Winter Organic Wonderland: Evaluating organic fertilizers for greenhouse production
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Introduction
Historically, Minnesota’s greenhouse industry was focused on vegetable production. With the introduction of interstate highways and refrigeration, fresh produce could travel long distances, and there was a shift away from growing food as flower production became a more profitable use of greenhouse space. Now there is considerable public interest in renewing winter food production in Minnesota in conjunction with a growing demand for organic produce, and produce vendors and restaurants are looking for local winter sources of organic produce to meet consumer demand.

This study evaluates organic fertility sources in a greenhouse setting. Most organic fertilizers require some degree of microbial breakdown before the nutrients are in a form plants can take up and use. Crops of interest were fertilized with commercially available organic fertilizers and compared to a conventional greenhouse fertilizer. Our objective is to determine the effect of fertility source on crop yield, nutrient composition of plant and soil, Vitamin C content, microbial biomass and nitrogen mineralization.

Materials and Methods
Five crops were grown in five different fertility treatments.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Nitrogen Recommendation¹</th>
<th>Media Base</th>
<th>Fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Giant Mustard</td>
<td>Fe 15-6-6</td>
<td>SanGro LC8®</td>
<td>Lightning Dark Weather Feed 0-15-6-16</td>
</tr>
<tr>
<td>Mizuna</td>
<td>Fe 4-0-4</td>
<td>Purple Cow Organic Potting Mix Mv</td>
<td>Compost from mix 0.5-0.2-0.4</td>
</tr>
<tr>
<td>Arugula</td>
<td>Fe 5-0-0</td>
<td>Brighter Future</td>
<td>Compost and blend of greensand, rock, peat, vermiculite, and lime (feeding今生)</td>
</tr>
<tr>
<td>Mix</td>
<td>Fe 8-4-4</td>
<td>Sunshine Natural and Organic Potting Mix Mv</td>
<td>Diamonc® © 2-5-0.2</td>
</tr>
<tr>
<td>Soil Litter (PL)</td>
<td>Fe 5-0-0</td>
<td>Sunshine Natural and Organic Potting Mix Mv</td>
<td>SUSTÄNE® 8-4-4</td>
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<tr>
<th>Treatment</th>
<th>Media Base</th>
<th>Fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Comparison (CC)</td>
<td>SanGro LC8®</td>
<td>Lightning Dark Weather Feed 0-15-6-16</td>
</tr>
<tr>
<td>All-In-One (AO)</td>
<td>Purple Cow Organic Potting Mix Mv</td>
<td>Compost from mix 0.5-0.2-0.4</td>
</tr>
<tr>
<td>Deep Winter Greenhouse Mix (DW)</td>
<td>Sunshine Natural and Organic Potting Mix Mv</td>
<td>Diamonc® © 2-5-0.2</td>
</tr>
<tr>
<td>Fish Emulsion (FE)</td>
<td>Sunshine Natural and Organic Potting Mix Mv</td>
<td>SUSTÄNE® 8-4-4</td>
</tr>
<tr>
<td>Poultry Litter (PL)</td>
<td>Sunshine Natural and Organic Potting Mix Mv</td>
<td>SUSTÄNE® 8-4-4</td>
</tr>
</tbody>
</table>

Timeline
All crops planted Nov-12/15
Mizuna Harvest 1 Dec 9-16
Spinach Harvest 1 Dec 16-Jan 1
Mizuna Harvest 2 Jan 4
Spinach Harvest 2 Jan 7-21
Red Giant Mustard Harvest 1 Feb 11-25

Results

Harvest Yield
- Response to fertility treatment varied across crops.
- Our conventional control did not outperform organic treatments.
- Overall, Arugula yields were 50% less than the other Mesclun mix crops, Mizuna and Red Giant Mustard.
- The yield of the second harvests in the greens is proportional to the yield of the first harvest.

Vitamin C Content
- Vitamin C content varies with fertility treatment for Mizuna and Red Giant Mustard.
- Vitamin C content variation by treatment is similar in Mizuna and Red Giant Mustard.

Summary
We found that yield varies by fertility treatment within a crop, and fertility treatments do not perform uniformly across crops. Fertility treatments are driving differences in Vitamin C content, though this may be a secondary effect. Incoming soil and plant tissue data will help determine any nutrient excesses or deficiencies in fertility treatments. These results underscore the importance of knowing the fertility requirements of individual crops to maximize yield while reducing inputs.

References:
2. R. E. Widmer, “A History of Minnesota Agriculture” [Minnesota Report 238, Minnesota Agricultural Experiment Station, University of Minnesota, St Paul, MN, 1997].

Further information
Email eaperkus@umn.edu with any questions regarding this research.
Visit http://www.extension.umn.edu/ for periodic updates on this project and related research.

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