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Challenges and Potential Solutions for Vegetable Producers in Miami–Dade County

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The production of winter fresh market vegetables in Miami-Dade County can be traced back to late 1800s and supports the local economy through employment and revenues. The major vegetable crops are snap bean (*Phaseolus vulgaris*), squash (*cucurbita pepo*), sweet corn (*Zea mays* var. *rugosa*), Cuban sweet potatoes (Boniato) (*Ipomoea batatas*), okra (*Abelmoschus esculentus*), and tomatoes (*Solanum lycopersicum*). However, vegetable producers are facing a number of challenges, such as strategies for marketing, food safety, overseas competition, implementation of Best Management Practices (BMPs), Good Agricultural Practices (GAPs), pest control, freeze protection, and soil and water management. Marketing and food safety are top considerations, especially for new and small farm growers (with gross sales less than $250,000 a year) due to limited budget. However, outbreaks of food borne disease could result in business closure for either small or large producers. Good Agricultural Practices, such as Tomato-GAPs, have become a mandatory requirement in Florida. It is important to implement Integrated Pest Management (IPM) systems including cultural, biological, mechanical, and chemical practices with sufficient scouting to prevent pest resistance and to benefit the environment. Best Management Practices (BMPs) for soil nutrient and water management in vegetable production are needed to reduce production costs and protect downstream water supplies.

Major vegetable production and economic values

The production of winter fresh market vegetables in Miami-Dade County, especially winter tomatoes for export to northern areas, can date back to as early as 1800s because of the favorable weather. That is why Miami–Dade County has been referred to as the nation's "salad bowel" or "winter bread basket" (Lamberts, Dade County Farm Bureau). Based on the data from 2012 census, there are about 29,703 acres of vegetable crops harvested each year throughout the county, and the major crops are beans (Fig. 1), sweet corn, summer squash, boniato (sweet potatoes), tomato, okra, eggplant, pepper, Asian vegetables, and herbs (Table 1). Miami–Dade is No. 1 in production of snap bean and summer squash in both State of Florida and the United States. The total value of vegetables can be as great as $137 million in gross sales, and the total number of employees involved in the agricultural industry is about 12,000 (USDA, 2012). However, vegetable producers, especially those new or with small acreages, need strategies to overcome their challenges in order to survive in the competitive business.

Marketing strategies

Marketing is a top priority, especially for small farms. They need to know where to sell their products and who the customers are. It is called "sale before sown" (Richardson, 2005) in order to avoid the business closure. A good strategy is to plan ahead and anticipate what can be sold to outlets. Market analysis not only helps determine if the prospective enterprise can be profitable, but also determines how it will promote and market the products. Do not grow crops before identifying buyers. Try to start with easy and simple approaches, for instance, target local markets including U-picks (Fig. 2), roadside stands, farmers markets, and retail outlets before focusing on regional, national, and international markets (Wade, 2010). Even for sophisticated enterprises, local markets can be a great alternative.

For potential customer resources, growers need to check with any possible buyers, such as specialty distributors, restaurants, customers at farmers' markets, and retail produce managers. Evaluate each individual resource, producing capacity, time frame, and work on an agreement or contract if possible. Once an agreement has been reached, growers have to follow appropriate guidelines, including time, packaging, quantity, and quality, to meet their customers' needs. Establishing a good reputation promotes future business and contracts. Always try to start with a small scale and test the capability to grow and market new products before scaling up. Experiences at the small scale provide information for moving to a larger scale planting such as production technologies and skills for growing, managing, marketing and handling processes.

Diversify vegetable crops in markets in case of weather, pests or collapsed market wiped out one crop, so the grower has the others to rely on. Another advantage of diversity is that once a grower has established connections with buyers, increasing the varieties he/she offers them would be an acceptable approach to expand the business. Growing something unique or with value-added features would be an example. Develop unique business features rather than following anybody else's process and competing with them. Seek approaches to differentiate the products not only by what farmers are growing but also how to grow them, and pursue possibilities to add values to the products, which may include nutritional, and healthy value improvement, such as packaging and handling, home delivery and prewashing.

