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# CARROT VARIETY PRODUCTION ON A SANDY SOIL USING RECLAIMED WATER AND DRIP IRRIGATION[1]

J. M. White
*Central Florida Research & Education Center*
*IFAS, University of Florida*
*Sanford, FL 32771*

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*Abstract.* **Five carrot (*Daucus carota* L.) varieties were planted in a Candler fine sand on 21 Jan. 1992. Fertilizer was applied at 120 N-53-P-100 K lb/acre preplant and 28 N-4.8 P-27 K lb/acre was applied in seven applications by drip irrigation. Reclaimed water was used for irrigation (reclaimed water can only be used on carrots which will be heat-treated or peeled in processing and cannot be applied to carrots for fresh market in Florida). Oxamyl, the only material available for root-knot nematode control, did not provide adequate control for fresh market carrots. Sugar refractometer readings, average root weight, and marketable yields were statistically similar among the five varieties evaluated. Yield ranged from 232 to 320 48-lb units per acre, which was lower than expected, but within range of the state average of 302 units per acre. Problems with nematodes and drip tubing clogging contributed to the low yields.**

About 9,000 acres of carrots were harvested in Florida in 1991-92 with a value of $20.88 million and a yield of 145 cwt/acre or 302 48-lb units/acre (Freie and Young, 1993). Florida's carrot production is currently on organic or muck soils, whereas, the two leading producers of carrots, California and Texas, grow carrots on mineral soils. Muck soil acreage is limited and natural oxidation reduces the depth by 0.1 ft each year (Stephens, 1955). With additional pressure from state agencies and environmental groups to return the farmed muck land back to marsh land, producing carrots on other Florida soils needs investigating.

Within the past 10 years, freeze damage to citrus in central Florida has made land previously planted to citrus available. The soil generally is a deep sand with low water holding capacity. To utilize this type of soil for carrot production, irrigation would be required. Studies reported here were conducted to evaluate the yield, root size, and sugar content of five varieties of carrots when grown in a sandy soil using drip irrigation with reclaimed water.

## Material and Methods

The growing site was selected based on land available which was serviced by reclaimed water from Conserv II, which is a project of the City of Orlando and Orange County, FL. The preplant soil pH was 6.2 and the soil tested medium (24 ppm P) for P, very low (16 ppm K) for K, and very high (80 ppm Mg) for Mg (Mehlich-1 extraction). A preplant broadcast fertilizer of 120N-53P-100K lb/acre from a commercial 10N-4.4P-8.3K fertilizer was applied, then oxamyl at 4 gal/acre was sprayed over the soil in the plot area for nematode control. The soil was tilled to a depth of 6 inches and beds were formed spaced 5 ft apart (rather than 46 inches, as is done commercially, due to the tractor and equipment available). Five carrot varieties were seeded 21 Jan. 1992, on a Candler fine sand which had been in an orange grove until recent freezes killed the trees. Two rows 4 inches apart were planted on each side of the bed with a spacing of 12 inches between each set of rows. Biwalled drip tubing (Hardie Irrigation, Sanford, FL) with emitter holes spaced 12 inches apart and a delivery rate of 0.4 gpm/100 ft was placed in the center of the beds. Frequency and duration of irrigation was controlled by a time clock. The length of the tubing was 260 ft from the supply line. Treatments were replicated 4 times in a randomized complete block design, with each plot being two beds wide by 130 ft long. A water meter was placed in the water line to measure the amount used. A dosatron (Dosatron, Intl., Clearwater, FL) proportional injector was used to apply additional fertilizer during irrigation. A total of 28N-4.8P-27.4K lb/acre was added from 27 Feb. through 27 Apr. 1992 in 7 applications. The irrigation schedule was adjusted in frequency and duration as carrots matured and additional water was required. Carrot roots were harvested by hand on 18 May 1992, 118 days after planting. Marketable carrot root number and weight was recorded from a sample plot 5 ft (one bed) wide by 10 ft long for each of the 5 varieties. A sugar (°brix) reading was taken from carrot juice pressed from a section taken 2.5 inches from the crown.

## Results and Discussion

Carrot germination and emergence were excellent for all varieties. After 4 weeks, it was observed that sections of the drip line were not functioning uniformly. Attempts to flush and clean the line improved water uniformity for about 3 days after each weekly cleaning. The drip lines were cleaned with phosphoric acid and flushed once a week, but the problem continued. A filter was needed but was not available at that time. Areas which did not receive uniform watering were marked and data not taken from them.

