Constant Feed Fertigation

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Wisdom for the day

Gail Mann

“If you don’t get better, it’s gonna get worse!!!”

FACT IS:

IF WE DON’T GET BETTER, THINGS WILL GET WORSE!!

WHAT THINGS CAN WE DO BETTER?
FERTIGATION

The practice of applying fertilizers directly through irrigation water.

In its simplest form it is just side dressing Nitrogen through the irrigation system.
CONSTANT FEED FERTIGATION

- Fertigation where plant nutrient and water requirements are applied in short increments as the plant needs them, generally, with every irrigation.

“Feed and water the plants daily with the precise required amount and types of nutrients and the precise required amount of irrigation water”
Basic assumptions:

- Nutrient uptake rates are crop-specific.
- Plants need different quantities of the various nutrients at different stages of their growth cycles.
  - Vegetative, Flowering, Fruit Development, Hardening, etc.
- Each nutrient has a specific purpose and can limit production and/or quality if deficient at the time it is required.
- There is no such thing as “something for nothing”. If you want higher yields and better quality, higher, more efficient, or more timely inputs are required.
- Nutrients should be available to the plants “Just-in-Time” to reduce leaching losses, salt stress, and avoid luxury feeding.
Dynamics of nutrient uptake

Of course, the plant can’t handle it’s entire annual water portion applied at once.
Dynamics of nutrient uptake

Same holds true for nutrients, too.

Nutrients should be applied according to their requirement pace.
Dynamics of nutrient uptake

Constant Feed Fertigation
= Teaspoon feeding.

Nutrients are supplied just-in-time.
To Do Fertigation Right You Need to Understand:

1. Nutrient uptake rates for the crop over its life span.

2. Water uptake rates for the crop over its life and how it varies with weather conditions.

3. How much water the soil will hold within the root zone.
Dynamics of nutrient uptake

Example Tomatoes

Nutrient uptake rates (g/plant)

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Transplanting</th>
<th>Vegetative growth</th>
<th>Flowering and fruiting</th>
<th>Harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ca</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Huett, 1985
Watering Practices and Fertilizers

Cannot be separated from each other

ESPECIALLY

With shallow rooted crops

And

With soils or media with low water holding capacity
IF YOU OVERWATER YOU UNDER-FERTILIZE

- It is easy to leach fertilizers out of the root zone of low water holding capacity media with shallow rooted.

- **Overwatering with overhead and dry fertilizers leach fertilizers easily PLUS can cause high salt conditions.**

- With drip and conventional fertilizer practices, roots grow into the wet area while dry fertilizers are easily leached out of the wet area.

- **With constant feed fertigation we can put what the plant needs into the “sweet spot” every day in small increments.**
The Benefits of Fertigation: Fertilizer Savings and Efficient Utilization

Nutrients in solution & fed to the plants daily for ready uptake by the roots

Without fertigation, drip tends to leach fertilizers out of the root zone to edges
Plant water requirements
• Are proportional to the rate of evapotranspiration (ET) which depends on:
  • Stage of plant development—Crop Curves and Kc Curves
  • Meteorological conditions (temp., wind, radiation, humidity)—from weather stations and ET measurement devices
Crop Curve for Mature Blueberries On Drip in the Florida
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Calander weeks

Kc(ETGauge)
Weather Stations & ET Gauges

- Extensive Research shows that Evaporation data is proportional to crop water use.

Weather Stations

Both measure evaporation in Inches per day

ET Gauge
A good Fertigation program is based on proper water management, considering:

- Soil types and their characteristics
Irrigation of Blueberries on Bark and Light Soils

Net Application per Irrigation at 60% Available Moisture for various root depths.

