Vegetarian Newsletter

A Horticultural Sciences Department Extension Publication on Vegetable Crops

Eat your Veggies!!!!!

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Evaluation of Strawberry Cultivars in Florida: 2007-09

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INTRODUCTION

Strawberry (*Fragaria* x *ananassa* Duch.) production in Florida is the second largest in the U.S. after California, with about 3360 hectares and gross sales over $330 million. Florida is the largest supplier of strawberries during the winter months in the U.S. and the majority of the strawberry production occurs in the west central part of the state. Strawberry yields in Florida have increased over the years due to the use of soil fumigation, raised beds with polyethylene mulch, defined fertilization practices, and planting pest-free stocks from northern nurseries. Some of the benefits of the annual hill system are improved weed control, high early yields and large fruit size, and ease of harvest. The west central Florida strawberry industry sets fresh transplants, with active crowns and intact and functional leaves during early October. Ripe fruit is harvested from mid-December until mid-March or later, if the market prices are favorable.

The goal of a successful breeding program is to develop cultivars to satisfy market and grower requirements. From the market point of view, among the most important strawberry fruit characteristics are uniform shape, size, firmness, flavor, color, and prolonged shelf life. On the other hand, growers are interested on having cultivars with disease resistance, high yields under different weather conditions, and acceptable yield earliness, which allow them to supply the market when premium prices are available. Planting different cultivars in the same farm is a common practice among strawberry growers in Florida. The purpose is to complement the production peaks of each cultivar in order to maintain a steady supply through the season, especially during the early part of the fruiting season.

There is current need for cultivars to complement the harvests peaks of 'Strawberry Festival', which is the most planted cultivar in Florida. However, the performance of the

strawberry cultivars need to be investigated in Florida to determine adaptability and performance among cultivars and advanced breeding lines. The objective of this study was to compare the performance of several strawberry cultivars in west central Florida.

MATERIALS AND METHODS

Two trials were conducted during the 2007-08 and 2008-09 strawberry seasons at the Gulf Coast Research and Education Center of the University of Florida, located in Balm, Florida. The soil at the experiment site is classified as a Myakka fine sand siliceous, hyperthermic, Oxyaquic Alorthod. The organic matter content and the soil pH of the experiment site were 1.5% and 7.3, respectively, and were measure 4 weeks before transplanting. Planting beds were pre-formed with a standard bedder, 69 cm wide at the base, 61 cm wide on the top, and 25 cm high, and spaced 1.22 m apart on centers. The soil was fumigated with 398 kg/ha of methyl bromide + chloropicrin (67/33 v/v). Simultaneously, beds were covered with black high-density polyethylene mulch (0.04 mm-thick). No preplant fertilizer was used. Fertilization and pest control were done according the requirements of the crop. Fertigation was applied through a single-drip tape line (237 L/ha per min) buried between 2 and 5 cm deep, and the experimental area was equipped with 15 L/min sprinklers for frost protection and crop establishment.

During the 2007-08 season, the cultivars tested were ‘Winter Dawn’, ‘Florida Elyana’, ‘Florida Radiance’, ‘Strawberry Festival’, ‘Treasure’, and ‘Camarosa’, whereas in the 2008-09 season, ‘Winter Dawn’, ‘Florida Elyana’, ‘Florida Radiance’, ‘Strawberry Festival’, ‘Treasure’, ‘FL 05-73’, and ‘FL 05-107’ were planted. The experimental design was a randomized complete block design with 4 replications. Bare-root strawberry transplants from certified nurseries in Nova Scotia, Canada were planted in 15 Oct. 2007 in double rows 38 cm apart, 20 plants per 7.6 m plot. Sprinkler irrigation was used 8 h/day for 10 days to ensure plant establishment.

Strawberry marketable fruit weight and number were collected two times per week, beginning on mid-December of each season and using every plant of each plot. A marketable fruit was defined as a fruit without visible blemishes and with at least 75% of red skin. Early yield consisted on the cumulative yield from the first six harvests, whereas the total yield included the twenty-four harvests through the season. The weight per fruit was determining by dividing the fruit weights by the fruit numbers of the early and total yields. Cultivar means were compared with a Fisher’s protected least significance difference (LSD) test at the 5% significance level.

