some of the root measurements obtained in the present study and in their relationships to other growth variables measured are not surprising. However, the variability observed in the present study seemed acceptable for the intended purpose of the proposed methods.

Although there is abundant and useful information on the botanical, horticultural, and pest factors that affect carrot growth and development, none of the previous studies seem to provide for simple methods for monitoring or for field appraisal of carrot growth and development that would be useful to pest and crop managers in Florida. Such methods have been investigated and proposed for use in IPM applications during celery [Apium graveolens L. var. dulce (Mill.) Pers.] and cabbage (Brassica oleracea L. Capitata group) production in Florida (Strandberg, 1979, 1985). This study provides information on some simple and expedient methods for appraisal or monitoring of carrot growth and managing pests in Florida, but the approach should also be useful elsewhere.

**Literature Cited**


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**MUSKMELON FRUIT RESPONSE TO K SOURCE AND METHOD OF APPLICATION**

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**Additional index words.** Potassium fertilization, drip irrigation, fertigation, Cucumis melo L. var. reticulatus.

Abstract. 'Athena' muskmelon (Cucumis melo L. var. reticulatus) was grown in 1999 in Gainesville, Fla., on polyethylene-mulched raised beds with drip irrigation to evaluate effects of K source and method of K application on fruit yield. The soil was low in Mehlich-1 K and 160 lbs per acre (4-ft bed centers) K were applied for the season from KCI, K2SO4, or KNO3. The K was applied either 100% preplant incorporated in the bed or in 12 equal weekly injections through the drip irrigation system. N was supplied at 190 lbs per acre from NH4NO3 (and KNO3), with a combination of incorporated and injected N. All muskmelons received Mg and S from MgSO4. Early yield (first harvest) was not affected by K source. Total-season (five harvests) yield averaged 470 cwt per acre (23.5 tons per acre) and was not affected by K source. Early yield was not affected

This research was supported by the Florida Agricultural Experiment Station, and approved for publication as Journal Series No. N-02123.
Low M-1 soil test K concentrations (28 ppm) also were present in the second season, spring 1994, and 110 lbs per acre K were again recommended. The proportion of CR-K did not interact with K rate this second season. Muskmelon yields responded linearly (5% probability) to K fertilizer rate. Muskmelon treated with 25% to 50% CR-K responded with 100% and 95% relative yield, respectively, compared to 69% relative yield where no CR-K was included in the fertilizer treatment.

Two cultivars of muskmelon (one orange-fleshed and one green-fleshed) were used in spring and fall experiments in Gainesville, Florida, evaluating crop response to K on soils testing very low in Mehlich-1 K (Pacheco, 1996). The spring experiment was on a sandy soil testing 14 ppm Mehlich-1 K (very low) and the fall experiment was conducted on a sandy soil testing 17 ppm Mehlich-1 K (very low). Melons were planted on beds spaced on 5-ft centers and were drip irrigated with K, from KNO₃ and KCl, applied in a combination of preplant incorporation and fertigation methods. In the spring, there was a quadratic response to K with total marketable yield leveling off after 75 lbs per acre K (linear-plateau model). The quadratic model predicted a maximum yield with 140 lbs per acre K. In the fall, yield was maximized with 50 lbs per acre K according to a linear-plateau model, whereas the quadratic maximum K rate was 120 lbs per acre K.

Several studies, including those above, have provided some documentation of the University of Florida muskmelon K fertilizer recommendations (Csizinsky et al., 1985; Hochmuth and Cordasco, 2000). However, no studies have been conducted to determine responses to K source and method of application, as has been done for other vegetables (Locascio and Alligood, 1992; Locascio et al., 1997a, b). The objective of this study was to evaluate K source and method of K application for effects on muskmelon fruit yield and size.

**Materials and Methods**

'Athena' ('Eastern' fruit type) muskmelon was grown at the Horticultural Research Unit of the University of Florida in Gainesville to evaluate fruit yield responses to K source and application method. The soil for the experiment was prepared by plowing and disking in Mar. 1999. The soil pH was 6.0 (2:1 water:soil mixture), and the soil was medium-low in Mehlich-1 extractable K. Raised beds were formed on 4-ft centers with preplant fertilizers incorporated in the soil with a roto-tiller. Preplant fertilizers consisted of 20% of total N for all plots and the prescribed amount of K, depending on the specific K treatment. The total amount of N for the season was 190 lbs per acre (Hochmuth, 2000; Hochmuth and Hanlon, 1995). No other fertilizers were applied.