<table>
<thead>
<tr>
<th>Soils Type</th>
<th>FC %</th>
<th>PWP%</th>
<th>Avail Moist %</th>
<th>Diameter spread</th>
<th>irrigation level</th>
<th>root zone ft</th>
<th>gallons per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Bark —(similar to loamy sand) Drip</td>
<td>0.13</td>
<td>0.04</td>
<td>0.08</td>
<td>1</td>
<td>0.4</td>
<td>0.75</td>
<td>500</td>
</tr>
<tr>
<td>Overhead</td>
<td>0.13</td>
<td>0.05</td>
<td>0.08</td>
<td>3.5</td>
<td>0.4</td>
<td>0.75</td>
<td>2800</td>
</tr>
<tr>
<td>Old Bark—(similar to Sandy Loam) Drip</td>
<td>0.21</td>
<td>0.10</td>
<td>0.11</td>
<td>1.25</td>
<td>0.4</td>
<td>0.75</td>
<td>700</td>
</tr>
<tr>
<td>Overhead</td>
<td>0.21</td>
<td>0.10</td>
<td>0.11</td>
<td>3.5</td>
<td>0.4</td>
<td>0.75</td>
<td>3800</td>
</tr>
<tr>
<td>sandy-loam Drip Overhead</td>
<td>0.09</td>
<td>0.02</td>
<td>0.07</td>
<td>1</td>
<td>0.4</td>
<td>1.5</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td>0.09</td>
<td>0.02</td>
<td>0.07</td>
<td>4</td>
<td>0.4</td>
<td>1.5</td>
<td>5500</td>
</tr>
<tr>
<td>Loamy Sand Drip Overhead</td>
<td>0.14</td>
<td>0.04</td>
<td>0.10</td>
<td>1.25</td>
<td>0.4</td>
<td>1.5</td>
<td>1300</td>
</tr>
<tr>
<td></td>
<td>0.14</td>
<td>0.04</td>
<td>0.10</td>
<td>4</td>
<td>0.4</td>
<td>1.5</td>
<td>7900</td>
</tr>
<tr>
<td>sandy loam Drip Overhead</td>
<td>0.23</td>
<td>0.09</td>
<td>0.14</td>
<td>1.5</td>
<td>0.4</td>
<td>1.5</td>
<td>2100</td>
</tr>
<tr>
<td></td>
<td>0.23</td>
<td>0.09</td>
<td>0.14</td>
<td>4</td>
<td>0.4</td>
<td>1.5</td>
<td>11000</td>
</tr>
<tr>
<td>sandy loam-OM Drip Overhead</td>
<td>0.29</td>
<td>0.1</td>
<td>0.19</td>
<td>2</td>
<td>0.4</td>
<td>1.5</td>
<td>3800</td>
</tr>
<tr>
<td></td>
<td>0.29</td>
<td>0.1</td>
<td>0.19</td>
<td>4</td>
<td>0.4</td>
<td>1.5</td>
<td>14900</td>
</tr>
<tr>
<td>Loam Drip Overhead</td>
<td>0.34</td>
<td>0.12</td>
<td>0.22</td>
<td>4</td>
<td>0.4</td>
<td>1.5</td>
<td>8700</td>
</tr>
<tr>
<td></td>
<td>0.34</td>
<td>0.12</td>
<td>0.22</td>
<td>4</td>
<td>0.4</td>
<td>1.5</td>
<td>17300</td>
</tr>
</tbody>
</table>

Automation with Drip is practically a must for success

BB Hobbs Inc. Soils and Irrigation Management 24
Constant Feed Fertigation vs. Controlled Release Fertilizers
Problems with Controlled Release Fertilizers

• Expensive: 3 – 5 times more costly than conventional materials
• Usually only addresses nitrogen
• The “control” is in the hands of the manufacturer, the weather and other climatic conditions
The Benefits of Constant Feed Fertigation

**Advantages for the plant:**

- Nutrients are directed to the active root zone.
- Uniform and precise distribution of nutrients.
- Nutrients are already dissolved, hence ready for uptake by the roots.
- Plant enjoys continuous nutrition. No temporary deficiency should occur.
- Less salt stress—NEVER a high Salt level because of spoon feeding.
- Higher Yields and Quality.
Yield Differences Can Be Seen

Same Farmer, 3 days younger, Drip & Fertigation

Dry Fertilizer & Traveler
# Yield Results of SC Tomatoes

mid 1980s when converted

<table>
<thead>
<tr>
<th>Type</th>
<th>Average</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>900</td>
<td>1400</td>
</tr>
<tr>
<td>Sprinkler</td>
<td>1350</td>
<td>1550</td>
</tr>
<tr>
<td>Drip</td>
<td>1400</td>
<td>1600</td>
</tr>
<tr>
<td>Fertigated</td>
<td>2000</td>
<td>2800</td>
</tr>
</tbody>
</table>
Similar results on Florida Tomatoes----2006

Crop of Florida 47s in 2006. All fertigated on old plastic
Fertigation Basics

➢ Soil Samples tied to GPS Maps
Soil Sample

Aerial with GPS Boundary

Overlay Soil Types
Soil Sample

Color Soil Types

Smart Sample
Fertigation Basics

- Have a plan to follow

- But be ready to modify it by:
  - Visual observations
  - Tissue samples
Fertigation Success Is Not Automatic

• There is really no recipe
• Hard work and close attention to the crop is required.
• There is always a lot of learning to do with each new soil and crop.
• Proper water management is a must
Wisdom for the day...

