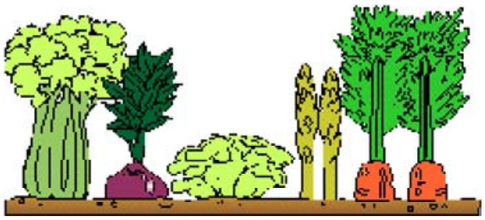

VEGETARIAN NEWSLETTER

A Vegetable Crops Extension Publication
Vegetarian 03-02
February 2003

University of Florida
Institute of Food and Agricultural Sciences
Cooperative Extension Service

Vegetarian Archive Vegetarian Index

Print Version

COMMERCIAL VEGETABLES

- Planting by the Signs in February - Resource Information for Extension Agents
- Southwest Florida Vegetable Research Investment Fund
- Update and Outlook for 2003 of Florida's BMP Program for Vegetable Crops
- Proliferation Ability of Nutsedges

List of Extension Vegetable Crops Specialists

* * * * * * * UPCOMING EVENTS CALENDAR * * * * * * *

Florida Postharvest Horticulture Industry Tour. Statewide. March 10-13, 2003. Contact Steve Sargent at 352-392-1928 or sasa@mail.ifas.ufl.edu OR Mark Ritenour at 561-201-5548 or mrit@mail.ifas.ufl.edu

Drip Irrigation School. Ft. Pierce-IRREC. March 13, 2003. Contact Betsy Lamb at 772-468-3922 x138 or emlamb@mail.ifas.ufl.edu OR Ed Skvarch at (561)462-1660 or eask@mail.ifas.ufl.edu. This program will provide CEU and CCA credits and certificates of attendance.

Urban Farming Workshop. Seminole County Extension Auditorium. Sanford, FL. April 12, 2003. Contact Richard Tyson at rvt@mail.ifas.ufl.edu

Florida Postharvest Horticulture Institute at FACTS. (Florida Agricultural Conference & Trade Show). Lakeland. April 29-30, 2003. Contact Steve Sargent at 352-392-1928 or sasa@mail.ifas.ufl.edu

Vegetable Field Day. GCREC-Bradenton. April 10, 2003. Contact Don Maynard at 941-751-7636 x239 or dnma@mail.ifas.ufl.edu

116th Florida State Horticultural Society. Sheraton World Resort Hotel International Drive - Orlando, June 8-10, 2003.

PLANTING BY THE SIGNS IN FEBRUARY - RESOURCE INFORMATION FOR EXTENSION AGENTS

The University of Florida/IFAS neither recommends nor has it done research to make recommendations to plant according to moon phases nor the astrological signs. The purpose of this article is informational. However, I wish I had a dollar for every time over the last 22 years when I've been asked (mainly by old-timers) if the signs were "right" to plant a crop. Lately, we've had more clientele with organic [Circular 375 Organic Vegetable Gardening (1) is an excellent resource to help clientele and agents] and bio-dynamic approaches to vegetable gardening and production. It helps to understand where they are coming from (4). See Table 1. for explanation of numbered references in parentheses.

J. Raymond Joyce, Extension Agent for Laurens and Johnson counties in Georgia, simplified some basic principles for clientele that you might want to access on the web (3). A website (2) that helps explain the philosophy and mechanics of gardening by the moon, how calculations are made, and how to generate a calendar for the month is referenced as well as a chapter from a classical book documenting southern agriculture lore (7). Not that we're advocating the practice, just trying to understand where clientele are coming from, to better communicate and extend our applied research-based information to Extension clientele.

For agents to better communicate UF/IFAS vegetable planting recommendations, the UF/IFAS Florida Vegetable Gardening Guide (6) recommended planting date ranges could be used. A starting point with a client, is understanding that clients will use something like the Farmers Almanac (5) or calendar with lunar and other signs as their main reference to integrate local Extension recommendations into their February, 2003 garden (experienced repeatedly by senior author's 22 years of interacting with rural clientele):

Table 1.

Vegetable Crop	February 2003 Planting Dates		
	North Florida	Central Florida	South Florida
Beans (bush, pole, lima)	----------------	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15
Beets	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27
Broccoli	4, 5, 9, 10, 14, 15	----------------	----------------
Cabbage	4, 5, 9, 10, 14, 15	----------------	----------------
Cantaloupes	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15
Carrots	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27
Cauliflower	4, 5, 9, 10, 14, 15	----------------	----------------
Celery	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15	----------------
Chinese Cabbage	4, 5, 9, 10, 14, 15	----------------	----------------
Collards	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15
Corn, Sweet	----------------	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15
Eggplant	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15
Kale	4, 5, 9, 10, 14, 15	----------------	----------------
Kohlrabi	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27
Leeks	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15	----------------
Lettuces (crisp, butter head, leaf, romaine)	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15	----------------
Mustard	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15
Okra	----------------	----------------	4, 5, 9, 10, 14, 15
Onion, Bunching	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15
Onion, Multipliers	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27
Parsley	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15	----------------
Peas, English	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15
Peas, Southern	----------------	----------------	4, 5, 9, 10, 14, 15
Pepper	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15
Potatoes, Irish	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27
Potatoes, Sweet	----------------	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27
Pumpkin	----------------	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15
Radish	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27
Squash, Summer	----------------	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15
Squash, Winter	----------------	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15
Tomatoes	4, 5, 9, 10, 14, 15	4, 5, 9, 10, 14, 15	----------------
Turnips	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27	20, 21, 22, 23, 26, 27