The total amount of K for the season was 160 lbs per acre, supplied from three sources (K₂SO₄, KCl, or KNO₃), applied either 100% preplant incorporated in the bed or injected in the drip irrigation system in 12 equal applications during the season. The preplant N and K fertilizers were spread by hand on 12 March 1999, over the surface of the soil in the plot area and incorporated. Beds were formed, fumigated with methyl bromide/chloropicrin at 350 lbs per acre, and pressed mechanically. Drip irrigation tubing (0.5 gal per min per 100 ft) was placed on the surface in the center of the beds and the beds were mulched with black polyethylene mulch. Plots were single rows (beds) 40 ft in length. The experiment was a factorial arrangement of three K sources and two application methods in randomized complete-block design.
On 22 Mar. 1999, seeds of ‘Athena’ muskmelon were hand-planted through the mulch in hills spaced 18 in apart but alternating on either side of the drip tubing. Two weeks later, the seedling numbers were reduced to one plant per hill. Drip irrigation was used to maintain soil moisture in all plots at -8 to -12 cb as determined by tensiometers with the tip placed 8 in deep in the root zone. N and K fertilizers were injected with venturi injectors weekly by dissolving the appropriate fertilizers in water and injecting the solution through the drip irrigation system. There were 12 injections made later, the seedling numbers were reduced to one plant per hill. Drip irrigation was used to maintain soil moisture in all plots at -8 to -12 cb as determined by tensiometers with the tip placed 8 in deep in the root zone. N and K fertilizers were injected with venturi injectors weekly by dissolving the appropriate fertilizers in water and injecting the solution through the drip irrigation system. There were 12 injections made.

Foliar diseases and insects were controlled by applications of recommended pesticides determined by field scouting. Muskmelon fruit were harvested as they began to turn yellow and slip from the vine, with the first harvest on 4 June 1999. Early-maturing fruit were those fruit picked on the first harvest date; there were five harvests for the season. Fruit were graded into marketable or cull (misshapen or rotted) categories, and weighed. Yield data were analyzed by analysis of variance.

### Results and Discussion

The muskmelon crop grew very well and nutrient deficiency symptoms were not observed. There were no interactions of K application method and K source for any variable measured. Early marketable and cull fruit yields (first harvest) were not affected by K application method or K source (Table 1). Total-season marketable fruit production was affected by K application method (Table 2). Muskmelon fruit production was 14% greater with fertigation than with all K applied preplant in the soil. This type of crop response to drip fertilizer application has been observed in other studies with other crops (Locascio et al., 1997b). Several reasons have been offered for this type of response, including the possibility of increased soluble salt injury because more fertilizer was placed in the soil with the 100% preplant treatment. In studies with tomato (Lycopersicon esculentum Mill.), soil soluble salt concentrations at the end of the season on the sides of the bed were greater with all-preplant fertilizer compared with split applications (Locascio et al., 1989). When all the fertilizer is uniformly incorporated in the bed at planting, only those nutrients in the wetted zone of the drip tube will be available to the crop, thus the fertilization efficiency might be reduced.

K source did not affect total season fruit production. The fact that K source did not influence muskmelon fruit production in this study is similar to responses to K sources with other crops, such as strawberry (Fragaria × ananassa Duchesne) (Locascio and Saxena, 1967) and tomato (Locascio et al., 1997a). Fruit size was likewise not affected by K source. This study has shown that drip-irrigated muskmelons can be fertilized with either of several sources of K, but that fertigation of the K is preferable to preplant application of all of the K in the soil.

### Literature Cited


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**Table 1. Main effects for early muskmelon fruit yield, first harvest, K study, Gainesville, Fla., 1999.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>K source</th>
<th>Marketable no.</th>
<th>Marketable wt (cwt)</th>
<th>Cull (no.)</th>
<th>Cull wt (cwt)</th>
<th>Avg. fruit wt (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertigation</td>
<td>K₂SO₄</td>
<td>490</td>
<td>30</td>
<td>50</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td>Preplant</td>
<td>KCl</td>
<td>710</td>
<td>40</td>
<td>40</td>
<td>1</td>
<td>4.7</td>
</tr>
<tr>
<td>Prob. &gt; F</td>
<td></td>
<td>0.2189</td>
<td>0.2751</td>
<td>0.7600</td>
<td>0.5356</td>
<td>0.7611</td>
</tr>
</tbody>
</table>

**Table 2. Main effects for total-season muskmelon fruit yield, five harvests, K study, Gainesville, Fla., 1999.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>K source</th>
<th>Marketable no.</th>
<th>Marketable wt (cwt)</th>
<th>Cull (no.)</th>
<th>Cull wt (cwt)</th>
<th>Avg. fruit wt (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertigation</td>
<td>K₂SO₄</td>
<td>10,580</td>
<td>500</td>
<td>450</td>
<td>13</td>
<td>4.7</td>
</tr>
<tr>
<td>Preplant</td>
<td>KCl</td>
<td>9,550</td>
<td>440</td>
<td>760</td>
<td>21</td>
<td>4.2</td>
</tr>
<tr>
<td>Prob. &gt; F</td>
<td></td>
<td>0.0309</td>
<td>0.0323</td>
<td>0.2362</td>
<td>0.2499</td>
<td>0.0892</td>
</tr>
</tbody>
</table>

