



IFAS EXTENSION

## Extension Programs in Northeastern Florida Help Growers Produce Quality Strawberries by Improving Water and Nutrient Management<sup>1</sup>

Robert Hochmuth, David Dinkins, Michael Sweat, and Eric Simonne<sup>2</sup>

The Florida strawberry industry is primarily located in the Plant City area with approximately 6,000 acres. There is scattered acreage in other parts of the state including Bradford County and the surrounding area of northeastern Florida. The Bradford County area was once the main strawberry producing area in the state with 1500 acres of strawberries grown during the period of 1915 to 1920. This rich heritage is still important to Bradford County's economy today. Strawberry acreage in northeastern Florida (Gainesville and north) was estimated at 40 acres in 2003.

Growers in northern Florida have traditionally used plastic mulch culture with overhead irrigation and have depended upon pre-plant fertilization to supply nutrients for the growing season. With heavy rainfall or excessive irrigation, this practice is inefficient and has resulted in nutrient deficiencies at the end of the growing season in part due to nutrient leaching, especially nitrogen. Extension programs in this production area have emphasized teaching growers the benefits of using drip irrigation as a tool

for improved water and nutrient management (Figure 1).

On-farm Extension demonstrations throughout the 1990s provided opportunities for growers in the Suwannee Valley area and northeastern Florida to learn how to use drip irrigation for water and fertilizer delivery resulting in increased yield and quality. Drip irrigation is now used by over 95% of the growers in this region of northeastern Florida.



**Figure 1.** On-farm demonstration of strawberries grown on plastic mulch with drip irrigation.

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2. Robert Hochmuth, multi county extension agent, Suwannee Valley Research and Education Center, David Dinkins, county extension director, Michael Sweat, county extension director, Baker County Extension Service, Eric Simonne, professor, Horticultural Sciences Department, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611

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Drip irrigation systems on strawberry farms provide the opportunity to improve nutrient efficiency and reduce crop production costs. Petiole sap-testing programs (Table 1, Figure 2) provided by county Extension agents throughout Florida have taught growers the best nutrient management practices through this technology (Plant Petiole Sap-Testing Guide for Vegetable Crops, UF/IFAS Circular 1144, <http://edis.ifas.ufl.edu/CV004>). Information was collected during visits with north Florida strawberry growers during the spring fruiting seasons (Feb-May) from 1998-2003 to evaluate various fertilization programs being used (Strawberry Production in Florida, HS736, <http://edis.ifas.ufl.edu/CV134>). Potassium levels were within the ranges in 80% of the samples without drip fertilization, but were within the recommended ranges in 100% of the samples when UF/IFAS drip fertigation recommendations were used. This Extension effort revealed nitrogen management was much more difficult when drip fertigation was not used. The petiole sap tests indicated one pre-plant application of fertilizer was usually insufficient to meet the crop requirement for nitrogen, even when very high rates or some controlled-release nitrogen is used in the pre-plant application. In those crops where drip fertigation was not used, the nitrogen levels in the petiole sap dropped below recommended levels most years. Petiole sap nitrogen levels in March to April frequently fell below 100 ppm if drip fertigation was not used. In years with excessive rainfall, fields with no drip irrigation showed insufficient nitrogen sap levels 90% of the time.



**Figure 2.** Sap Testing Meter

As growers adopted drip irrigation and used recommended fertigation practices (Table 2),

nitrogen and potassium levels were maintained within the recommended ranges. During the spring harvest season of March-May, plants appeared healthy and vigorous when petiole sap nitrogen levels were 250-500 ppm. (Figure 3 and Figure 4) Plants with less than 200 ppm during that period appeared to have poor color and low vigor.



**Figure 3.** Healthy strawberry.



**Figure 4.** Strawberries grown on plastic mulch with drip irrigation.

The recommended rate of nitrogen (N) and potassium (K<sub>2</sub>O) for the main fruiting season is 0.75 lbs/A/day (Strawberry Production in Florida, HS736, <http://edis.ifas.ufl.edu/CV134>). Drip fertigation programs at the rate of 0.75 lbs/A/day of nitrogen and K<sub>2</sub>O were successful in maintaining excellent crop nutrient status. When once-a-week applications of the recommended rates were used, the growers were successful. The various fertilizer sources typically used and weekly amounts applied are shown in Table 3.

This overall Extension program effort has resulted in reductions of water use by 50% on 30 acres of strawberries adopting drip irrigation. In addition, improved fertilizer management programs are reducing fertilizer amounts by at least 20% through more efficient use. Fertigation programs are also improving crop yields and quality by maintaining proper nutrient levels for the duration of the harvest season.

**Table 1.** Sufficiency ranges for petiole sap testing for different growth stages of strawberry grown in northern Florida (from Strawberry Production Guide for Florida, HS736, <http://edis.ifas.ufl.edu/CV134>).

Crop Development Stage	Fresh Petiole Sap Concentration (ppm)	
	NO <sub>3</sub> -N	K
November, soon after planting	800-900	3000-3500
December, first harvest	600-800	3000-3500
January, main season	600-800	2500-3000
February, main season	300-500	2000-2500
March, main season	200-500	1800-2500
April, late harvest, near end of season	200-500	1500-2000

When petiole sap test falls below sufficiency rates, check irrigation program or increase fertigation by 20% for one week, and re-determine sap nutrient content.

**Table 2.** Daily nitrogen (N) and potassium (K<sub>2</sub>O) application rates (lbs/A/day) for strawberries grown in northern Florida with or without freeze protection.

Month	With Freeze Protection			Without Freeze Protection		
	Plant Status	N	K <sub>2</sub> O	Plant Status	N	K <sub>2</sub> O
October	planting (mid Oct)	0.4	0.4	planting (mid Oct)	0.4	0.4
November	vegetative	0.4	0.4	vegetative	0.4	0.4
December	fruit set	0.6	0.6	vegetative	0.4	0.4
January	1st picking	0.6	0.6	bloom	0.4	0.4
February	fruiting	0.75	0.75	fruit set	0.6	0.6
March	fruiting	0.75	0.75	fruiting	0.75	0.75
April	fruiting	0.75	0.75	fruiting	0.75	0.75
May	fruiting	0.75	0.75	fruiting	0.75	0.75
June	fruiting	•	• <sup>z</sup>	fruiting	0.75	0.75
Total for season		145	145		152	152

If 30 lbs per acre of each N and K<sub>2</sub>O are applied preplant, then injections during the first 4 weeks after planting may be omitted.  
 Adjust rates based on petiole sap test readings.  
 z Freeze protected strawberry plants seldom fruit in June.

**Table 3.** Optional strawberry fertigation programs used in northern Florida for the main fruiting season.

Recommended Fertilizer Rate (lbs/A/day)		Amounts of Fertilization Products Injected Once a Week per Acre <sup>z</sup>				
		Premix Option 1	Premix Option 2	Grower Mix Option 3 <sup>y</sup>		
N	K <sub>2</sub> O	Liquid 7-0-7	Liquid 8-0-8	Ammonium Nitrate	+	Potassium Nitrate
				34-0-0		13.5-0-46
0.4	0.4	4.0 gal	3.5 gal	6.0 lbs	+	6.1 lbs
0.6	0.6	6.0 gal	5.2 gal	8.8 lbs	+	9.1 lbs
0.75	0.75	7.5 gal	6.5 gal	11.0 lbs	+	11.4 lbs

<sup>z</sup> One acre for strawberry is equal to 10,890 linear feed of bed.  
<sup>y</sup> Growers would mix these ingredients on their own.