The dates in the integrated planting guide are for moon-sign best planting dates without regard to optimum frost-free periods; using the UF/IFAS Vegetable Planting Guide recommended planting months. The Farmers Almanac Outdoor Planting Table for the Southeast U.S. takes average last frosts and length of growing season into consideration, so planting dates are conservatively moved later into the growing season, so there may be some discrepancies between table dates (which are strictly based on moon signs) and Farmers Almanac recommendations. Additional information moon sign information that might be helpful with clients:

- February seedbeds are planted the 17th, 18th, 25th, 26th, and 27th.
- February plant pests are to be controlled on the 5th-7th, 19th-22nd.

4-H Agents may want to test these dates in controlled, replicated trials as 4-H Plant Science projects or youth Science Fair projects, testing the hypothesis of age-old tradition (planting dates of root vs. leaf crops, etc.)   Documented results would surely make for a colorful and interesting 4-H Demonstration or Science Fair project, as will be shown by the co-author (8) in the remainder of this article in his own words:

… "I first heard about gardening by the signs from my dad. He said that his Grandpa only planted when the signs were right. To be honest, it sounded like a lot of hocus-pocus. I decided that it would make a good science fair project. The purpose of the project was to see if the moon had any effect on the plants rate of growth. There are two aspects of planting by the moon. The first part involves planting according to lunar phases, Table 2. The moon has four phases, each lasting about seven days. The first and the second phases of the moon are supposed to be the best time to plant an above ground crop. During this time, the moon has a greater gravitational force bringing water to the above ground parts of the plant. The third and fourth phases of the moon are supposed to be the best time to plant a below ground crop (radish, peanuts, potatoes) since more water will be available in the root zone. The second part of gardening by the moon involves the astronomical signs. Farmers know them by names such as the head, heart, twins, feet etc. However, most people refer to these as the signs of the zodiac. Examples include, Taurus, Cancer, Gemini, and Leo etc. Each of these signs is known as being fruitful or barren, watery or dry, fiery or earthy. Planting guides such as the *Old Farmers Almanac* say that the best time to plant is when a moon phase and the most ideal sign occur together for a particular crop. The materials that I used to conduct my project were commercial potting soil, pots, and Sparkler radish seed. I sowed the seed on the best and worst days for planting according to the Almanac. Each planting was allowed to grow for a period of thirty days. (No fertilizer was used) At the end of the thirty- day period the plants were removed. The roots and vegetative parts were measured. The Almanac had predicted that the best day for planting below ground plants would be on October 27th. This was during the third phase of the moon under the sign of Cancer (considered to be the most fruitful). This sign gave the best result for all of the plantings. The worst possible day for planting yielded the poorest result. There is evidence to suggest that the signs may truly have an affect on a plants rate of growth. My next project will be to test the signs on an above ground crop next spring."

Table 2. Radish growth when planted according to signs and lunar phases.

October, 2002 Planting Date	Sign	Lunar Phase	Root Growth	Top Growth
17th	Aquarius	2nd	7.9cm	4.3cm
19th	Pisces	2nd	8.0cm	4.1cm
21st	Aires	Full	9.3cm	3.9cm
24th	Taurus	Third	9.0cm	4.0cm
25th	Gemini	Third	5.5cm	4.0cm
27th	Cancer	Third	9.5cm	4.7cm

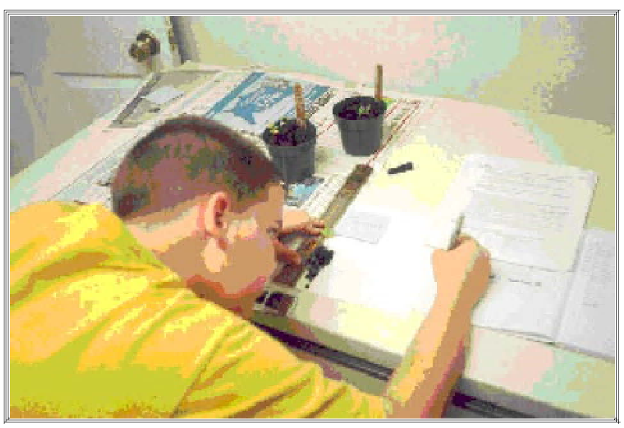

Figure 1. Recording centimeters of root and shoot growth of all treatments at end of experiment.

