Strawberry Nutrient Management

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Key Components of Strawberry Nutrient Management

1) Good site selection
2) Soil test (prior to planting and every 3 years)
3) Amend soil prior to planting
4) Tissue testing (at least every 2 years)
5) Crop rotation/Cover crop
6) Well-timed fertilizer applications
7) Observation
Get Off to a Good Start, Choose the Right Site!

• Well drained sandy loam
  – Proper drainage is critical for root health

• pH 6.2-7.0
  – Nutrients are only available to plant if soil pH is correct

• High organic matter (at least 3%)
  – Excellent source of slow release nutrients
  – Provides water holding and nutrient holding capacity
Soil pH And Nutrient Availability
Know What You Are Working With
Test the Soil

• Nutrients to test for:
  – Nitrogen, potassium, phosphorous, magnesium, calcium, boron

• Soil pH

• Organic matter content
Soil Test

• Most useful prior to planting
• Should be done every 3-4 years (or before planting)
• Use the same lab to increase consistency of results
• Soil tests and recommendations are approximations and should be used as a tool
How To Take A Soil Test

• Label the bag
• Sample each ‘Management Block’ separately
• Collect a sample with trowel to 6-8” at 10 different locations zigzagged across the management block
• Combine all trowel samples in a bucket and mix
• Place 2 cups in the sample bag and send into lab for analysis
  – Take out sticks or large debris
Amending the Soil

• Animal manures
  – Good source of slow released N
  – Can provide K, P and Ca
  – Can be a source of weed seeds if not well composted
  – Not a good source of Mg
Amending the Soil

- pH
  - Start early!
  - Amending pH with lime (raise pH) or sulfur (lower pH) takes time
  - start amending the soil at least one year prior to planting
  - Consider soil type
Cover Crops

• Cover crops should be part of the long-term nutrient management plan

• Minimum 30% of land should be set aside for rotation
  – cover crop a field for 3 years

• Do not grow strawberries in a site for more than 5 consecutive years
Selecting a Cover Crop

• Determine what the objective of the cover crop is:
  – Weed management, nematode suppression, nutrients, organic matter
  – Weed suppression and organic matter require higher seeding density.

• Soil conditions

• Length of cover crop period

• Available equipment
Tissue Analysis

• Principles:
  – Optimal level of nutrients at a certain time of year have been established through research
  – Collect plant tissue at this same time of year to determine if plant has sufficient nutrients in the tissue
  – Use this information to inform nutrient management decisions
Tissue Analysis

Advantages

• Give an accurate picture of nutrients available to plants
• Can detect deficiency before visual symptoms observed
• Allows for more efficient use of nutrients

Disadvantages

• Cost
• Time to collect tissue
Collecting Tissue Samples

• Standards have been developed for specific sampling conditions:
  – Time of most stability in nutrients
  – Plants grown in appropriate soil pH
    • 5.5-7.0 – Strawberry & Raspberry
    • 4.5-5.5- Blueberry

• Time of collection:
  – *Strawberry* - newly expanded leaves collected after renovation, late July-early August
  – *Raspberry* - Fully expanded primocane leaves in early August
  – *Blueberries* - young leaves exposed to full sun in late July

Analysis is only meaningful if sample was properly collected!
Collecting Tissue Samples

• Divide your farm into ‘Management Blocks’
  – Sections that are treated in a similar manner
  – Different soil types
  – Different moisture status

• Collect tissue samples from each management block every 2 years
Collecting the Tissue Sample

- Walk a ‘W’ pattern through the field
- Collect a total of ~50 leaves
- Rinse leaves in distilled water
- Remove petiole
- Pat dry
- Place in LABELLED paper bag and mail to lab
  - Send it in on Monday or Tuesday
## Sufficiency Ranges for Strawberries

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Deficient Below</th>
<th>Sufficient</th>
<th>Excess</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>1.9</td>
<td>2.0-2.8</td>
<td>4.0</td>
</tr>
<tr>
<td>P (%)</td>
<td>0.20</td>
<td>0.25-0.40</td>
<td>0.50</td>
</tr>
<tr>
<td>K (%)</td>
<td>1.3</td>
<td>1.5-2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Mg (%)</td>
<td>0.25</td>
<td>0.3-0.5</td>
<td>0.8</td>
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<tr>
<td>S (%)</td>
<td>0.35</td>
<td>0.4-0.6</td>
<td>0.8</td>
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<tr>
<td>B (ppm)</td>
<td>23</td>
<td>30-70</td>
<td>90</td>
</tr>
<tr>
<td>Fe (ppm)</td>
<td>40</td>
<td>60-250</td>
<td>350</td>
</tr>
<tr>
<td>Mn (ppm)</td>
<td>35</td>
<td>50-200</td>
<td>350</td>
</tr>
<tr>
<td>Cu (ppm)</td>
<td>3</td>
<td>6-20</td>
<td>30</td>
</tr>
<tr>
<td>Zn (ppm)</td>
<td>10</td>
<td>20-50</td>
<td>80</td>
</tr>
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NRAES Strawberry Production Guide
Fertilizer