RESULTS AND DISCUSSION

2007-08 Season

There were significant effects of cultivars on the fruit number, fruit weight, and weight per fruit during the 2007-08 and 2008-09 seasons. During the first season, the highest early fruit number was found in plots planted with ‘Strawberry Festival’ with 243,900 fruit per ha, whereas there were no early fruit number differences among ‘Treasure’, ‘Winter Dawn’, ‘Florida Elyana’,

and ‘Camarosa’, ranging between 125,800 and 166,100 fruit per ha (Table 1). However, there were no significant differences among plots planted with ‘Strawberry Festival’, ‘Treasure’, and ‘Winter Dawn’ in the total fruit number during the season, while the lowest number was found in the ‘Camarosa’ plots.

Early fruit weight was the highest in plots planted with ‘Strawberry Festival’ and ‘Treasure’, ranging between 3.3 and 3.5 t/ha (Table 1). Other cultivars produced early fruit weights between 1.9 and 2.4 t/ha. There were no differences in early fruit weight among the remaining cultivars. Plots planted with ‘Strawberry Festival’, ‘Treasure’, and ‘Florida Radiance’ did not differ in total fruit weight, with yields above 12 t/ha. The lowest total fruit weights were found with ‘Camarosa’ and ‘Florida Elyana’. The heaviest fruit were obtained in plots planted with ‘Treasure’ during the early harvests, averaging 19.7 g per fruit, followed by ‘Florida Elyana’, ‘Florida Radiance’ and ‘Camarosa’, whose fruit ranged between 16.5 and 17.4 g. The smallest fruit were produced by ‘Strawberry Festival’ and ‘Winter Dawn’. Fruit size changed as the planting season progressed, as shown by the season-total weights per fruit. There were no significant differences in the weights per fruit of five out of six cultivars, ranging between 18.4 and 22.3 g per fruit (Table 1).

Table 1. Comparison of fruit number, yield and weight per fruit of different strawberry cultivars, 2007-08 season, Balm, Florida, USA.

Cultivar	Fruit number		Fruit weight		Weight per fruit	
	Early[a]	Total	Early	Total	Early	Total
	no. x 10^3/ha		t/ha		g	
Strawberry Festival	243.9 a	820.6 a	3.5 a	12.7 ab	14.3 c	15.5 b
Treasure	166.1 b	730.7 ab	3.3 a	15.0 a	19.7 a	20.5 a
Winter Dawn	125.8 bc	647.4 ab	1.9 b	11.9 b	15.3 c	18.4 ab
Florida Elyana	137.2 bc	567.4 b	2.4 b	11.5 bc	17.4 b	20.3 a
Florida Radiance	113.8 c	600.0 b	1.9 b	12.2 ab	16.5 b	20.3 a
Camarosa	134.5 bc	399.1 c	2.3 b	8.9 c	16.8 b	22.3 a
Significance ($P<0.05$)	*	*	*	*	*	*

[a]Values followed by the same letter do not significantly differ at the 5% level according to Fisher’s protected LSD test.

2008-09 Season

Plots transplanted with ‘Strawberry Festival’ and ‘Winter Dawn’ resulted in the highest early fruit number, with values of 183,600 and 184,900 fruit per ha, respectively. The lowest early fruit weights were obtained with the advanced line ‘FL 05-107’, and with ‘Florida Elyana’ and ‘Florida Radiance’ (Table 2). However, the advanced line ‘FL 05-107’ produced the highest total fruit number along with ‘Strawberry Festival’, both exceeding 710,000 fruit per ha. In contrast, ‘Winter Dawn’ and ‘Florida Elyana’ had the lowest values for this variable with less than 400,000 fruit per ha.

‘Strawberry Festival’ and ‘Winter Dawn’ produced the highest early fruit weight among all the cultivars, with 3.9 and 3.7 t/ha, respectively (Table 2). There were no significant differences on early fruit weights among the remaining cultivars, which ranged between 2.2 and 2.8 t/ha. Plots planted with the advanced line ‘FL 05-107’ provided the highest total fruit weights during this season (21.3 t/ha), followed by ‘Strawberry Festival’, ‘Treasure’, and ‘Florida Radiance’, which produced between 13.0 and 15.4 t/ha. The lowest total fruit weight was obtained in plots planted with ‘Winter Dawn’. ‘Florida Radiance’, ‘Florida Elyana’, and the advanced line ‘FL 05-107’ produced the heaviest early and total weights per fruit during the season, ranging between 26.3 to 32.7 g per fruit (Table 2). In most cases, there were no significant differences on early weight per fruit among the remaining cultivars. ‘Strawberry Festival’, ‘Treasure’, and ‘Winter Dawn’ had weight per fruit between 19.8 and 24.2 g.

Table 2. Comparison of fruit number, yield and weight per fruit of different strawberry cultivars, 2008-09 season, Balm, Florida, USA.