References:

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Planting by the Signs of the Moon, http://www.griffin.peachnet.edu/ga/laurens/ag/hort/hortnews/plantbymoon.html
Planting by the Moon, http://home.att.net/~millero/lunar.html
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SP 103 Florida Vegetable Gardening Guide, http://edis.ifas.ufl.edu/VH021
Wigginton, B.E. 1972. The Foxfire Book. Anchor Books, Random House. New York, NY. Pp. 212-227.
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(Jacque Breman, Union Co. Ext. Dir. and Clint Williams, Union Co. 4-H Member - Vegetarian 03-02)

SOUTHWEST FLORIDA VEGETABLE RESEARCH INVESTMENT FUND

Vegetable farming has never been an easy proposition but in recent years it has become even more difficult in a rapidly changing and dynamic world economy. Survival in this environment has not been easy.

Over the past decade, the number of vegetable growers in Southwest Florida has fallen precipitously to a point where the number of vegetable growers in Southwest Florida is now approximately the same as the number of Florida panthers estimated to be surviving in the wild. Unlike the panther, however there has been little public sympathy for their plight and none of the multi-millions of government and private dollars that have been allocated toward saving the big cat.

There is no question that the industry has undergone massive transformations and has overcome tremendous challenges in the past quarter century. Although they are farming differently than in the past, Florida growers remain among the most productive in the world.

The success of the industry has been due to a number of factors. Favorable climate, abundant land and water, as well as the tenacity and rugged individualism of our growers have all been major factors contributing to the development and survival of the industry.

Vegetable growers in Southwest Florida also acknowledge that much of the strength and progress in the vegetable industry can be directly attributed to the strong partnership and collaborative effort between growers, government, educational institutions and industry in conducting agricultural research aimed at finding solutions to growers' problems. While all of these factors have made positive contributions, the dynamics of the industry are changing and will continue to change at an increasingly rapid pace.

During the past decade, there has been an enormous upsurge of foreign competition with tremendous negative impact on the entire industry. Although pests and diseases have always been a menace to agricultural producers, new pests and diseases have appeared to plague growers. In addition, new problems have emerged. The industry now has to contend with environmental concerns, labor availability, water shortages and many other issues.

Another thing that has changed is American demographics; agricultural producers now constitute less than 1% of population. With the reduced involvement with agriculture, public perception of agriculture is changing. These changes have impacted the sources of funding available to support agricultural research. Policy makers at every level have placed greater emphasis on addressing such national issues as education, the environment, social issues, and technology.

In December 1999, a group of grower and other industry representatives attending a meeting of the Southwest Florida Vegetable Advisory Committee expressed dissatisfaction with the direction, focus and quantity of vegetable research being conducted by IFAS. These concerns lead to a meeting with the director and research faculty at the UF/IFAS Southwest Florida Research and Education Center. The meeting proved to be quite informative for the committee members.

At the meeting, growers came to realize that there were several factors to be considered. Firstly, as government support for agricultural research has dwindled, remaining funds have often been applied to more basic research efforts as well as so-called sustainable agricultural research that often seems to have little practical application in relationship to the growers immediate needs and wants. Secondly, although private corporations still fund agricultural research in many areas, these efforts tend to be motivated by profit and focused on specific products. Lastly, research costs money and lots of it and as the old saying goes - he who pays the piper - calls the tune. Quite simply, if the committee hoped to influence the future direction of vegetable research and guarantee the continuation of unbiased research that addresses growers' needs; sufficient funds would have to be put in place.

With this realization, the committee decided to explore their options. Research into how other commodity groups handled this dilemma revealed that the citrus and sugar industries had already come to this conclusion and had well-established commodity based research efforts. Acting on this information, the Southwest Florida Vegetable Advisory Committee launched the Southwest Florida Vegetable Research Investment Fund in June 2000. Now in it's third year, over 45 growers and industry partners have joined together and contributed more than $85,000 to fund vegetable research in southwest Florida.