• A well prepared soil should have enough P, K, Mg and Ca in the soil to provide sufficient nutrients for the life of the planting

• Supplemental N is required during the growing season
Nitrogen

• Strawberry plants require supplemental N throughout growing season

• Year 1:
  – 60-70 lbs/A
  – Calcium nitrate: readily available, low salt index, low potential for volatilization

• Year 2:
  – 70-100 lbs/A
  • Urea (potential for volatilization)
  • Ammonium nitrate
Timing of Nitrogen Application

• N that is stored in the plant in the fall is the primary source for flower and fruit development the following season

• Placing N on in spring will lead to increased growth (~50% of spring applied N goes to leaves), but may not increase yield
  – Most of this N will be lost in the leaves during renovation!
Fertilizer Sources of N

- Ammonium Nitrate
  - Provides N in immediately and delayed availability
  - Inexpensive form of N
  - Can acidify the soil
  - Ammonium toxicity can occur if:
    - pH is too low
    - too cold
    - Volatilization (applied in warm, humid conditions)
    - no microbial activity (fumigated soil)
Fertilizer Sources of N

• Calcium Nitrate
  – Readily available form of N
  – Low salt index
    • good to use on first year planting and on fields that have been fumigated
    • High tunnels where there is no rain fall

• Potassium Nitrate
  • Potassium is an important mineral for fruit quality
Fertilizer Sources of N

• Urea (Granular)
  – Very inexpensive
  – Subject to volatilization

• Urea (Foliar Spray)
  – Useful for correcting deficiency
  – Not an efficient as sole source of N
    • Can only apply ~ 2 lbs N/ Acre
Fertilizer N Use Efficiency in Strawberry

- 32% - 63% of applied N is recovered in the plant
  - 32 - 63 lbs N/Acre recovered (Based on application rate of 100 lb N/Acre)

- Estimated N accumulation in plants over the season ~ 45 - 80 lbs N/Acre

- N available in soil (organic matter) contributes the difference
N Deficiency

- Death of older leaves due to movement of N to young growing leaves
- Reduced growth
- Red colouring of leaves due to reduced chlorophyll
Excess N

• Dark green colour
• Increased vegetative growth- plants tend to be weak
• Reduced yield
• Can lead to Mg\(^{2+}\) and Ca\(^{2+}\) deficiency
• Acidification of the soil
• Reduced fruit quality- soft fruit/botrytis problems
Luxurious Uptake

• “Luxurious” N uptake occurs under high N conditions

• Excess N accumulates in the form of amino acids and other organic compounds

• Increases susceptibility to pest and disease pressure
How Do You Know Your N Status?

• Visual Assessment
  – Pay attention to what your plants look like!

• Soil Analysis
  – Important to do before you plant so you can amend soil as needed
  – Can give you an idea of the status of N in the soil
  – Does not always reflect what is going on in the plant
How Do You Know Your N Status?

• Foliar Leaf Analysis
  – Good indication of the N status of the plant
  – Sufficiency ranges have been established for strawberries
  – Leaf samples should be taken late July to Early August

• Combine all three analysis techniques to maintain the best nutrient management program
Phosphorus

• P availability affected by:
  – Soil temperature, moisture and pH
    • P limited if not at optimal level
  – Soil biology
    • Microorganisms increase P availability
  – Organic matter
  – Soil type
    • High clay soils fix more P than lighter soils
  – Cation content
    • High Ca and Al can limit P availability
• P is not very mobile in the soil

• Must be incorporated in the soil to be effective

• Amend soil prior to planting

• Can be applied through drip
  – Can precipitate with other nutrients and clog emitters
K Fertilizer

- Strawberries have high requirement for K
- Primary transport mechanism is diffusion
- Availability of K is dependent on:
  - Organic matter
  - Soil texture
  - Type of clay
  - Mg and Ca content
K Fertilization

- Preplant incorporation is most effective
- Fertigation can be used in established fields
- Topdressing is not effective
- Addition of K can induce Mg deficiency
  - Add Mg if K/Mg ration exceeds 4
Micronutrients

• Ca
  – Deficiency not often due to low Ca in soil
  – Moisture management is critical

• Mg
  – Deficiency seen on sandy, acidic soil, high Al or K

• Mn
  – Strawberry tolerant of extremes

• B
  – Water uptake is critical
  – Prone to leaching on course soils
Summary

• Before you apply nutrients be able to answer these questions:
  – What do I currently have in the soil?
  – Where will the nutrient go? (ground water, soil, air, into the plant?)
  – What part of the plant will I be feeding? (leaves, roots, crowns?)
  – Why do I want to improve the growth of this plant component? (bigger plant? ... bigger yield?)
Summary

• Build up your soil organic matter...
  – Provides a stable, long term N source
  – Will help retain the fertilizer N you apply
  – Will help with water management

• Focus on improving the N status of the plants in the fall
  – N stored in the roots and crown are crucial to flower and fruit growth in the spring