Understanding quality is what the customer needs. Most customers prefer to purchase high quality products with the same or some extra cost, including freshness, uniformity, flavor, and

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Fig. 1. Overview of green bean field. Photo: Qingren Wang.

Fig. 2. Roadside stand and U-pick for fresh vegetables. Photo: Qingren Wang.

Table 1. Major vegetables in Miami-Dade County (USDA, 2012).

Major vegetables	Acreage
Beans	11,126
Squash	2,159 (seems incorrect)
Sweet corn	5,252
Sweep potato/boniato	2,825 (2007 data)
Tomato	3,809

natural maturity, which make grading and handling more challenging. A unique, high-quality product that customers cannot get elsewhere can keep them coming back again. Feedbacks from customers for new products can always help the growers adjust their production.

Food safety regulations

It is of great importance to guarantee food safety because a food-borne illness outbreak could result in a bankruptcy for the business operators. There have been a number of major incidents of food-borne illness outbreaks in the United States and each one incident resulted in significant financial losses amounting from hundreds million up to few billion dollars (Reyes and Evans, 2008). Among foodborne diseases, 90% resulted from biological agents, i.e. bacteria, virus, and parasites. Accordingly, foodborne illness is a health hazard and can cause death. It is estimated that each year over 1.5 billion children under age of five in developing countries suffer from diarrhea and over 3 million die as a result. Costs related to foodborne illness include healthcare, laboratory research, investigation, controlling outbreaks, loss of revenue, and legal procedure costs for related litigation. Therefore, in the United States, many produce operators and farms have gone out of business after foodborne illness outbreaks were traced back to them due to litigation and regulatory actions that brought them financial hardship (Simonne, 2010).

To prevent such risks, many major retail outlets now have required their produce suppliers to document their food safety practices by means of certification or documentation. It is critically important for growers of fresh produce to keep the food safety in their entire operations. To guarantee the food safety, growers need to follow the procedures:

1. Prevent any potential contamination sources including biological, chemical, and physical agents.
2. Minimize contacts from human or animal feces; ensuring clean and safety water supply.
3. Use manure and municipal biosolids safely if they are allowed to be utilized.
4. Focus on worker health and hygiene, such as appropriate training, hand washing station, toilet facility, and employee accommodations.
5. Follow the law and regulations of local, state and federal standards.
6. Be accountable with effective monitoring and documentation.
7. Implement Good Agricultural Practices (GAPs), and Good Handling Practices (GHPs).
8. Establish an efficient trace-back system starting from cultivation, management, and harvest to packing, transportation, and handling.

All GAP programs include detail procedures and guidelines as a chain of custody system from the farm to the consumer. It can help growers self-audit their operations in production, processing, and transportation to safeguard the food products, the environment, and the consumers. It is a priority for growers to follow the GAP guidelines because it can benefit both consumers and producers. With such a system officials can trace contaminated foods back to the handlers and growers to determine who is responsible for unsafe agricultural products because the risk of contamination during the transportation and distribution can be a major concern (U.C.-Davis Coop. Ext., 2011). Tomato GAP (T-GAP) has been put into practice mandatorily by Florida Department of Agriculture and Consumer Services (FDACS), which is an example to develop specific GAPs for other vegetable crops.

Implementation of BMPs to benefit growers and the environment

Best Management Practices are necessary for growers to maximize nutrient use at the farm and minimize soil nutrient losses through runoff and leaching. Thus, when used properly BMPs result in a better, more efficient and productive system to benefit

the growers. Efficient nutrient management program is required in Miami–Dade County vegetable production as soil fertility is poor and the environment is vulnerable. Vegetable crops are mostly produced in rocky soils in Miami–Dade County, which can hardly retain soil nutrients. These soils are typically 4–6 inches deep overlaying porous limestone bed rock. The area also has a shallow aquifer, the Biscayne Aquifer. The relatively small soil profile creates a challenge for growers to balance nutrient availability for plants with minimal losses. However, the enrollment for BMPs in Dade County is still voluntary and it requests that the growers must have owned the land. The major concern is that a number of growers in the county are leasing the land with a short term, from a single season to a couple of years, which creates some limits to carry out BMPs countywide.