To date, the fund has successfully funded eleven projects in three priority areas: methyl bromide alternatives, water management and conservation and Integrated Pest Management. The majority of this research has been conducted on growers' farms. Examples of research that has been funded over the past few years includes:

- Field Demonstration Studies of Fumigant Alternatives for Double Crop Nematode Control and Comparisons of Sampling Techniques – J.W. Noling, J.P. Gilreath, and G. McAvoy,
- Evaluating Insecticidal Rotations for Optimizing Control of Pepper Weevil – D.J. Schuster, P.A. Stansly and J. Conner,
- Irrigation Scheduling Using Real Time Soil Water Data for Vegetable Production in SW Florida – S. Shukla, T. Obreza, C. Vavrina, E. Simonne, and G. McAvoy
- Soil Based Phosphorus Rates for Vegetable Production – T. Obreza and G. McAvoy, and
- Tomato Row Middle Weed Control – W.M. Stall and G. McAvoy.

Generous in-kind contributions by cooperating growers has allowed the fund to greatly leverage it's research dollars producing results that would have cost far more in a traditional research setting. The novel approach taken by the fund to ensure the continuation of practical vegetable research needed to keep growers competitive in the global market place has also lead to a renewed and closer relationship between researchers and producers.

Members have been enthusiastic about the fund's progress. A. J. Nychyk of Nychyk Brothers Farm commented "the research fund marks the first time that vegetable growers have come together to attack common problems affecting all growers." Chuck Obern of C&B Farm observed, "Grower directed research ensures that growers will receive a final product that is practical in nature and meets the industries needs." In essence, the fund is a strategic partnership of growers and others in the vegetable industry that came together to pool their resources to address research needs of common concern.

The SW Florida Vegetable Research Investment Fund is managed by the contributor-members who prioritize and fund research projects through a democratically elected advisory committee. Membership is based on contributions of one dollar per cropped acre per year or flat fee for industry partners. Contributors hold the purse strings and are free to choose from public or private research groups and hold researchers accountable for performance. To ensure transparency and application of proper accounting of member contributions, all funds are held in an escrow account maintained by the Florida Fruit and Vegetable Association Education Foundation on behalf of the SW Florida Vegetable Research Investment Fund. Association with FFVA also ensures that contributions are tax-deductible.

In addition to helping to meet the research needs of Southwest Florida vegetable producers, the fund is also fostering a new spirit of cooperation and communication between growers and researchers as well as increasing the exposure of UF/IFAS within the local agricultural community.

The formula that has made the Southwest Florida Research Investment Fund a success is a testimony to the extension model. Listen to clients, identify their perceived needs and wants, provide a product that meets their needs and evaluate the results.

The process of change is certain and will continue to proceed even faster. Challenges will continue to confront the vegetable industry. Foreign competition is here to stay and will undoubtedly increase. Southwest Florida vegetable growers and their industry partners realize that they will never be able to compete on the basis of cheap land or labor but must maintain their competitive edge through technological advances based on sound research.

Hopefully establishment of the Southwest Florida Vegetable Research Investment Fund will help ensure that the vegetable industry will continue to contribute more than 10,000 jobs and $300 million dollars per year to the regional economy of Southwest Florida.

(Gene McAvoy, Ext. Agt. II, Hendry Co. - Vegetarian 03-02)

UPDATE AND OUTLOOK FOR 2003 OF FLORIDA'S BMP PROGRAM FOR VEGETABLE CROPS

Increased environmental concerns supported by reports of high NO_3-N and P levels in some springs and streams in Florida, have resulted in the passage of the Surface Water Improvement and Management (SWIM) Act of 1987. Together with the Federal Clean Water Quality Act of 1977, the SWIM Act created a program that focused on preservation and/or restoration of the state's water bodies through the development and implementation of Best Management Practices (BMPs). BMPs are cultural practices that should increase or maintain yields while being environmentally robust, economically feasible, and based on science and best professional judgment. BMPs are based on IFAS research results, and therefore, follow IFAS recommendations (Maynard and Olson, 2001). Florida growers, faced with the new BMP program, legitimately requested reliable data documenting the impact of current production practices on water quality. Much of this research has been completed as outlined in Table 1.

In this context, the goal of our multi-disciplinary research and extension program is to (1) actively participate in the development of the BMP manual, (2) develop research-based information supporting the efficacy of fertilization and irrigation BMPs, and (3) provide vegetable growers with recommendations and educational programs that help them comply with the new legislation. This paper outlines the current status of the BMP manual for vegetables, describes several research projects on the testing of possible BMPs for vegetable crops, and discusses challenges and opportunities for the implementation and adoption of the BMP program in Florida.

The BMP Manual for Vegetables Grown in Florida

The *'Agronomic and Vegetable Crops BMP Manual for Florida'* will describe BMPs for the 142,000 ha, $1.4 billion vegetable industry in Florida (Witzig and Pugh, 2001). The seven sections of the manual are 'Pesticide management', 'Conservation practices and buffer', 'Sediment control', 'Irrigation and nutrient management', 'Water resources', 'Seasonal and temporary farming operations', and 'Record keeping and accountability'. Each section is divided into specific BMPs. Each BMP description is 2 to 3 pages long, consisting of a title, pictures, working definition, set of 'things to do' (BMPs), 'things to avoid' (potential pitfalls), supplemental technical criteria, and references (Table 1 and Table 2).