Cultivar	Fruit number		Fruit weight		Weight per fruit	
	Early[a]	Total	Early	Total	Early	Total
	no. x 10^3/ha		t/ha		g	
Strawberry Festival	183.6 a	710.6 a	3.9 a	15.4 b	21.2 b	21.7 b
Treasure	121.2 bc	537.4 b	2.7 b	13.0 bc	22.3 b	24.2 b
Winter Dawn	184.9 a	388.1 c	3.7 a	7.7 d	20.0 b	19.8 bc
Florida Elyana	67.6 d	323.8 c	2.2 b	10.6 c	32.5 a	32.7 a
Florida Radiance	86.6 cd	510.4 b	2.8 b	13.4 bc	32.3 a	26.3 ab
FL 05-73	130.8 b	592.0 b	2.6 b	11.0 c	19.9 b	18.6 c
FL 05-107	69.9 d	787.0 a	2.2 b	21.3 a	31.5 a	27.1 a
Significance (P<0.05)	*	*	*	*	*	*

[a]Values followed by the same letter do not significantly differ at the 5% level according to Fisher’s protected LSD test.

During both growing seasons, ‘Strawberry Festival’ consistently produced the highest early and total fruit numbers among all tested cultivars. Similarly, the same cultivar had the highest early fruit weight. With regards to total fruit weight, ‘Florida Radiance’, ‘Treasure’ and ‘Strawberry Festival’ resulted in the highest values among all cultivars tested during both seasons. The advanced line ‘FL 05-107’ seemed to be a promising germplasm that produced the highest fruit weight in the 2008-09 season, but more testing is needed to confirm that result. There was no consistency on specific cultivars producing the largest early fruit, while ‘Florida Radiance’ and ‘Florida Elyana’ had the largest total weight per fruit during both seasons.

These results indicated that ‘Strawberry Festival’ is an adequate choice as a main cultivar for production under Florida’s conditions, which could be complemented during low production periods with other promising and late producing cultivars, such as ‘Florida Radiance’ and ‘Treasure’. The performance of the advanced line ‘FL 05-107’ needs to be further investigated because of its elevated total fruit weight during the only season when it was tested.

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Attracting Beneficial Insects to Your Farm

By: Robert Hochmuth, Multi County Extension Agent
North Florida Research and Education Center – Suwannee Valley

Earlier this fall Carolyn Saft, Suwannee County Extension Agent and I were preparing to teach a workshop on "attracting beneficial insects to your farm". I wanted to collect samples of these insects for farmers to see and learn to identify. What happened next made a major impact on me! I searched several areas here on our farm at the North Florida Research and Education Center – Suwannee Valley. Most areas on the farm are kept clean and mowed and provided little hope for finding many beneficial insects. However, I found two small areas that were "gold mines" for discovering several species of "good bugs". The first site was a planting of both native and introduced landscape plants and flowers. The native flowering plants like butterfly weed, frost weed, Rudbeckia, salvia (tropical sage), and swamp sunflower all had lots of good bugs. In addition, a popular non-native, crepe myrtle, was also loaded with good bugs. The second good collection site was a fall watermelon planting used for insect research purposes. One of the research trial requirements was "no insecticide sprays" to allow the silverleaf whitefly to build natural populations so Dr. Susan Webb, UF/IFAS Entomology Specialist could observe their feeding patterns. Well, as you can imagine, the whitefly populations did very well. But also, other beneficials such as lacewing, lady beetles, and big eyed bugs were very easy to find.

So the impact on me was the realization that we could do a lot more to attract beneficial insects to our farm. Here are a few key points to consider when trying to attract beneficials (from "Habitats for Beneficial Insects", Cornell University, http://www.nysaes.cornell.edu/pp/resourceguide/appendix/appendix_b.php and "Natural Enemies and Biological Control", UF/IFAS, http://edis.ifas.ufl.edu/in120).

Any organism that feeds on another organism is a natural enemy. Insects that are natural enemies of pests are called beneficial insects. Other arthropods such as spiders and certain mites

also are beneficial. There are two main types of beneficial arthropods, predators and parasitoids. Predators, such as ladybugs and spiders, will attack several different kinds of insects, and will consume several types of prey throughout their life cycle. Parasitoids are wasps or flies that lay their eggs on or inside other arthropods; they are also called parasites. The egg hatches and the immature parasitoid feeds on the victim, called a host, eventually killing it. Each developing parasitoid kills only one host in the course of its life cycle, but parasitoids are more specific in the insects they attack than are predators.