By Arthur Schopenhauer

“All truth passes through three stages:
First, it is *ridiculed*.
Second, it is *violently opposed*.
Third, it is *accepted as being self-evident*.”
Typical Micro-Irrigation System

Legend

<table>
<thead>
<tr>
<th>#</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water Source</td>
</tr>
<tr>
<td>2</td>
<td>Pump</td>
</tr>
<tr>
<td>3</td>
<td>Check Valve</td>
</tr>
<tr>
<td>4</td>
<td>Throttling Valve</td>
</tr>
<tr>
<td>5</td>
<td>Pressure Relief or Sustaining Valve</td>
</tr>
<tr>
<td>6</td>
<td>Chemigation Valve or Back Flow Preventer</td>
</tr>
<tr>
<td>7</td>
<td>Antisyphon Fertilizer Injector Valve</td>
</tr>
<tr>
<td>8</td>
<td>Fertilizer Pump</td>
</tr>
<tr>
<td>9</td>
<td>Fertilizer Meter</td>
</tr>
<tr>
<td>10</td>
<td>Fertilizer Tank</td>
</tr>
<tr>
<td>11</td>
<td>Chemical Feed Pump and Tank</td>
</tr>
<tr>
<td>12</td>
<td>Main Filter</td>
</tr>
<tr>
<td>13</td>
<td>Back Wash Assembly</td>
</tr>
<tr>
<td>14</td>
<td>Back Wash Throttling Valve</td>
</tr>
<tr>
<td>15</td>
<td>Back Wash Airvent</td>
</tr>
<tr>
<td>16</td>
<td>Back Up Filter</td>
</tr>
<tr>
<td>17</td>
<td>Pressure Sustaining and/or Reducing Valve (As Necessary)</td>
</tr>
<tr>
<td>18</td>
<td>Water Meter</td>
</tr>
<tr>
<td>19</td>
<td>Main Shutoff Valve</td>
</tr>
<tr>
<td>20</td>
<td>Mainline</td>
</tr>
<tr>
<td>21</td>
<td>Field Valves</td>
</tr>
<tr>
<td>22</td>
<td>Submain</td>
</tr>
<tr>
<td>23</td>
<td>Laterals</td>
</tr>
<tr>
<td>24</td>
<td>Submain Flush Valves</td>
</tr>
<tr>
<td>25</td>
<td>Controller</td>
</tr>
</tbody>
</table>

Pipe

Controls
Drip Irrigation Systems
Fertigation Controller
Fertigation Controller
Fertigation Controller
Automatic Diesel Engine
Automatic Diesel Engine
Safety Interlocks and BFPs

Figure 4. Typical layout for an injection system showing many of the safety interlocks and backflow prevention devices required to prevent contamination of the environment. (Courtesy of L.J. Schwankl, Univ. of California-Davis).
Chemigation Valve, NC Valve & Fert Meter
FERTILIZER INJECTORS

- Water driven pumps
- Positive displacement pumps
- Venturi injectors

- All fertilizer pumps give some trouble!!!!
- Easy to maintain and parts is the key.
Water Driven Fertilizer Pumps

- No power requirements
- Economical
- Easy to install
- Pressure sensitive
- Maintenance required
Electric Positive Displacement Pumps

- Large Volume
- Easy to maintain
- Maintenance required
Venturi Fertilizer Pumps

- Inexpensive
- 15 psi differential required.
- Should use with booster pump for best economy
pH Control System

SAMPLE NETAJET INSTALLATION

TANK A

TANK B

TANK C
pH Control Product

Inlet

pH Control

Minimum 6 1/2'
pH control system
pH control system
Fertigation Maintenance

- Maintain pumps per manufacturers recommendations.
  - Seals
  - Weep holes.

- Check fert meters by comparing tank withdrawal with computer count.

- Salt out. Liquids will salt out. Make provisions to easily flush crystals from lines.
So neither he who plants nor he who waters is anything, but only God who makes things grow.

1 Corinthians 3:7 NIV