



## Performance of Lettuce (*Lactuca sativa*) Grown in Soilless Media in Vertical Hydroponics

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Florida growers use several types of hydroponic production systems to grow a wide variety of vegetables. One popular soilless media system in Florida is a vertical one of leafy greens such as lettuce (*Lactuca sativa*). The soilless media used in this system has traditionally been perlite and or coconut fiber, however, higher cost of these media has led to the need to research composted pine bark as an alternative medium choice. A research trial evaluating four soilless media materials or combinations was conducted at the Suwannee Valley Agricultural Extension Center near Live Oak, Florida in 2013 and 2014. ‘Tropicana’ lettuce was transplanted into VertiGro® pots for three crops, two in Spring 2013 and one in Spring 2014. The media treatments were: coconut fiber, composted pine bark, perlite plus coconut fiber on the top two inches, and composted pine bark plus coconut fiber on the top two inches. The yield and quality of lettuce at harvest was recorded with no significant differences among any of the four soilless media evaluated in two of the three plantings. However, during the first planting, coconut fiber produced the highest yield followed by composted pine bark plus coconut fiber. The lowest yields were found with perlite plus coconut fiber, and composted pine bark alone. These results suggest composted pine bark may be an acceptable media in a lettuce crop grown in a VertiGro® production system.

Interest in growing vegetables in greenhouses and other types of protected culture in Florida has greatly increased in Florida in the last few years. The popularity is largely due to the increased market demand for high quality, fresh, locally grown specialty crops. Leafy green vegetables, including lettuce, have become very popular at local markets such as local farmers markets. The increased demand for locally grown vegetables has created new opportunities for small and beginning farmers to establish a specialty crop enterprise. Growers are using protected culture, such as a greenhouse, high tunnel, or even open shade structures to extend the typical marketing season for outdoor field production. Lettuce is being grown in several types of hydroponic or soilless production systems including, nutrient film technique, open beds, lay-flat bags, upright bags, floating rafts, vertical soilless media containers, and vertical aeroponic systems (Fedunak and Tyson, 1997; Hochmuth et al., 2012; Tyson et al, 2013). One of the popular systems used in Florida is VertiGro®, a vertical system of polystyrene pots filled with soilless media.

Very little research has been done in Florida to evaluate the performance of leafy greens grown in various soilless media choices. Traditionally, vertical media-based systems have used perlite, coconut fiber or vermiculite, or a combination mixes of those materials as the media. However, these media have increased in price during the past few years and alternative materials have

been considered. In North Florida there is a large pine pulpwood industry and pine bark is a readily available byproduct of the pulpwood industry. Since pine bark can be composted and aged to make a suitable soilless media, this trial compared composted pine bark to traditionally used materials. The trial was conducted to evaluate the performance of four soilless media treatments in the production of ‘Tropicana’ lettuce in a VertiGro® system inside a high tunnel in North Florida.

### Materials and Methods

The trial was conducted in a 19 x 48 ft standalone unheated high tunnel with an open ridge vent and roll up sidewalls (VertiGro®, Summerfield, FL). The passive ventilation system included roll up sidewalls with polyethylene and an open ridge vent at the greenhouse peak. The greenhouse glazing was a single layer of clear polyethylene. The high tunnel and production system was provided to the University of Florida by VertiGro® in 2013 to support research and Extension activities at the Suwannee Valley Agricultural Extension Center, Live Oak, FL.

The media trial was conducted using individual 5-pot-high stacks of the VertiGro® production system. The system included automated nutrient solution delivery system. The pH was set at 5.8 and the EC was set at 1.8 millimhos. The nutrient solution provided approximately 120 ppm N, 50 ppm P, 200 ppm K, 48 ppm Mg, 220 ppm Ca, 60 ppm S, 3.5 ppm Fe, 0.3 ppm Cu, 1.3 ppm Mn, 0.3 ppm Zn, 0.7 ppm B, and 0.05 Mo (Hochmuth

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Table 1. Effect of soilless media type on marketable yield (lbs) of three crops of ‘Tropicana’ lettuce grown in VertiGro<sup>®</sup> towers in a high tunnel in North Florida in 2013–14<sup>z</sup>.

