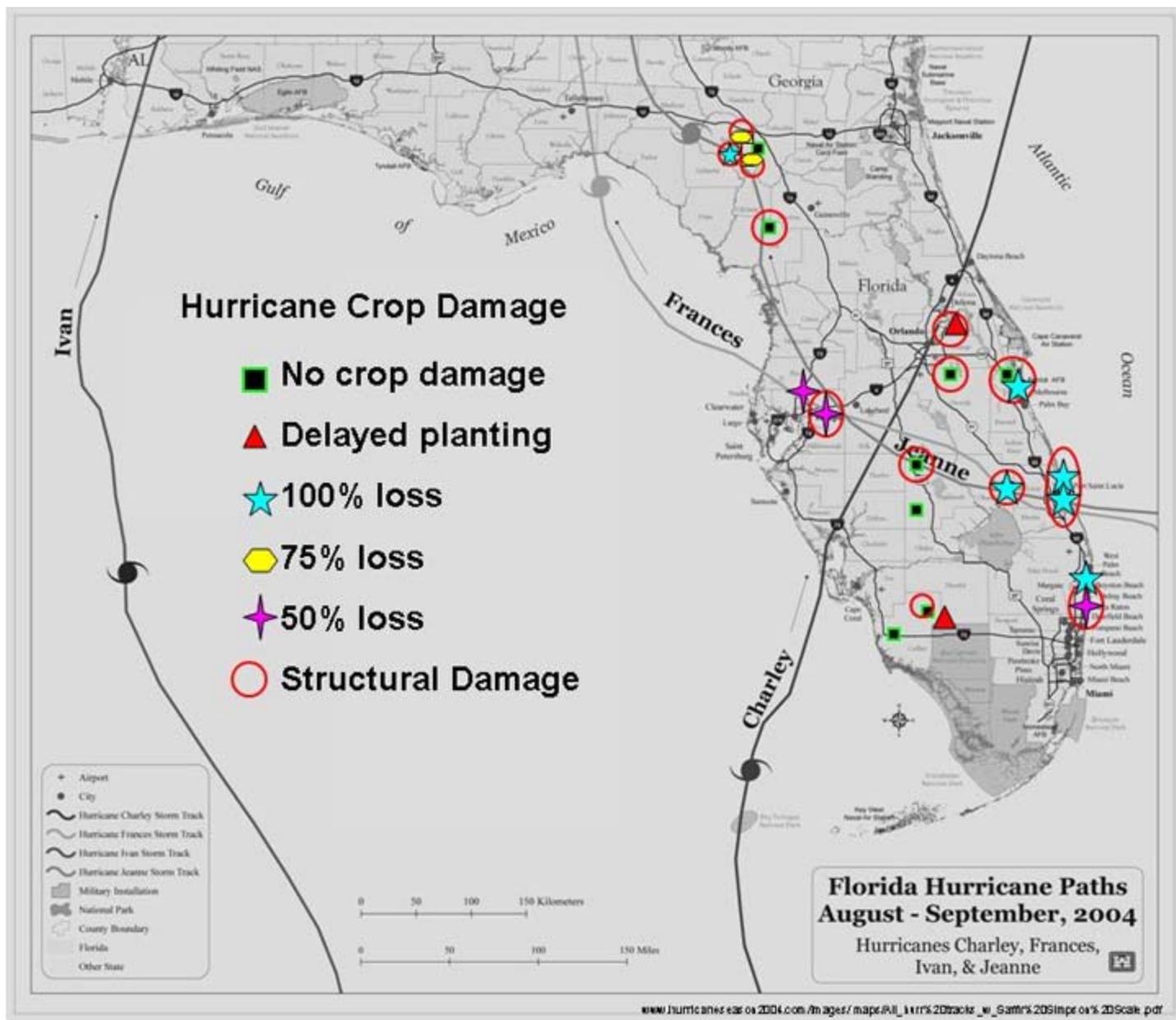


Fig. 1. Areas and levels of crop and structural damage to Florida greenhouse vegetable producers caused by the 2004 hurricanes.

greenhouse vegetable industry and improve production and marketing practices (NCGVGA, 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 as the NOAA National Hurricane Center has predicted yet another 'above-normal active hurricane season' expected for 2005 with 12 to 15 tropical storms, 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 them as an equal to nursery and other industries who use greenhouses for crop production.

Table 7. Summary of greenhouse vegetable crop damage from the hurricanes, 2004.

Damage	Acres (no.)	% of total acreage	Producers' (%)
Delayed planting	10	16	10
100% crop loss	22	35	25
75% crop loss	4	6	10
50% crop loss	7	10	15

*Number of producers surveyed = 20; Some producers did not have crop damage.

Table 8. Summary of greenhouse (vegetable) structural damage from the hurricanes, 2004.

Damage	Producers (no.)	Producers ^z (%)
Roof damage	10	50
Sidewall/curtain	6	30
Loss of entire structure	5	25
Total	15	75

^zNumber of producers surveyed = 20; Some producers had more than one type of damage.

Table 9. Summary of secondary damages to greenhouse vegetable growers as a result of hurricanes, 2004.

Damage	Producers (no.)	Producers ^z (%)
Disease	4	20
Insects	2	10
Other	4	20
Total	10	50

^zNumber of producers surveyed = 20; Some producers did not have damage.

Table 10. Summary of insurance information, Florida greenhouse vegetable producers, 2004.

Insured	Acres (no.)	% of total acreage	Producers (no.)	Producers ^z (%)
Crop	11.5	18	7	35
Structure	47.5	74	11	55
Equipment	N/A	N/A	8	40

^zNumber of producers surveyed = 20; Some producers had more than one type of insurance.

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