

Alternative Greenhouse Crops

By Robert C. Hochmuth, Daniel J. Cantliffe and Nicole L. Shaw

A significant greenhouse vegetable industry has flourished in Florida for almost 20 years. A statewide survey conducted in 1991 by UF indicated 66 acres of greenhouse vegetables were produced in Florida. European seedless cucumber (Figure 1) and tomatoes (Figure 2) represented 96 percent of the total acreage in 1991.

A survey conducted in the same manner in 2001 indicated the total statewide acreage was 95 acres.

However, tomato and cucumber represented only one-third of the total acreage in 2001. The leading greenhouse vegetable crop as of 2001 was colored bell pepper. Herb production (primarily basil) had increased to nearly 17 acres which was greater than European seedless cucumber and only slightly less than tomato (18 acres). Lettuce was produced in seven acres of greenhouses and strawberry in one acre. The complete details of these surveys are available at <http://nfrec-sv.ifas.ufl.edu>.

In addition, to the "big three" greenhouse vegetable crops – pepper, European seedless cucumber and tomato – other alternative crops have become very important in North American greenhouses. This is especially evident in Florida and is driven by the unique markets in the Sunshine state.

Large urban centers such as Orlando, Miami, Tampa, Jacksonville and others provide marketing opportunities for many high value alternative greenhouse crops for restaurants and spe-

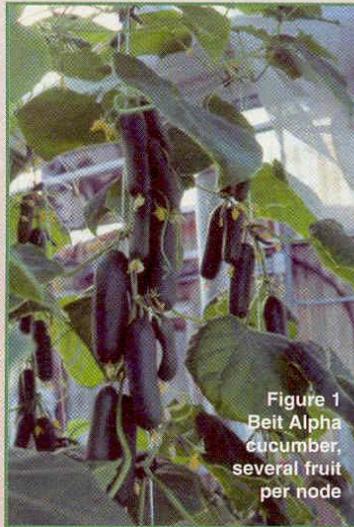


Figure 1
Beit Alpha
cucumber,
several fruit
per node

cialty ethnic markets. The abundant Florida cruise ship industry also provides a close market for many high value specialty crops.

The demand for the highest quality is often difficult to meet by any other production system than greenhouse culture. Several crops, other than the "big three," are being successfully grown and marketed now and others are being evaluated by the University of Florida. A discussion of those crops will follow next.

Mini Cucumber

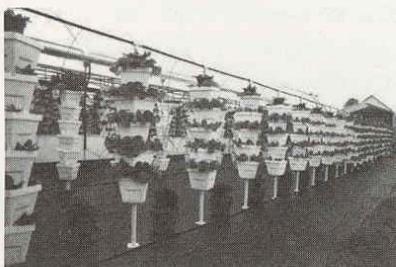
Mini cucumber (Beit Alpha types) (Figure 1), a smaller version of the standard European seedless cucumber has become a popular new crop. New to the U. S. is the Beit Alpha cucumber, a major cucumber type grown in Israel and exported to Europe. The Beit Alpha cucumber originated in Israel and is now being distributed throughout the world. Beit Alpha cucumbers are hybrids that are gynocercious and parthenocarpic, thus they do not need to be pollinated for fruit development. The fruit is seedless and has a thin skin like the European cultivars, but does not require a plastic shrink wrapping for prevention of dehydration after harvest. This is a major advantage in the cost of post harvest handling and marketing. Fruit production is prolific for Beit Alpha cultivars; many of the small fruits are set on each node and on the laterals. Yields can be compact (10 harvests or less) or continuous (more than 30 harvests), depending on season. Beit Alpha cultivars grow well under extreme environmental conditions, especially high temperature (90 to 95 C). These cucumbers appear to be sensitive to low temperatures (below 50 F) especially in the seedling stage.