Plant diversity in an agricultural setting generally adds stability to a system and helps encourage the presence of beneficial insects. There are different options for providing plant diversity depending on whether the main crops are annuals or perennials. Generally, crop diversity can be achieved over a period of time or in a area of a field using crop mixtures, crop rotations, border crops or windbreaks, or plants known to be attractive to beneficial insects. Landscape diversity will generally favor populations of beneficial insects while lack of diversity will generally increase insect pest outbreaks. Adding plant complexity to a system can be achieved by providing sites which beneficial insects may use to obtain nectar or pollen, survive on alternative insect pest species, find habitats in which to increase their numbers and/or as sites in which to overwinter.

Flowering plants may provide nectar that can increase the life span of a beneficial species and number of eggs it can produce. Such flowering plants can be used as part of the farm's saleable crops as well as provide needed landscape diversification. In choosing which plants to use to add diversity, a good rule of thumb would be to avoid plants in the same family as the cash crop being grown since they may also serve as hosts for insects and diseases. Weeds may also play a significant role in adding plant diversity. Flowering weeds in the families Compositae (daisy), Labiatae (mint), and Umbelliferae (dill, Queen Anne's Lace) are often cited in the literature as being able to support stable populations of natural enemies. Multiple blooming sunflower varieties are also excellent for attracting beneficial insects.

We are in the process of developing a plan here at the North Florida Research and Education Center – Suwannee Valley farm to incorporate some of these practices to encourage more beneficial insects in the future and use the farm to teach others these valuable IPM principles.

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Using solid oxygen fertilizers to alleviate flooding problems in vegetable production

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Flooding affects crop production

Vegetable plants uptake oxygen from the soil matrix. Under flooding conditions, plants may not have enough oxygen to survive. Flooding has been a problem in Florida. Agriculture losses from flooding as a result of the hurricane Irene in 1999 and a storm (13.9 in) in 2000 were estimated at $77 and $13 million, respectively, in Miami-Dade County with nearly 19,000 acres of crop damage.

Slow-release oxygen fertilizers

Slow-release oxygen fertilizers are eco-friendly compound fertilizers. They are insoluble and inert if there is no water in the soil. In waterlogged or flooded soils, slow-release oxygen fertilizer will gradually release oxygen for up to 6 months. Meanwhile, they also provide calcium and/or magnesium nutrients.

Application of oxygen fertilizer

Application of slow-release solid oxygen fertilizers (e.g., magnesium peroxide plus additives) can effectively increase oxygen bioavailability in flooded soils, alleviate the problem, and reduce or exclude economic loss in vegetable production suffering from flooding. Application methods include before and after planting or sowing. The method before planting can save labor but the

fertilizers may be wasted if there is no flooding. The other method requires more labor input because manipulation in crop plants is time consuming but this method may save the fertilizers if there is not a flooding problem during the growing season. We recommend applying the fertilizers before planting or sowing for vegetable production.

Exemplification

We grew traditional Italian basil (cv. Genovese OG) in 6 inch-pots with ProMix growth medium with (treatment) or without (the control) 1 g slow-release solid oxygen fertilizer incorporated into the growth medium. The plants were not flooded or flooded for five days after they were all 20 cm tall. Their chlorophyll contents were determined using SPAD 502 Chlorophyll Meter (Konica Minolta Holdings, Inc., Ramsey, New Jersey). The biomass was also measured after the five-day flooding. The results showed that the chlorophyll contents and biomass of the flooded plant with oxygen fertilization were both significantly greater than those of the control (Figure 1, 2 and 3).

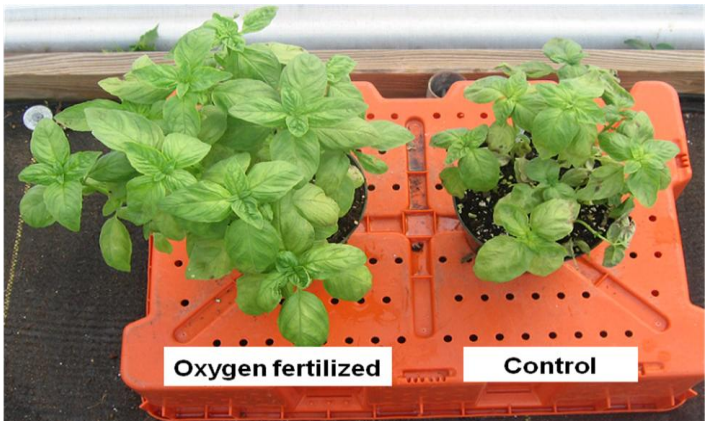

Figure 1. The difference in growth of flooded basil plants with or without oxygen fertilization.