In a competitive marketplace where only the most efficient producers remain in business, the cost of implementing BMPs is of great concern to the grower community. Thus, several cost-share programs are available to partially reimburse the cost of BMP implementation. These programs are administered by USDA's Farm Agency Service (the Conservation Reserve Program, and the Conservation Reserve Enhancement Program), the Natural Resources Conservation Service (the Environmental Quality Incentive Program, Emergency Conservation Program, Small Watershed Program, Stewardship Incentive Program, Wetlands Reserve Programs, Wildlife Incentives Program), or by state or local agencies (Tri-county Agricultural Area – Water Quality Cost Share Program –see Livingston-Way, 2000; the Indian River Citrus Area – Water Quality Protection Program, Alternate Water Supply Construction Cost-Share Program, the Suwannee River Partnership).

Current Research Projects With Drip Irrigation

While extensive, recommendations for vegetable production are readily available (Maynard and Olson, 2001), the documentation of the environmental impact of these recommendations is still incomplete (Table 3). As illustrated in the following research projects, several strategies are under investigation to reduce the risk of N leaching.

In a project entitled 'Field testing of possible BMPs for watermelon' conducted at the North Florida Research and Education Center – Suwannee Valley (NFREC-SV), spring watermelons were grown between 1998 and 2002 following current IFAS fertilization and irrigation recommendations (Maynard and Olson, 2001). Nitrate levels in the soil water at the 1.6-m and 7-m depth were monitored every three weeks with suction-cup lysimeters and wells. Watermelon marketable yield ranged between 43,680 and 72,280 kg/ha, which was comparable to current commercial yields (Witzig and Pugh, 2001). Nitrate-nitrogen concentration in the lysimeters ranged from 20 to 150 mg/L NO_3-N except when cover crops were grown between vegetable crops. Under cover crops, nitrate concentration in the lysimeter samples ranged between 5 and 20 mg/L NO_3-N. Nitrate concentration in the monitoring well samples was always below 20 mg/L NO_3-N. It was concluded that economical yields of watermelon may be produced with current fertilizer and irrigation recommendations. However, it was not possible to maintain NO_3-N levels in the soil water or the shallow groundwater below the EPA drinking water standard, when current production recommendations were followed.

The relevance of using the EPA drinking water standard (10 mg/L NO_3-N; USEPA, 1994) as the threshold for discharge monitoring has been questioned because the fate of nitrate below the root zone is unknown, and water just below the root zone of vegetables is typically not used for potable water supply. Monitoring water below the root zone does account for dilution of nitrate in the root zone. However, this concentration has been selected because no alternative threshold exists for shallow water.

Because NO_3-N moves with the water front, optimizing irrigation management may reduce nitrate leaching. Scheduling drip irrigation is the topic of an on-going project (2000-2003) at NFREC-SV. The goal of this project is to develop specific guidelines for drip irrigation scheduling of bell pepper using real-time weather data. In one experiment, bell pepper (*Capsicum annuum*) was grown with plasticulture under factorial combinations of three N (75%, 100% and 125% of the recommended 224 kg N/ha rate) and four irrigation rates (33%, 66%, 100%, and 133% of I-3, the reference rate). Varying drip tape and fertilizer injector numbers created factorial combinations of N and irrigation rates. For I-3, daily drip irrigation was based on class A pan evaporation and a crop factor ranging between 0.20 and 1.00 depending on crop growth stage. Total seasonal irrigation was 74,687 L/100 m of bed for I-3. Soil water tension decreased with increasing water amounts and remained under 20 kPa with the 66% I-3 rate in the top 30-cm soil zone. Bell pepper yields were significantly affected by N and irrigation rates (all $p<0.01$). Fancy yield was significantly greater with 125% than with 100% N rate. Fancy and marketable yields responses to water rates were both quadratic ($p<0.01$) and maxima occurred at 97% and 94% of I-3, respectively. A combination of 280 kg/ha of N and 95% I-3 resulted in highest bell pepper yields grown with plasticulture (Simonne et al., 2001).

In another experiment conducted at NFREC-SV, three levels of sensor-based, high-frequency irrigation treatments and four levels of twice-daily irrigation treatments were applied to bell pepper. The two highest sensor based irrigation treatments resulted in yields similar to the two highest daily irrigation treatments (marketable yields ranged between 17,000 and 20,000 kg/ha for these treatments), but used approximately 50% less seasonal irrigation water. This resulted in irrigation water use efficiencies of 1209-2316 kg/ha/m^3 for the sensor- based treatments while daily treatments ranged from 703 to 1612 kg/ha/m^3. Sensor based irrigation treatments resulted in significantly higher soil volumetric moisture levels at the 15 and 30 cm depths. These results indicate that high frequency irrigation events can maintain crop yields while reducing irrigation water requirements.