Several production and post harvest trials have been conducted by the University of Florida, both in Gainesville and Live Oak, in the past five years. Several cultivars have produced very high marketable yields, equivalent to or higher than standard European cucumber types. Most Beit Alpha types produce fruits 15 to 20 cm in length and specific size is important in certain ethnic markets. A primary production challenge has been powdery mildew. Most early released cultivars were very susceptible to the disease; however, newer releases appear to have increased tolerance. As

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Figure 2



Figure 3



Figure 4

Figure 2 Cluster tomato production in perlite. **Figure 3** Herbs, edible flowers and specialty greens in VertiGro towers. **Figure 4** Bibb lettuce grown in NFT channels.

many as 18 cultivars are being evaluated by R. Hochmuth this spring at the NFREC-SV near Live Oak and a dozen others have been evaluated by D. Cantliffe and N. Shaw, Dept. of Horticultural Sciences, Gainesville.

Lettuce and Other Leafy Green Vegetables

The traditional greenhouse lettuce crop in Florida and elsewhere is a bibb heading type grown in NFT channels (**Figure 4**) or in a floating system. The product is usually sold as a “living plant” with the roots still attached and packaged in a bag or special plastic clam shell.

Lettuce is a fast crop, typically taking 30 to 35 days from seeding to harvest. Growing lettuce in the warm season in Florida makes the disorder, leaf tip burn difficult to manage. Environmental controls for temperature and light and cultivar selection are critical to properly managing

tip burn.

Lettuce acreage in Florida was about one acre in 1991, two acres in 1996, and seven acres in 2001. The later increase was mostly due to one large new operation in Central Florida.

Opportunities for greenhouse growers to supply other specialty leafy green vegetable crops is also increasing. Recent educational programs in Northern Florida connected growers with restaurant chefs. These programs revealed great interest among chefs to purchase specialty salad greens. Developing production systems and timing technologies for these markets can be very challenging. Trials at the North Florida Research and Education Center – Suwannee Valley, with vertical systems (Verti-Gro) for several specialty leafy green vegetables (**Figure 3**), have been encouraging for growers to meet this challenge.

Herbs

In the last decade, there has been a dra-

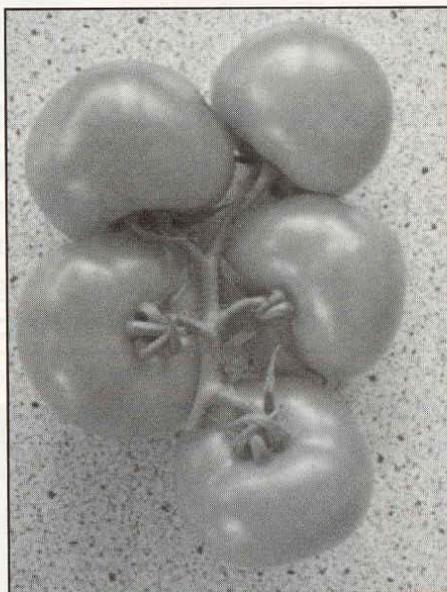
matic increase in greenhouse herb production in Florida, from virtually none in 1991 to nearly 17 acres in 2001. Herbs now rank third in greenhouse food crops, accounting for 18 percent of the state’s greenhouse acreage. The major herb now grown in Florida greenhouses is basil, however, dozens of other herbs are being grown also.

Herbs have a long history of use by humans. In ancient times, as well as today, herbs have been used for medicinal, cosmetic and culinary purposes. Herb and spice consumption in the U.S. doubled between 1965 and 1985, from 1 to 2 lbs. per capita according to a report by S. Stapleton UF/IFAS NFREC-SV in 2001.

The volume of basil and oregano sold in the U. S. increased 187 percent and 75 percent, respectively, from 1981 to 1991. Total sales value of fresh-cut herbs produced in U. S. greenhouses was \$30,995,000 accounting for nearly 14 percent of all greenhouse food crops sales in 1998. Fresh-cut herbs accounted for \$647,000 in sales of food crops from Florida greenhouses in 1998. The demand for fresh-cut herbs is expected to increase in part due to health-conscious consumers and increasing consumption of ethnic cuisine.

Greenhouse production of herbs offers several market advantages including more rapid plant growth, wintertime production when market prices are highest and a clean product. The clean, hydroponic product may not require washing prior to shipment, which contributes to a longer shelf-life and a high quality appearance. Quality was rated as the most important factor in selecting herb suppliers by 78 percent of herb buyers responding to a national survey.

