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Comparison of Bare-Root and Plug Strawberry Transplants in Soilless Culture in North Florida 98-04

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Introduction

Strawberry is a major crop produced in Florida on 6,000 acres annually. The strawberry crop is valued slightly over 100 million dollars, behind only tomato, pepper, and potato in vegetable crops during 1995-96 (Anon, 1997). Essentially all strawberries in Florida are grown using plastic mulch culture in fields. Most fields are planted each year with little opportunity for crop rotation. The production system requires soil fumigation each year prior to application of new mulch. Fumigation is required primarily for control of diseases, weeds and nematodes. The potential loss of the major fumigant, methyl bromide, after the year 2000, has created a need to search for alternative fumigants or production systems. Some strawberry production in Europe is being done with soilless bag culture outdoors on raised beds. In addition, vertical hydroponic production systems have become available and are being used commercially on a limited scale in the U.S., including Florida.

Two such systems being used commercially in Florida include the VertiGro ™ and VerZontal ™ soilless culture systems. The VertiGro system uses a stack of styrofoam pots filled with a soilless mix (Carpenter, 1997). The VerZontal system uses media-filled 4 inch pots held in tiers of PVC pipes (Garner, 1998). Greenhouse hydroponic and soilless production systems have been used for strawberries over the years on a limited basis in the U.S.

Most of the large commercial strawberry acreage for shipping is located in central Florida near Plant City and Dover. Strawberries are also produced in many other areas of Florida, but are generally grown for local direct sales. Several small farms in North Florida produce strawberries on five acres or less. Approximately 80% of the farms in

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North Florida are small farms and many are operated by part-time farmers. Without mulching and fumigation equipment, many growers are not able to grow strawberries in the current field plasticulture system. An alternative strawberry production system would be of interest to small farmers currently and may have future applications even on large commercial growers.

An outdoor hydroponic system using perlite bags could be a possible alternative system. Currently the greenhouse vegetable industry in Florida is using a perlite bag culture system for crops such as tomato, cucumber, and pepper successfully (Hochmuth, 1996). Much of this system can be successfully adopted for outdoor hydroponic strawberry production.

Traditionally, strawberry fields in Florida have been established annually using bare-rooted plants. Recently, plug plants have become available as an alternative. Plug plants do not require the large quantities of overhead irrigation during the planting and establishment period (Grubich, 1997). The plug plants could be well-suited for planting into bag culture systems. This trial was conducted to compare the performance of bare-root and plug strawberry plants in perlite bag culture on the North Florida region.

Materials and Methods

This trial was conducted in the 1997-98 season at the North Florida Research and Education Center - Suwannee Valley near Live Oak, Florida to evaluate bare-root and plug strawberry plants of three popular cultivars using perlite bag culture. Horticultural grade perlite was placed in a layflat bag approximately three feet long and ten inches in diameter. Bags were placed end to end on a level area of soil covered with a black polypropylene ground cover. Bags were arranged in pairs of rows with five feet between the centers of each pair to facilitate spraying with a tractor. Plots were arranged in a randomized complete block design with two replications.

Strawberry transplant plugs grown in North Carolina (We Gro Rite ™, Andrews, NC) and bare-root transplants grown in Canada were used as the treatment plants in this trial. The two transplant types were planted in the perlite production bags, plugs of each cultivar on 16 October 1997, and bare-root transplants of 'Camarosa' and 'Sweet Charlie' on 18 October 1997, and bare-root transplants of 'Chandler' on 22 October 1997. Plants received sprinkler irrigation twice daily for ten days to aid in the establishment of bare-root plants.

Irrigation during the season was supplied via half-inch polyethylene tubing laid in the center of each pair of rows. Six plants were planted in each bag and an irrigation emitter was placed at each plant (Hochmuth and Hochmuth, 1996). Emitters were Chapin's "Trickle Stik" with a 0.5 inch inside diameter leader. A standard hydroponic bag culture with two injectors and nutrient stock tank system was used for delivery of

water and nutrients (Hochmuth, 1992). Two stock tanks of concentrated nutrient solution were mixed as needed according to the University of Florida recommendations for hydroponic tomato (Hochmuth, 1990). Early in the season the irrigated solution contained 70 ppm N, 50 ppm P, 120 ppm K, 90 ppm Ca, 40 ppm Mg, and 55 ppm S. Micronutrient delivery was 2.8 ppm Fe, 0.2 ppm Cu, 0.8 ppm Mn, 0.3 ppm Zn, 0.7 ppm B, and 0.05 ppm Mo. N and K levels were increased to 150 and 200 ppm, respectively, during the fruiting season. A minimum of two and a maximum of six irrigation events per day during daylight hours were delivered and controlled with an automatic irrigation controller.