Another possible strategy to reduce the risk of nutrient leaching in Florida sandy soils is to increase soil water holding capacity (SWHC) by using inorganic amendments such as Phyllipsite-type zeolyte (Agriboost, ASI Specialties, Washington, DC). Its alumino-silicate arrangement creates an open, three dimensional, cage-like structure which can absorb and retain cations. Because of their high specific surface, zeolites are able to absorb up to 30% of their dry weight in gases such as nitrogen and ammonia, over 70% of water, and up to 90% of certain hydrocarbons. Phillipsite is one of the zeolites with high CEC and water retention capability of potential application in plant production (Dwairi, 1998). Blends (w:w) of air-dried USGA-approved sand and Agriboost were made at rates of 100:0, 92:8, 88:12, 75:25, 70:30, 60:40, 50:50, and 0:100. The SWHC of the 100:0 and 0:100 mixes (sand alone and Agriboost alone) were 26% and 31%, respectively. The addition of Agriboost linearly increased the SWHC of the USGA sand. However, in this test, the magnitude of the increase was practical at rates exceeding common rates used for soil amendments (few tons per hectare). Depending on pricing strategy, the use of this type of amendment may be limited to high value areas such as golf courses and up-scale landscapes.

Current Research Projects With Seepage Irrigation

Bare-ground culture with seepage irrigation is another production system used in Florida for many crops including potato *(Solanum tuberosum)*. With seepage irrigation, the height of a perched water table is controlled by the flow of water into irrigation ditches spaced between planting beds. Two cultural practices are under investigation to reduce the potential for NO_3-N movement into the perched water table. The first is the use of legumes planted as both summer cover crops and fall cash crops to supply N to the following winter-spring potato crop. With legumes in rotation, growers may be able to supply potato plants with high N rates while meeting the BMP rate for inorganic N. The treatments are cowpea (*Vigna unguiculata*), sorghum/sudan grass hybrid, or no summer cover crop in combination with fall planted green bean (*Phaseolus vulgaris*). Potatoes were planted in all plots following beans and fertilized at four nitrogen rates (0, 112, 168, 224, 280 kg/ha). The summer and fall legume crops add approximately 55 kg/ha of N to the system. We found that growers may reduce the inorganic N rate well below the 224 kg N/ha BMP rate and still maintain historic yields.

The second alternative production system is the use of controlled release fertilizers to replace all or part of the N required for production. Research to identify a CRF program that releases N at a rate and concentration that matches potato plant need during the season is ongoing. However, initial experiments have shown that total applied nitrogen can be reduced by 45% using some CRF sources compared to the BMP recommendations without impacting yield (Hutchinson and Simonne, 2002).

Extension Educational Efforts

Specific educational programs cannot be implemented until the final approval of the BMP manual. Yet, state, county and commodity meetings are increasing the importance of water and regulatory issues. The Florida Drip Irrigation School is a day-long program that focuses on fertilizer, water and chemical management in plasticulture (Simonne et al., 2002). Education, communication, patience, and economical feasibility will be keys to the successful implementation of this BMP program in Florida.

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Simonne, E., D. Studstill, R. Hochmuth, T. Olczyk, M. Dukes, R. Munoz-Carpena, and Y. Li. 2002. Drip Irrigation: The BMP era. Citrus & Vegetable Mag., Oct. pp.6-18.
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Table 1. Proposed sections in the 'Agronomic and Vegetable Crops BMP manual for Florida' and corresponding BMPs.

General Area/Area of Application	BMP Area
Pesticide management / Farm level	Integrated pest management, Precision agriculture, Pesticide record keeping Personal protective equipment, Pesticide storage, Spill management, Pesticide application equipment washwater and container management, Pesticide equipment calibration Pesticide mixing and loading activities
Conservation practices and buffer/watershed and farm level	Field border, Riparian buffers, Wellhead protection, Wetlands protection, Windbreak
Sediment control/Watershed and farm level	Access road, Bed preparation, Conservation tillage, Contour farming, Critical area planting Ditch construction and maintenance, Filter strip, Sediment basin, Grade stabilization structures, Land leveling, Grassed waterway
Irrigation and nutrient management/ Field level	Soil survey, Soil testing/soil pH, Micronutrients, Proper use of organic fertilizer materials, Linear bed foot system for fertilizer application, Chemigation/fertigation, Controlled-release fertilizers, Optimum fertilizer management, Supplemental fertilizer application, Irrigation scheduling, Irrigation system maintenance and evaluation, water supply, Frost and freeze protection, Tail water recovery systems, Tail water reuse and waterborne pathogens, Tissue testing, Double cropping, Cover crops, Conservation crop rotation
Water resources/farm level	Farm pond, Flood protection, Pipelines, Springs protection, Water control structure, Water table observation well
Other	Seasonal and temporary farming operations
Record keeping and accountability	Fertilizer record keeping, Rainfall/irrigation record keeping, Inventory of on-farm pesticide storage, Pesticide applicator's record keeping, Worker protection training log

Table 2. Type of action and expected type of impact on water quality for fertilization and irrigation practices targeted by the BMPs.