Studies by S. Stapleton and R. Hochmuth were conducted to examine marketable yield of selected fresh-cut herbs from fall through spring in a vertical hydroponic greenhouse production system (Verti-Gro, Lady Lake, Fla.) in north cen-



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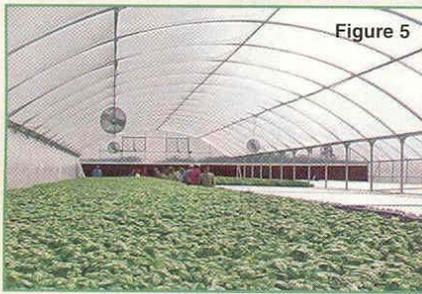


Figure 5 NFT basil production.



Figure 6 Hydroponic chives in perlite bags.



Figure 7 Greenhouse 'Galia' melons.

hydroponic greenhouse production system (Verti-Gro, Lady Lake, Fla.) in north central Florida. Herbs included in the trial were: arugula (*Eruca vesicaria*), basil (*Ocimum basilicum*), purple basil (*Ocimum basilicum*), chervil (*Anthriscus cerefolium*), dill (*Anethum graveolens*), lemon balm (*Melissa officinalis*), sweet marjoram (*Origanum majorana*), oregano (*Origanum vulgare*), parsley (*Petroselinum crispum*), Italian (flat leaf) parsley (*Petroselinum crispum*), sage (*Salvia officinalis*), and thyme (*Thymus vulgaris*).

The best overall performers in the Verti-Gro systems have included: basil, oregano, parsley, sweet marjoram and thyme. Basil is also commonly grown for fresh cut in containers filled with soilless media and also grown for whole-plant sales in NFT systems (Figure 5).

Other successful trials for herb production have included mints and chives (Figure 6) in lay-flat bags filled with perlite. As with most greenhouse specialty crops, growers must become especially knowledgeable about the differences in herb pricing, packaging, post harvest handling, and marketing for success and profit.

'Galia' Type Muskmelon

'Galia' muskmelon (*Cucumis melo* L. *Reticulatus* group) could become another hydroponic crop favorite. The 'Galia' melon is a green-fleshed muskmelon with a golden-yellow netted rind at maturity. 'Galia' fruits have a unique aroma and sweet flavor, and show promise as a specialty melon. Grown hydroponically in a protected-ag structure, 'Galia' fruit (Figure 7) quality surpasses the quality of field-grown orange muskmelons because of its bold aroma and high sugar content, leading to higher market value.

The Florida vegetable industry is facing many challenges, including the loss of the soil fumigant methyl bromide in 2005; increased regulations on water, fertilizer

and pesticide use; increased urbanization and loss of production land in southern Florida; challenges from weather, including freezes, wind and rain; and increased regional and global market competition.

Not only are alternative growing methods needed, including protected agriculture in non-traditional growing regions of Florida, but also new specialty commodities, such as 'Galia' melon, may be what Florida growers need to stay competitive. In Europe, 'Galia' melons are in high demand and well known for their superior quality and high soluble solids; furthermore, 'Galia' has become an identifiable trade name.

Research conducted by the UF Protected Ag Project in Gainesville by graduate student, Juan Rodriguez, has evaluated several aspects of 'Galia' muskmelon production, including: cultivar selection, nutrient management, soilless media, disease and insect management, pruning methods and

pollination. Disease and insect management can be especially challenging in greenhouse muskmelons grown in Florida.

Prices for imported 'Galia' melons have varied from \$1 to \$3.50 per lb in 1999-2000. Currently this is a very specialized niche market in Florida; however, as production challenges are solved and consumer's acceptance increases, 'Galia' muskmelon may become a popular alternative greenhouse crop in the future.