**Table 3. Main effects for early muskmelon fruit yield, first harvest, K study, Gainesville, Fla., 1999.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>K source</th>
<th>Marketable no.</th>
<th>Marketable wt (cwt)</th>
<th>Cull (no.)</th>
<th>Cull wt (cwt)</th>
<th>Avg. fruit wt (lb)</th>
</tr>
</thead>
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<tr>
<td>Fertigation</td>
<td>K₂SO₄</td>
<td>9,660</td>
<td>430</td>
<td>760</td>
<td>21</td>
<td>4.2</td>
</tr>
<tr>
<td>Preplant</td>
<td>KNO₃</td>
<td>9,860</td>
<td>470</td>
<td>490</td>
<td>13</td>
<td>4.5</td>
</tr>
<tr>
<td>Prob. &gt; F</td>
<td></td>
<td>10,670</td>
<td>510</td>
<td>570</td>
<td>17</td>
<td>4.6</td>
</tr>
</tbody>
</table>

**Table 4. Main effects for total-season muskmelon fruit yield, five harvests, K study, Gainesville, Fla., 1999.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>K source</th>
<th>Marketable no.</th>
<th>Marketable wt (cwt)</th>
<th>Cull (no.)</th>
<th>Cull wt (cwt)</th>
<th>Avg. fruit wt (lb)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>K₂SO₄</td>
<td>10,666</td>
<td>1,406</td>
<td>6669</td>
<td>6823</td>
<td>0.8382</td>
</tr>
<tr>
<td>Preplant</td>
<td>KCl</td>
<td>1,166</td>
<td>1,106</td>
<td>1,669</td>
<td>1,682</td>
<td>0.3823</td>
</tr>
</tbody>
</table>

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INTERACTIONS BETWEEN NITROGEN RATES AND CULTIVAR ON THE YIELD OF STRAWBERRY

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Additional index words. Water management, fertilization, nutrient management, Fragaria × ananassa.

Abstract. Water and nitrogen (N) fertilizer are two major inputs in the production of high value strawberries in Florida. Although IFAS recommendations are available for water and fertilizer management, water restrictions and ground water issues in west central Florida require an increasing level of irrigation and nutrient management. The objective of this research was to evaluate the joint effects of water and N fertilizer rates on fruit yields of 'Sweet Charlie' and 'Camarosa'. Strawberry were produced in 2000/2001 using standard production practices. Rates of N fertilizer were 0.50 (N-1), 0.75 (N-2), and 1.00 (N-3) lb/acre/day (66, 100, and 133% of the recommended rate for Feb.-Mar., respectively). Water application rates were 100% or 80% of the recommended yearly average IFAS rate (11,500 gal/acre/week) for I-1 and I-2, respectively. Water and fertilizer rates were created simultaneously by using different numbers of drip tapes under the polyethylene mulch. Fruit were harvested 24 times between 19 Dec. and 15 Mar., graded as marketable and non-marketable, weighed, and counted. A significant (P = 0.01) interaction was observed between cultivar and N rate for total and Jan. marketable yield. For each cultivar, the irrigation rate × N rate interaction was not significant (P > 0.69). For 'Camarosa', total, Feb., and Mar. marketable yields increased linearly as N rate increased. For 'Sweet Charlie', marketable yields response to N rate was quadratic for total and Feb., and linear in Mar. The effect of irrigation rate was not significant for any marketable yields. This supports the current recommended N-rates for strawberry production for 'Camarosa' and 'Sweet Charlie'. However, these preliminary results also suggest that current irrigation recommendations may be reduced by 20% for Camarosa, except in Mar., and for the whole season for 'Sweet Charlie', without significantly reducing marketable yield.

Strawberry (Fragaria × ananassa Duchesne) is a high value crop with an estimated value in 1998-1999 of approximately $150 million in Florida (Witzig and Pugh, 2000). Most of the 6,200 acres are located in central Florida, in Hillsborough county. Bare-root plants are planted on black plastic-mulched, raised beds in the fall. Fields are overhead irrigated for the first 2 weeks to ensure plant survival. Because of the high value of the crop, fertilizer and water application to strawberry are intensively managed. Based on soil test results, approximately 20% of the N and K, and 100% of P are applied preplant, and the remaining N and K are injected throughout the growing season (at least once weekly) through the drip irrigation system (Locascio and Martin, 1985; Locascio et al., 1977; Maynard et al., 2000).

Water is essential in three aspects of strawberry production. First, approximately 15 acre-in of water are needed for plant establishment during the first 2 weeks. Then, based on historical weather data and reference evapotranspiration data from Tampa, FL, recommended irrigation amounts are approximately 7 acre-in for an Oct.-Mar. production season (Haman, 2000; Mansell et al., 1976). A common practice is to irrigate straw-