Soilless Media	Marketable Weight (lbs) per Tower of 20 Plants <sup>y</sup>		
	Crop 1	Crop 2	Crop 3
Pine bark	8.08 c	9.76	9.89
Coconut fiber	10.25 a	9.84	10.76
Pine bark and coconut fiber	9.24 b	9.51	10.14
Perlite and coconut fiber	7.61 c	10.30	10.19
Significance <sup>x</sup>	***	ns	ns

<sup>z</sup>Within columns, means followed by different letters are significantly different according to Duncan’s Multiple Range Test at  $P < 0.05$ .

<sup>y</sup>Harvest weights were measured from harvesting 20 plants per tower. Crop 1 was harvested on 25 March 2013, Crop 2 on 9 May 2013, and Crop 3 on 4 Apr. 2014.

<sup>x</sup> Significant at  $P < 0.001$ .

ns Nonsignificant.

and Hochmuth, 2008). The 220 ppm Ca is provided by the combination of calcium nitrate (150 ppm) and calcium in the well water (70 ppm). Irrigation scheduling during the season was set to provide 20% leaching at each irrigation event. The number and duration of the events increased as the crops grew, starting with two events per day at transplanting and increasing to six events per day at peak crop demand. All media treatments were irrigated using the same schedule. ‘Tropicana’ lettuce plants were produced in 200-cell Speedling (Sun City, FL) transplant trays filled with a standard germinating soilless mix and were grown for approximately four weeks at which time the transplants were placed into VertiGro<sup>®</sup> pots. This research trial included the production of three crops. The first crop (Crop 1) was transplanted on 21 Feb. 2013 and harvested on 25 Mar. 2013, the second crop (Crop 2) was transplanted on 21 Mar. 2013 and harvested on 9 May 2013, and the third crop (Crop 3) was transplanted on 1 Mar. 2014 and harvested on 4 Apr. 2014. The four media treatments were: 100% coconut fiber, 100% composted pine bark, 80% perlite plus coconut fiber on top two inches, and 80% composted pine bark plus coconut fiber on top two inches. The coconut fiber was placed on the top part of the pot to facilitate transplanting. The composted pine bark was obtained from a local source (Georgia Florida Mulch, Perry, FL). The mulch was composted and aged for over ten years. It is important that the pine bark be well composted for successful use as a soilless media. All three lettuce crops were monitored for insects and diseases on a weekly basis, yet no pesticide applications were necessary.

Plots were established by using 20 plants per tower and one tower per plot. Plots were arranged in a randomized complete-block design with four replications. A once over harvest was used to collect yield and quality parameters. Plants were harvested by cutting the stem at the level of the media in the pot. Yield measurements were taken on the fresh weight harvested from each plot. Observations were also made for leaf color on the heads.

All data were analyzed using SAS statistical software (SAS Institute, Inc., Cary, NC). The analysis of variance (ANOVA) was performed and significant differences between treatment means were separated using Duncan’s Multiple Range Test.

## Results and Discussion

The lettuce crops grew well in all three trials with no differences in color, tip burn or other quality parameters. Marketable yield data (Table 1) shows differences between media treatments only in Crop 1. Yield data from Crop 1 show the highest yield in 100% coconut fiber, followed by composted pine bark plus coconut fiber. Both perlite plus coconut fiber and 100% composted pine bark had the lowest yield and were not significantly different from each other. In Crop 1, the perlite plus coconut fiber treatment towers were noticeably smaller, but had the same color.

Yields were not significantly different between any of the media treatments during Crops 2 or 3. All treatments in Crops 2 and 3 were observed to have the same color and no other differences in quality or size were observed.

This trial was conducted to determine if composted pine bark could serve as an alternative to the media traditionally used in vertical systems such as VertiGro<sup>®</sup>. Composted pine bark is less expensive per pot than either coconut fiber or perlite in North Florida where composted pine bark is readily available and is a renewable resource. Cost may be higher in areas where pine bark is not a locally available product. Based on the three crops of lettuce grown in this research trial, composted pine bark would be an acceptable alternative to perlite or coconut fiber in vertical systems for lettuce. Further work is needed to better describe and classify various grades of composted pine bark.

## Literature Cited

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