The average marketable root size was determined by measuring a sample of 20 roots from each replication. 'Caro-Choice' and 'Caro-Pride' had a significantly larger width (measured 2.5 inches from the crown) than 'Caro-Best' (Table 1). 'Caro-Pride' was significantly longer than 'Caro-Choice' and 'Apache'. The average root weight was not significantly different among the 5 cultivars. The average root weight ranged from 1.79 oz ('Apache') to 2.57 oz ('Caro-Pride'). Number of marketable roots per linear bed foot was 8.4 ('Caro-Pride'), 11.3 ('Six Pence'), 12.9 ('Caro-Best'), 13.9 ('Caro-Choice'), and 15.5 ('Apache'); with 'Apache' having a significantly larger number than 'Caro-Pride'. Marketable yield, when expressed in 48-lb units/acre ranged from 232 for 'Caro-Pride' to 365 for 'Caro-

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Table 1. The effect of carrot variety on root size, marketable yield, and sugar level when grown in a sandy soil using reclaimed water in a drip irrigation system.

| Variety | Marketable root size Width[z] (inch) | Avg. length[y] (inch) | Wt. (oz.) | No. 48-lb units/A | Sugar conc.[y] (°brix) |
|---|---|---|---|---|---|
| Caro-Choice | 1.17 a[x] | 7.16 bc | 2.31 a | 365 a | 8.75 a |
| Apache | 1.04 ab | 6.47 c | 1.79 a | 320 a | 8.70 a |
| Six Pence | 1.06 ab | 7.49 ab | 2.44 a | 303 a | 8.23 a |
| Caro-Best | 0.96 b | 7.43 ab | 1.87 a | 275 a | 8.53 a |
| Caro-Pride | 1.17 a | 8.06 a | 2.57 a | 232 a | 8.70 a |

[z]Average width or diameter taken 2.5 inches from the crown.
[y]Sap reading taken from a section 2.5 inches from crown using a refractometer to measure brix.
[x]Mean separation in columns by Duncan's multiple range test, 5% level.

Choice', but was not found to be significantly different (Table 1). This compared favorably with the overall state yield of 302 48-lb units/acre. Variations occurred among replications due to irrigation problems and root-knot nematode injury. Nematode control achieved would not meet commercial standards required for fresh market.

Brix sugar refractometer readings were taken (Table 1) to determine if there was a variety difference. The readings ranged from 8.23 to 8.75 and were not statistically different.

These studies indicate that marketable yields of 5 varieties were similar and that yields were similar to those produced on organic soil. In conclusion, carrots can be grown on deep sandy soils, but nematodes will need to be controlled (Anonymous, 1992). An adequate irrigation system which can also be used to supply nutrients is necessary. This study used 7975 gal/acre/day of water which included line flush water and water lost due to two line breaks. The deep sandy field was never too wet for carrot production. Irrigation frequency and duration had to be increased as carrots grew and matured. The total amount of fertilizer used was 149N-58P-128K lb per acre. The total N was about 40 lb higher than recommended, but was added due to the water requirement and leaching. If drip irrigation is used, a filtering system is required. There were less differences in average root weight, yield, and brix sugar readings among the 5 varieties than expected. This indicates a quality carrot can be produced on sandy soils in central Florida using the correct cultural practices and current varieties. It should be noted that under Florida DER rules for reuse of reclaimed water, "irrigation of edible crops that will not be peeled, skinned, cooked or thermally processed before consumption using an application method that allows for direct contact of the reclaimed water on the crop is prohibited" (Anonymous, 1990). Therefore, reclaimed water may not be used on fresh market carrots at the current time.

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# POLE BEAN YIELD AS INFLUENCED BY COMPOSTED YARD WASTE SOIL AMENDMENTS

S. R. Kostewicz
*Horticultural Sciences Dept.*
*IFAS, University of Florida*
*Gainesville, FL 32611-0690*

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*Abstract.* **Composted Yard Waste (CYW) at rates of 0, 25, 50 and 100 tons/acre were applied and incorporated into a sandy soil in the spring of 1993. These plots were superimposed on plots previously treated with identical CYW rates in 1991. The plots were split into subplots that either received a second application or did not and into fertilized and unfertilized areas. The pole bean *Phaseolus vulgaris* L. cultivar 'Dade' was planted. Pole beans grown with fertilizer significantly outyielded pole beans grown with no fertilizer regardless of compost application rate. Yields were 439 and 201 bu/acre, respectively. With the single CYW applications made in 1991, the highest yield of pole beans was with the 100 ton/acre rate (403 bu/acre). The second application of 100 ton/acre rate made in 1993, reduced the yield of beans by 14% (42 bu) as compared to the yield with the 50 ton rate. This was attributed to N tie-up from the more immature compost used in the 1993 application.**

The composting of waste materials from urban settings has become of great interest in recent years as a means of reducing landfill volume required and in general to promote recycling and environmental awareness. A variety of materials and mixture of feedstocks for the composting processes have resulted in a wide range of materials available. Initially one material, yard waste, was of interest and

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