Fertilization and irrigation proposed BMP	Relative level of supporting research data	Expected impact on water quality	Type of action on nutrients
Soil survey	Complete for Florida	Remote	Increase overall farming efficiency
Soil testing and soil pH	Complete	Indirect	Provides basis for adequate nutrient applications
Micronutrient	Complete	Indirect	Apply adequate amounts and form
Proper use of organic fertilizer materials	Extensive	Indirect	Supply some nutrients; increase soil water holding capacity
Linear bed foot system for fertilizer application	Complete	Indirect	Make adequate fertilizer calculation for plasticulture
Chemigation/fertigation	Complete	Indirect	Increase overall farming efficiency; supply adequate fertilizer amounts in the bed
Controlled-release fertilizer	Very limited	Direct	Supply adequate fertilizer

			amounts; reduce leaching risk
Optimum fertilization management	Complete	Direct	Supply adequate fertilizer amounts
Supplemental fertilizer application	Extensive	Indirect/Adverse	Replace leached fertilizer based on leaf or petiole results
Irrigation scheduling	Incomplete	Direct	Reduce leaching risk from irrigation water
Irrigation system maintenance and evaluation	Complete	Indirect	Increase overall farming efficiency; increase irrigation and fertilization uniformity
Water supply	Complete	Mostly indirect Direct	Define water quality parameters for proper irrigation management Use of back-flow prevention device
Frost and freeze protection	Needs updating	Direct	Reduce leaching risk from frost protection irrigation
Tail water recovery systems	Extensive	Indirect	Creates structures for recycling drainage water and run-off
Tail water reuse and waterborne pathogens	Incomplete	Direct	Recycling drainage water and run-off
Tissue testing	Extensive	Indirect	Monitoring tool for fine-tuning fertilization
Double cropping	Extensive	Mostly indirect	Increase cost-efficiency of production Traps residual fertilizer
Cover crops	Incomplete	Indirect	Traps residual fertilizer, adds nitrogen to the soil (legumes), increases soil organic matter content
Conservation crop rotation	Complete	Indirect	Management of air-borne and soil-borne pathogens

Table 3. Supporting research, expected impact on water quality and benefits of proposed BMPs.

Proposed Fertilization and Irrigation BMPs	Supporting Research in Florida	Expected Impact on Water Quality	Society, Grower, and Environmental Benefits
Soil survey	Complete	Remote	Increase overall farming efficiency
Soil testing and soil pH	Complete	Indirect	Provides basis for adequate nutrient applications
Micronutrient	Complete	Indirect	Apply adequate amounts and form
Proper use of organic fertilizer materials	Extensive	Indirect	Supply some nutrients; increase soil water holding capacity
Linear bed foot system for fertilizer application	Complete	Indirect	Make adequate fertilizer calculation for plasticulture
Chemigation/fertigation	Complete	Indirect	Increase overall farming efficiency; supply adequate fertilizer amounts in the bed
Controlled-release fertilizer	Very limited	Direct	Supply adequate fertilizer amounts; reduce leaching risk
Optimum fertilization management	Complete	Direct	Supply adequate fertilizer amounts
Supplemental fertilizer application	Extensive	Indirect/Adverse	Replace leached fertilizer based on leaf or petiole results
Irrigation scheduling	Incomplete	Direct	Reduce leaching risk from irrigation water
Irrigation system maintenance and evaluation	Complete	Indirect	Increase overall farming efficiency; increase irrigation and fertilization uniformity
Water supply	Complete	Mostly indirect	Define water quality parameters for proper irrigation management

		Direct	Use of back-flow prevention device
Frost and freeze protection	Needs updating	Direct	Reduce leaching risk from frost protection irrigation
Tail water recovery systems	Extensive	Indirect	Creates structures for recycling drainage water and run-off
Tail water reuse and waterborne pathogens	Incomplete	Direct	Recycling drainage water and run-off
Tissue testing	Extensive	Indirect	Monitoring tool for fine-tuning fertilization
Double cropping	Extensive	Mostly indirect	Increase cost-efficiency of production Traps residual fertilizer
Cover crops	Incomplete	Indirect	Traps residual fertilizer, adds nitrogen to the soil (legumes), increases soil organic matter content
Conservation crop rotation	Complete	Indirect	Management of air-borne and soil-borne pathogens

(Simonne, Hutchinson, Michael Dukes, George Hochmuth, and Bob Hochmuth - Vegetarian 03-02)

PROLIFERATION ABILITY OF NUTSEDGES

I was asked by Mike Aerts, FFVA, to come up with some literature that documents the proliferation of nutsedges. This review was for a branch of EPA, in their review of the Methyl bromide petitions. Thank goodness for graduate student's literature reviews which I quickly pulled and scanned.