Strawberry

The Florida greenhouse strawberry is a product that has captured the imagination of many over the past dozen years. Several aspects of this crop makes the greenhouse concept appealing, including: high fruit values, protection from freezing temperatures, high value in off the season, difficulty with labor harvesting (low crop culture), and challenges of finding suitable alternatives to methyl bromide. Even with high



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Figure 8 Alternative greenhouse strawberry production system, UF/IFAS Horticultural Sciences Department, Protected Agriculture Center, Gainesville. **Figure 9** Cut-flower zinnia trials at the UF/IFAS, NFREC, Suwannee Valley, Live Oak.

interest in greenhouse production of strawberry, commercial adoption remains relatively low in Florida (about one acre). Recent UF research has focused on new production and pest management systems for greenhouse strawberry (**Figure 8**). High plant populations are required for profits.

UF research conducted by Ashwin Paranjpe and Dan Cantliffe, Department of Horticultural Sciences, indicated plant densities of 17 plants/m² were required for break-even yields in horizontal trough systems. Other systems can also be used to further increase plant populations including vertical systems or moveable trough systems, also lending ease of harvest. Further cost analysis is needed for these plant densities in typical field culture. Challenges also increase in the greenhouse, in the area of pest management problems such as: powdery mildew, botrytis, aphids, spider mites and thrips. If these issues are resolved and if problems with soil fumigation and labor in field production persist, greenhouse acreage of strawberry could see rapid increases.

Miscellaneous Alternative Crops

As the markets demand highly specialized crops, greenhouse producers may consider meeting these needs. Often the market demands crops in condition or at a timing that can only be met by the utilizing the

protection of a greenhouse. Other crops being grown on a small commercial basis in Florida include: fresh-cut flowers, edible flowers, specialty peppers and tomatoes and eggplant.

The efforts at the NFREC-SV have been successful in refining a production system for cut-flowers similar to that used for vegetables. This project evolved out of interest in greenhouse tomato growers to produce other more profitable greenhouse crops.

The crops that have the most potential are those specialty cut flowers that are difficult to ship from other larger production areas. These include flowers such as zinnia (**Figure 9**), snap dragon, sunflower, delphinium and lisianthus. Small growers in North Florida have been successful in producing top quality flowers for local sales. Expansion of these local marketing efforts depends upon growers being able to grow several different species to maximize the number of specialty cuts to be sold on a weekly basis. In addition, flowers that continue to branch and produce more cuts on the same plant over a long period of time have shown to be the most profitable candidates. Zinnia and snap dragon, for instance, have this type of growth habit.

Edible flowers can be good companion crops for local greenhouse producers, especially herb producers. Although the demand is small, the value is high and the opportunity to provide high quality edible

flowers to chefs in urban Florida restaurants is great. Vertical production (Verti-Gro) of these has been highly successful in trials at the NFREC-SV. Edible varieties of nasturtium, viola, stock and marigold have all been successfully produced in trials at Live Oak.

Specialty varieties of pepper, tomato and eggplant also can provide alternative crop opportunities for greenhouse growers, especially for local markets. In some cases, production of specialized varieties of many crops in the field can be very difficult due to diseases, insects or weather problems.

The greenhouse may create opportunities to produce highly specialized crops, like heirloom tomatoes, off season specialty pepper or tender eggplant varieties. These are typically opportunities for small and specialized greenhouse operations. Many small operations have been successful with this diversification approach by selling directly to consumers at Farmers Markets or other retail markets.

High quality greenhouse tomato, cucumber or pepper accompanied with lettuce, cut flowers, strawberries, herbs and specialty leafy green vegetables can make a great crop mix at a local market for a small, but talented greenhouse grower.

For an up-to-date listing of UF trials and reports on greenhouse vegetables and links to other greenhouse vegetable Web sites, visit <http://nfrec-sv.ifas.ufl.edu> and www.hos.ufl.edu/ProtectedAg/.

Robert Hochmuth is a multi-county extension agent located at the UF/IFAS North Florida Research and Education Center, Suwannee Valley, Live Oak, bob-hoch@mail.ifas.ufl.edu.

Daniel Cantliffe is chairman/professor/team leader of the Protected Agriculture Project, Horticultural Sciences Department, UF; djc@mail.ifas.ufl.edu. Nicole Shaw is a biologist scientist, Horticultural Sciences Department, UF; colie@ufl.edu.

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