The Federal Clean Water Act, especially the restricted requirement level of phosphorus (≤ 10 ppb) in the wetland surface water of Everglades urgently forces agriculture to implement best management practices (BMPs) for soil nutrients and water. Ultimately, BMPs have to be incorporated into a farm plan, which includes proper planning and progressive decisions made with comprehensive records. However, to integrate BMPs into a farm plan, growers need an on-farm assessment, a quality assurance program with detail operation and maintenance, and the incorporation of any other appropriate federal conservation planning requirement. University of Florida has a comprehensive guideline for BMPs for Florida vegetable and agronomic crops (UF–IFAS, 2005). Simply, as a general guideline for Miami–Dade County BMPs in vegetable production, growers should follow these procedures:

1. Use soil water content or soil water tension monitoring devices with crops on plasticulture to more accurately schedule irrigation events.
2. Follow the wellhead protection BMP and consider special protection for open irrigation wells.
3. Develop a management plan that includes periodic establishment of summer cover crops (Fig. 3) to take up excess nutrients and to improve soil fertility after incorporated plant residues into the soil

Fig. 3. Sunn hemp cover crop system reducing nutrient leaching and improve soil fertility. Photo: Qingren Wang.

4. Improve water use efficiency, such as implementing drip irrigation and parallel irrigation vs. big gun irrigation system.
5. Apply fertilizers based on crop needs, soil testing and calibration of the specific land, which is an undergoing program supported by University of Florida.
6. Adjust balance of various nutrients including macro and micronutrients for optimal production.
7. Apply controlled-release fertilizers rather than conventional types with a feasibility evaluation.
8. Optimize fertilizer application rates, timing and methods based on soil type, crop productivity and growth stages. For instance, split application with light rates compared with one time heavy rate, basal, side dressing, and fertigation with appropriate irrigation schemes can improve nutrient use efficiency.

Pest management

Pest management is the other challenge in vegetable production of Miami-Dade County or south Florida. The favorable weather, warm and humid, makes pests including pathogens, weeds and insects extensively hard to control. Such pests can live longer and are more productive than that elsewhere. Major insects and pathogens for various vegetable crops in the Miami–Dade County area are as follows.

1. Beans: whiteflies, flower thrips, caterpillars, leafrollers, and aphids are major insects; and bacterial blight, bean rust, powdery mildew, alternaria spot, bean golden mosaic virus are dominant diseases.
2. Squash: aphids, whiteflies, melon & pickleworm, thrips, spidermites, armyworm, looper, root-knot nematodes are prevalent; and powdery mildew, downy mildew, bacterial leaf spot, and phytophthora blight are main concerns.
3. Sweet corn: armyworm, silkflies, cornstalk borer, cutworm, wireworm, aphids, and earworm are common insects; and rust, northern corn leaf blight, southern corn leaf blight, and bacterial leaf spot can often be seen in the field.
4. Tomato: the major insects on tomato crops are silverleaf whiteflies, leafworm, fruit worm, looper, and aphids; common diseases are bacterial spot, early spot, tomato spot, tomato yellow leaf curl virus, and groundnut ring spot virus.
5. Pepper: pepper weevil (grub), beet armyworm, tomato fruitworm, looper, and melon thrips are dominant insects; bacterial spot, phytophthora root rot, and pepper mosaic virus are main concerns to cause plant diseases.

To control these pests, it is recommended to carry out Integrated Pest Management (IPM), which includes the following approaches:

1. Host resistance: select pest resistant varieties whenever available.
2. Biological control: apply biological approaches, such as predators and parasites, to control major insects.
3. Cultural control: use cultural control measures, such as crop rotation, cover crops, trap crops, optimizing harvest timing, to manage the dominant insects and diseases.
4. Mechanical control: the mechanical control measures in insect management include traps, inducing lights, and sanitation; and those in disease management include disease-free seeds, removing infected plants, disinfecting equipment and tools.