Disease, insect, and mite populations were managed through integrated pest management scouting and control measures (Hochmuth and Maynard, 1996). Protection from frost and freezing temperatures was provided by application of Agryl ™ polypropylene floating row cover (2.0 ounces per square yard). The cover was held up and away from the plants by using wire hoops anchored in the ground. The wire hoops formed an arch over the bags of strawberry plants. The row cover protected blooms and fruit when ambient temperatures reached as low as 24^{o}F. Fruit was harvested and weighed from 23 December 1997 to 15 May 1998.

Results and Discussion

Monthly, early season, and total season strawberry yield is reported in Table 1. Total seasonal yield was one lb per plant for plug plants and 0.78 lbs per plant for bare-root plants, but these yields were not significantly different from each other. Early season production was higher for plug plants at 0.20 lbs per plant versus 0.04 lbs per plant for bare-root plants. Monthly yields during February through May were not significantly different between bare-root and plug plants.

'Camarosa' appeared to have higher total season yield at 1.16 lbs per plant than 'Chandler' or 'Sweet Charlie' at 0.7 and 0.8 lbs per plant; however, no significant difference was detected. No significant difference was detected for early yield (Dec - Jan) between the three cultivars. During the month of March, however, production was higher for 'Camarosa' than 'Chandler'. Production for 'Sweet Charlie' during March was not significantly different than the other cultivars. These were no significant difference in yield between cultivars during any month other than March.

The total yield in this study was somewhat less than the yield found in a similar study conducted in the 1996-97 season (Hochmuth and Crocker, 1997). In the 1997 study, yield of 'Camarosa' was 1.81 lbs per plant; 'Chandler' 1.57 lbs per plant' and 'Sweet Charlie' 1.09 lbs per plant. Frequent heavy rain and cloudy weather during the 1997-1998 winter season and extremely high temperatures in April and May have caused lower yields. In both of these studies 'Camarosa' performed very well with the

tendency to produce the highest total season yield and also has produced as high early yield as 'Sweet Charlie'.

This study indicates good production can be expected from any of the three cultivars evaluated. Plug plants will produce the highest early yield of strawberry when grown in perlite bag culture in North Florida. Total seasonal yield of strawberry is expected to be similar when using plug plants versus bare-root plants in this system.

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Table 1. Comparison of yield from bare-root and plug plants of three different cultivars of strawberry grown in perlite bag culture at Live Oak, FL during the 1997-98 season.

	Dec	Jan	Feb	Mar	Apr	May	Early Season (Dec and Jan)	Total Season
Plant Type	- - - - - - - - - - Yield (lbs per plant) - - - - - - - - - -							
Bare-root	0	0.04	0.16	0.28	0.23	0.04	0.04	0.78
Plug	0.01	0.19	0.16	0.35	0.22	0.02	0.20	1.00
Significance (P=0.05)[z]	**	**	NS	NS	NS	NS	**	NS
Cultivar	- - - - - - - - - - Yield (lbs per plant) - - - - - - - - - -							
Camarosa	0.003	0.16	0.19	0.48	0.26	0.03	0.16	1.16
Chandler	0.004	0.10	0.14	0.20	0.24	0.03	0.10	0.77
Sweet Charlie	0.01	0.08	0.14	0.26	0.17	0.02	0.10	0.73
Significance (P=0.05)[z]	NS	NS	NS	*	NS	NS	NS	NS
LSD (P=0.05)[y]				0.28				

[z] Significance was either highly significant at the 1% level (**), significant at the 5% level (*), or not significant (NS)
[y] Least significant difference (LSD) between treatments as determined at the 5% level of significance.