The results of review clearly indicates the need for growers to clean their equipment well when going from an area of nutsedge into a nutsedge free area. It also gives good credence to chemically fallowing fields with high nutsedge populations during the off season (summer). I thought many of you would be interested in some of the information in the review.

Purple Nutsedge

Purple nutsedge develops a pronounced rhizome system and perenniates by sexual propagation through tuber production. Purple nutsedge tubers contain at least six buds, which normally sprout between 10 to 40° C. Rhizomes can grow nearly 30 cm horizontally. When rhizomes have produced 6-8 nodes, their tips thicken and differentiate into new shoots or new tubers. Shoots and tubers generate more rhizomes, the process being repeated creating a system of rhizome-tuber-shoot chains.

Hauser (1962b) reported that tuber formation started 6 weeks after emergence and several tuber chains were visible 10 weeks after emergence of the first shoot. He determined that six weeks after sprouting, underground biomass comprised more than 50% of the total dry weight of purple nutsedge plants, and that 20 weeks after shoot emergence, 6 to 12 tons of subterranean biomass per ha were produced. In a separate study, Hauser (1962a) reported that purple nutsedge tubers planted 90 cm apart, yielded 11 million tubers and basal bulbs and 7.7 million shoots per ha in one season. In Israel, a single tuber planted in the field infested the soil to a radius of 90 cm in 90 days and continued invading the field at a rate of 2.8 m^2 per month, producing 10 million tubers per ha in 2 seasons (Horowitz, 1972).

Studies conducted in Florida showed that one tuber can produce 6 to 10 new tubers in 40 days. (Morales-Rayon et al, 1995). Studies in mulched tomato production showed that with an initial viable tuber density of 25/m^2, a nutsedge infestation of 400 tubers were found 13 weeks later at final harvest (Morales-Payan, 1999).

Yellow Nutsedge

Yellow nutsedge reproduces sexually and asexually. Although the significance of seed production is questioned, Hill et al (1963) showed that one yellow nutsedge seedling developed into a stand that produced over 90,000 seeds with an average germination of 46%. The vigor of seedlings has been reported to be less than that of tuber sprouts (Bell, et al., 1962). Asexual reproduction appears to be predominant, and the production of tubers is prolific. Yellow nutsedge tubers are produced at the end of rhizomes. The rhizomes of yellow nutsedge may grow 60 cm horizontally and produce 30 internodes before the apex differentiates, developing either a basal bulb or a tuber. As in purple nutsedge, a complex network of subterranean structures (rhizomes, roots and tubers) is formed by yellow nutsedges. However, yellow nutsedge tubers develop only at the end of rhizomes; without forming rhizome-tuber chains such as those formed in purple nutsedge.

One yellow nutsedge plant is able to produce several thousand tubers in one season. One tuber planted in a field in Minnesota produced 36 plants and 332 tubers in 16 weeks (Tumbleson and Kommendahl, 1961), while in Georgia, one tuber gave origin to 622 tubers in 17 weeks (Hauser, 1968). In one year a single tuber planted in a field produced, 1,900 plants and 7,000 tubers (Tumbleson and Kommendahl, 1962). In studies of yellow nutsedge infesting mulched tomato production in Florida, 1500 nutsedge plants/meter were found 12 weeks after an initial nutsedge count of 50 plants/meter (Morales-Payan, 1999).

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(Stall - Vegetarian 03-02)

Extension Vegetable Crops Specialists

Daniel J. Cantliffe Professor and Chairman	**Ronald W. Rice** Assistant Professor, nutrition
John Duval Assistant Professor, strawberry	**Steven A. Sargent** Professor, postharvest
Chad Hutchinson Assistant Professor, vegetable production	**Eric Simonne** Assistant Professor, vegetable nutrition
Elizabeth M. Lamb Assistant Professor, production	**William M. Stall** Professor **and editor**, weed control
Yuncong Li Assistant Professor, soils	**James M. Stephens** (retired) Professor, vegetable gardening
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This page is maintained by Susie Futch.... if you have any questions or comments, contact me at zsf@mail.ifas.ufl.edu