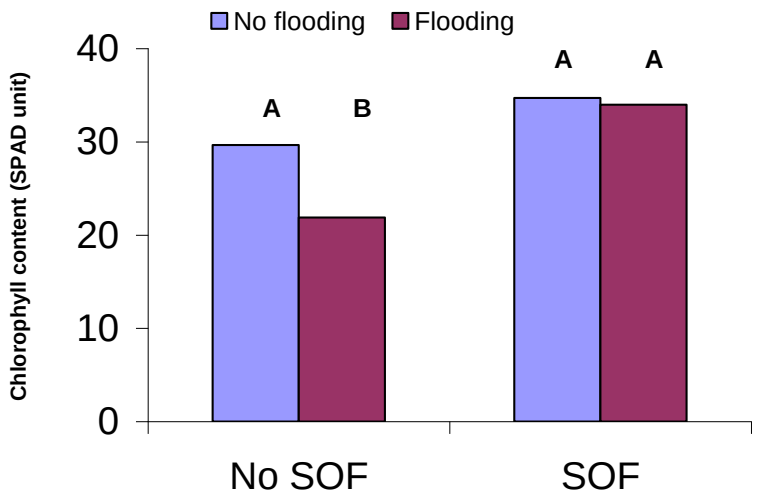

Figure 2. The chlorophyll contents of the basil plants without flooding were significantly ($p<0.05$) greater than those with flooding but without oxygen fertilization. There was, however, no difference in the chlorophyll contents of the plants without flooding and those with flooding but also with oxygen fertilization.

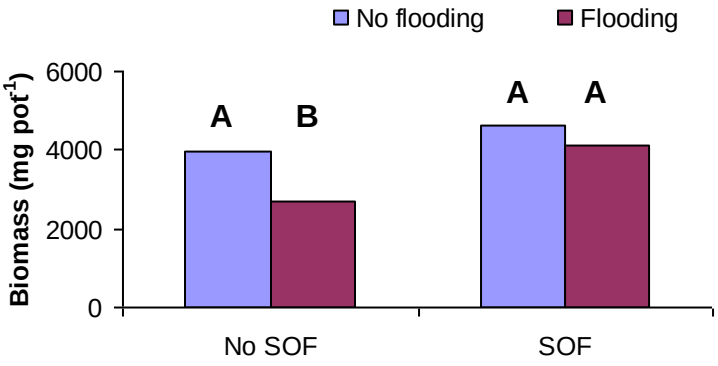

Figure 3. Biomass of the basil plants without flooding were significantly ($p<0.05$) greater than those with flooding but without oxygen fertilization. There was, however, no difference in the biomass of the plants without flooding and those with flooding but also with oxygen fertilization.

Summary and Conclusions

Slow release oxygen fertilizers are eco-friendly and affordable. They significantly increased oxygen bioavailability in the flooded soil grown basil. Therefore, they significantly alleviated reduction of chlorophyll contents and biomass of flooded basil plants and hence reduced economic loss caused by flooding. Oxygen fertilization is promising to become a new approach to minimize the negative impact of flooding on vegetable production in Florida.

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Biography: Monica Ozores-Hampton, UF/IFAS, Vegetable Specialist

By: Monica Ozores Hampton, Assistant Professor
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Since 1998, Dr. Ozores-Hampton has been a post-doctoral fellow at the Southwest Florida Research Center, initially working to develop non-chemical alternatives to Methyl Bromide and most recently evaluating the effects of nitrogen fertilization on tomatoes under commercial growing conditions. She received her bachelor's degree in horticulture from the Universidad Catolica de Chile, her master's degree in biological science from Florida International University, and her Ph.D. in horticulture from the University of Florida.

As vegetable specialist, Dr. Ozores-Hampton provides statewide leadership and science-based research and extension education programs on critical issues facing the vegetable industry in Florida. Her focus areas include plant nutrition and fertilizer use efficiency to demonstrate updated nitrogen recommended rates and facilitate the adoption of nutrient best management practices by the vegetable industry. Additionally, she conducts Tomato Yellow Leaf Curl Virus and pepper variety evaluation.

Dr. Ozores-Hampton's twelve-month, tenure-accruing position is a split appointment between extension (60 percent) and research (40 percent). Her primary clientele groups are county extension agents, commodity groups, regulatory agencies, and vegetable growers. She is a member of the American Society for Horticultural Science, the Florida State Horticultural Society, and the United States Composting Council.

Dr. Ozores-Hampton's office is located at the Southwest Florida Research and Education Center, Immokalee, Florida. She can be reached at (239) 658-3400 or by e-mail at ozores@ufl.edu.