5. Chemical control: chemical control is another option. The chemical control procedure mainly includes correctly identifying the pests, alternatively selecting various classes of pesticides (UF–IFAS, 2014) to reduce the pest resistance; and following the label for the application and field worker protections.

However, for an efficient control of field pests, growers need to combine all above approaches available into their pest management plan. To feasibly apply those approaches, growers have to consider the threshold of the input versus the output based on pest damaging occurrences through extensive scouting and an estimation of potential yield losses.

Freeze protection

Freeze protection is another challenge in Miami–Dade County vegetable production industry because a cold front, mostly occurring between late December and early February, could severely damage or even completely destroy vegetable crops(Ozores-Hampton, et al., 2010). For example, a mass cold front came through the whole state of Florida, and the air temperature reached as low as 28 °F in Homestead on 11 Jan. 2010, which was the coldest temperature ever. The economic loss in agriculture across the state of Florida due to this freeze damage was up to $273 million based on statistics from the U.S. Department of Agriculture (The Daily Caller, 2010). It is a common and effective approach to applying irrigation water with an overhead system (Fig. 4) for cold protection of vegetable crops. Applying water can reduce freeze damage because water has a higher heat capacity compared with air, and the sensible (inherent) heat of the water coming out of the ground gives off heat as it cools to 32 °F (0 °C). The heat of solidification (fusion), i.e., energy released can give off additional heat by changing water from liquid to solid form (ice).

To protect the crops from such damage, growers have to setup pipelines with an overhead irrigation system prior to the event. They have to closely watch the cold front through broadcast or on the internet, and check the dew temperature and the wind speed to decide the time pumping water. The general principle for switching pumps on is whenever the dew temperature is below 32 °F (frozen point) and the wind speed less than 10 mph. The Miami-Dade County Extension Service has an automatic monitoring system with five sites to cover most agricultural areas with hourly updated data, and a hotline for answering calls is available to guide growers for the protection whenever a potential freeze comes.

Competition from overseas

Market competition from overseas is challenging the local growers because a higher value of land, greater costs of materials and labor, and more expensive of fuel in Miami–Dade County compared to those elsewhere. Overall, the total cost of most fresh produce is much cheaper produced overseas, such as from Mexico, even plus transportation rather than that produced locally. The lower labor cost from overseas as compared to the local industry plays a major role for the market completion. Therefore, an increasing pressure has been put on local vegetable growers, which forces them to pursue other approaches for long term business viability, e.g., improving the yield and quality, producing vegetables with unique features, hydroponic and organic, utilizing the land efficiently, and reducing the cost through optimizing irrigation, fertilization, plastic material reuse.

Most overseas competitors originated from Central or South American countries, especially those from Mexico, but in recent years European greenhouse vegetable producers, such as those from Spain and Netherland, are taking advantages in competition with local growers for vegetable market. For instance, imports of fresh tomatoes from Mexico reached 54 million 25-lb cartons as early as 1990. More recently, a greater percentage of tomato sales have come from greenhouses, especially cluster-type tomatoes produced in Holland, Israel, Canada, and Spain in addition to Mexico (Cantliffe and Vansickle, 2012). Not only tomatoes but other vegetables with a large scale of greenhouse productions overseas have had a serious competition in the U.S. market. For example, the Mediterranean region of Europe is a major protected crop production area in the world. It has about 247,000 acres of vegetables grown in greenhouses and 741,000 acres grown with high tunnels and mulching. In contrast, there are only 1.9 million acres of total fresh vegetables, and 193,000 acres of winter fresh vegetables produced in the entire United States (Martinez, 1999).

Fig. 4. Tomato freeze protection with an overhead watering system. Photo: Qingren Wang.

Conclusion

Favorable weather has provided a unique opportunity for winter vegetable production for Miami–Dade County. However, growers in the fresh produce industry, especially those new or with small scales have to realize the reality and face the challenges. To succeed, marketing is a top priority, food safety is a great concern, implementing scientific sound technologies, i.e., BMP in soil nutrients and water, and IPM in pest control is fundamental, preparation for freeze protection is necessary, and improving quality and yields to compete the market with oversea providers are important considerations.

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